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1997
**Dry Bean
Grower Survey**

***of Pest Problems
and Pesticide Use
in Minnesota and
North Dakota***



NDSU EXTENSION SERVICE

North Dakota State University, Fargo, ND 58105

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This is the tenth annual survey of pest problems, pesticide use and grower practices of the Northharvest Bean Growers Association, an association of dry bean growers in Minnesota and North Dakota. Results of previous surveys dated 1987-1996 have been published (1, 2, 3, 4, 5, 6, 7, 8, 10). There was no survey in 1993.

The survey form (Figure 1, pages 3-4) was developed by research and extension faculty at North Dakota State University and the University of Minnesota and the directors of the Northharvest Bean Growers Association. The survey was completed by attendees at the Northharvest Bean Day in Fargo, ND on January 23, 1998. This was a new approach, as surveys in previous years were mailed to all Northharvest growers. The surveys were anonymous.

Throughout this report, trade names of chemicals are often presented as an aid to clearer communication. Mention of trade names does not constitute endorsement or recommendation by NDSU nor Northharvest Bean Growers.

Figure 1. Survey form.

Please circle or fill in the requested information on pest problems and pesticide use on your 1997 dry bean crop.

Total acres planted in 1997		
Irrigated acres		Dryland acres
Total acres harvested		
Acres with hail damage		
Acres with water damage		
State	County	Acres
Minnesota		
North Dakota		
South Dakota		
DRY BEANS GROWN IN 1997		
Class	Variety	Acres
Pinto		
	Arapaho	
	Bill Z	
	Fargo	
	Fiesta	
	Hatton	
	Nodak	
	Othello	
	RS101	
	Topaz	
	Winchester	
	Other	
Navy		
	Agri 1	
	Avanti	
	Mayflower	
	Midland	
	Norstar	
	Schooner	
	Upland	
	Vista	
	Voyager	
	Other	
Kidney		
	Cal Early (LRK)	
	Drake (DRK)	
	Foxfire (DRK)	
	Isles (DRK)	
	Montcalm (DRK)	
	Sacramento (LRK)	
	Other (specify)	
Seed source	Acres planted	
Western Grown		
Northharvest Grown		
Bin run		
Biggest Production Problem in Dry Beans in 1997 (circle one)		
	Acres Lost	Bean Class
Applied herbicide injury		
Herbicide drift injury		
Delayed planting		
Emergence/stand		

Biggest Production Problem (continued from previous column)			
	Acres Lost	Bean Class	
Harvest			
Disease			
Insects			
Micronutrient deficiency			
Weeds			
None			
Other (specify)			
Worst Weed Problems in Dry Beans in 1997 (Rank 1-3; 1=worst)			
	Cocklebur	Ragweed	
	Nightshade	Lambsquarters	
	Foxtail (pigeon grass)	Redroot pigweed	
	Kochia	Wild oat	
	Canada thistle	Other (specify)	
	Volunteer grain		
Insecticides Used on Dry Beans in 1997			
Insecticide	No. Acres Treated	No. of Sprays	
Worst Insect/Mite Problem in 1997 (Rank 1-3; 1=worst)			
	Grasshoppers		
	Leafhoppers		
	Spider Mites		
	Seed Corn Maggot		
Crop Rotation			
	Field #1	Field #2	Field #3
Year 1			
Year 2			
Year 3			
Year 4			
Micronutrient Use			
Acres treated with zinc		No. of sprays	
Other micronutrients		No. of sprays	
Non-Chemical Weed Management (double-pass counts as double acres)			
Practice	Acres treated	No. of passes	
Cultivation			
Rotary hoe/harrow			
No herbicide			
Worst Disease Problems in 1997 (Rank 1-3; 1=worst)			
	Alternaria		
	Bacterial Blight		
	Root Rot		
	Rust		
	White Mold		
	None		

Weed Control Chemicals Used On Dry Beans in 1997						
Mark weed control used and indicate areas treated for each item. Count double application, double cultivation, etc. as double acres.						
Weed control used	Class of bean	Acres treated	Class of bean (if additional)	Acres treated	Class of bean (if additional)	Acres treated
Roundup Ultra (preplant)						
Eptam (fall)						
Eptam (spring)						
Trifluralin (fall)						
Trifluralin (spring)						
Trifluralin + Eptam						
Sonalan (fall)						
Lasso/generics						
Dual						
Frontier						
Prowl						
Pursuit						
Basagran/generics						
Assure II						
Poast/Poast Plus/Ultima 160						
Other						
Dessicants						
Sodium Chlorate (Leafex, Defol)						
Gramoxone Extra						

Fungicides Used On Dry Beans 1997				
Fungicide	No. acres treated	No. of sprays	Application method (circle one)	
Bravo			air	ground
Maneb			air	ground
Champion/Champ			air	ground
Kocide			air	ground
Benlate (broadcast)			air	ground
Benlate (banded)			air	ground
Tilt			air	ground
Topsin (broadcast)			air	ground
Topsin (banded)			air	ground
Thiolux			air	ground
Other			air	ground
Any tank mixes? List the combination			air	ground

Responses

There were 206 useable responses (Table 1), roughly 30% of the responses received in the 1996 mail survey of all Northharvest growers. The survey responses in 1997 represented 92,437 acres (A), or 10% of the Northharvest total of 940,000 A planted in 1997.

Irrigation

Irrigation was used on 7% of Northharvest respondents' acres (Table 2), down from 8% in 1996. Irrigation was used on 19% of Minnesota respondents' acres, a slightly lower figure than in 1996. Irrigation was used on only 3% of North Dakota respondents' acres, the same as in the previous year.

Acres Harvested

Respondents harvested 92% of planted acres (Table 2), down from 97% in 1996 and the same as in 1995. Minnesota respondents harvested 93% of their acres and North Dakota respondents harvested 91% of their acres.

Acres Damaged by Hail or Water

Respondents reported 11% of their acres damaged by hail in each state (Table 2). Respondents reported 28% of their acres were damaged by water, with 31% damaged in Minnesota and 27% in North Dakota (Table 2).

Use of Western-grown and Northharvest-grown Seed

Western-grown seed was the most common seed source, planted on 61% of respondents' acres. Northharvest-grown seed was planted on 28% of respondents' acres, a slightly higher percentage than in 1996. North Dakota respondents planted Northharvest grown seed on 31% of their acres, while Minnesota respondents planted Northharvest grown seed on 19% of their acres. Thus, North Dakota respondents planted about half again as many acres to Northharvest-grown seed in 1997 as in 1996, and Minnesota respondents planted over twice as many acres to Northharvest-grown seed in 1997 as in 1996 (Table 3).

Bean Market Classes Grown

Pinto bean was the most common dry bean class grown in 1997, planted on 45% of Minnesota, 56% of North Dakota and 53% of all Northharvest respondents' acres,

respectively. Navy bean was the second most common dry bean class grown in 1997, planted on 26% of Minnesota, 33% of North Dakota and 31% of all Northharvest respondents' acres, respectively. Kidney bean was the third most common dry bean class grown in 1997, planted on 22% of Minnesota respondents' acres, but only 2% of North Dakota respondents' acres. Black beans were the third most common dry bean class grown in North Dakota, planted on 7% of North Dakota respondents' acres (Table 4).

Table 1. Number of Northharvest dry bean growers responding, total acres planted and acres planted by Minnesota and North Dakota respondents in 1997.

	Growers Responding	Acres Planted		
		Total ^a Acres	Respondents' Acres	Survey Acres (% of total)
Minnesota	59	190,000	24,519	12.9
North Dakota	147	750,000	67,918	9.1
Northharvest total	206	940,000	92,437	9.8

^a total of dry bean acres planted in each state (Reference 9)

Table 2. Acres irrigated, harvested, damaged by hail and by water in Minnesota and North Dakota in 1997.

	% of Respondents Acres		
	Minnesota	North Dakota	Northharvest
Irrigated	19.1	3.1	7.4
Harvested	93.3	91.1	91.6
Hail damaged	11.5	11.1	11.2
Water damaged	31.3	26.5	27.8

Table 3. Sources of seed used by Minnesota and North Dakota respondents for planting in 1997.

Seed Source	% of Respondents' Acres		
	Minnesota	North Dakota	Northharvest
Western Grown	66.0	58.6	60.6
Northharvest Grown	19.3	30.6	27.6
Bin Run	9.0	6.3	7.0

Table 4. Market class of dry beans grown by respondents in Minnesota and North Dakota in 1997.

Bean Class	% of Respondents' Acres		
	Minnesota	North Dakota	Northharvest
Black	2.2	7.3	6.0
Kidney	21.8	1.8	7.1
Navy	26.4	32.5	30.8
Pink	1.8	1.0	1.2
Pinto	44.5	55.8	52.8
Other	3.3	1.6	2.1

Varieties Grown

Norstar navy was the most common dry bean variety grown, planted by 27% of Northharvest respondents on 13% of their acreage. Othello pinto was the second most common dry bean variety grown, planted by 18% of Northharvest respondents on 8% of their acreage, followed by Topaz pinto planted on 8%, Hatton pinto on 5%, Winchester pinto on 5%, Maverick pinto on 5%, Montcalm dark red kidney on 5% and Vista navy on 4% of respondents' acres (Table 5).

Topaz was the most common pinto bean grown in Minnesota, planted on 23% of Minnesota respondents' pinto acres, followed by Hatton on 14% and RS101 on 12%. Othello was the most common pinto bean grown in North Dakota, planted on 18% of North Dakota respondents' pinto acres, followed by Topaz on 12% and Winchester on 11%. Othello was the most common pinto grown by all Northharvest respondents, planted on 15% of their pinto acres, followed by Topaz on 14%, Hatton on 10% and Winchester on 9% of their pinto acres (Table 6).

Norstar was the most common navy bean grown, planted on 49% of Minnesota, 42% of North Dakota and 43% of all Northharvest respondents' navy bean acres. Vista was the second most common navy bean grown, planted on 13% of Minnesota, 14% of North Dakota and 13% of

Table 5. Varieties grown in 1997 by Northharvest respondents in Minnesota and North Dakota.

Variety	Class ^b	Respondents		Acres Planted ^a	
		Number	%	Number	%
Arapaho	P	16	7.8	2280	2.5
Bill Z	P	15	7.3	1635	1.8
Chase	P	11	5.3	2190	2.4
Fargo	P	14	6.8	2115	2.3
Fiesta	P	7	3.4	1010	1.1
Hatton	P	33	16.0	4760	5.1
Maverick	P	27	13.1	4198	4.5
Nodak	P	12	5.8	1468	1.6
Othello	P	36	17.5	7333	7.9
RS 101	P	18	8.7	2760	3.0
Topaz	P	34	16.5	7010	7.6
Winchester	P	37	18.0	4523	4.9
Agri 1	N	10	4.9	1037	1.1
Mayflower	N	8	3.9	1200	1.3
Norstar	N	55	26.7	12369	13.4
Schooner	N	22	10.7	2800	3.0
Upland	N	12	5.8	1072	1.2
Vista	N	24	11.7	3801	4.1
Montcalm	DRK	15	7.3	4222	4.6

^a Includes varieties planted on more than 1% of respondents' total acres.

^b P=pinto; N=navy; DRK=dark red kidney

all Northharvest respondents' navy bean acres. Schooner was the third most common navy bean grown in North Dakota, planted on 12% of North Dakota respondents' navy acres. Montcalm dark red kidney was the most common kidney bean grown, planted on 74% of Minnesota, 23% of North Dakota and 64% of all Northharvest respondents' kidney bean acres (Table 6).

Production Problems

Weather was reported as the worst production problem by 50% of Minnesota respondents on 46% of their acres, 39% of North Dakota respondents on 30% of their acres and 42% of all Northharvest respondents on 35% of their acres. Disease was the second worst production problem, as reported by 24% of Minnesota respondents on 18% of their acres, 22% of North Dakota respondents on 19% of their acres and 23% of all Northharvest respondents on 19% of their acres. Weeds were the third worst production problem in Minnesota, as reported by 17% of Minnesota respondents on 9% of their acres. Emergence and stand problems were the third worst production problem in North Dakota, as reported by 12% of North Dakota respondents on 9% of their acres (Table 7).

Disease Problems

White mold was the worst disease problem for 72% of Northharvest survey respondents on 62% of their acres, followed by rust for 7% of respondents on 6% of their acres, bacterial blight for 7% of respondents on 6% of their acres and root rot for 6% of respondents on 6% of their acres.

Table 6. Leading varieties of dry bean, by market class, grown in Minnesota and North Dakota in 1997.

Class/Variety ^a	% of Respondents' Acres		
	Minnesota	North Dakota	Northharvest
Pinto			
Othello	5.3	17.8	15.0
Topaz	22.6	12.0	14.4
Hatton	13.6	8.7	9.8
Winchester	3.3	11.0	9.3
RS101	11.5	4.0	5.7
Navy			
Norstar	49.2	41.7	43.4
Vista	12.5	13.6	13.3
Schooner	3.1	11.8	11.8
Kidney			
Montcalm (DRK)	73.6	23.3	64.1

^a Varieties grown on more than 10% of respondents' acres, for that class, in at least one state.

White mold was the worst disease problem for 74% of Minnesota respondents on 63% of their acres. Root rot was the second worst disease problem for 11% of Minnesota respondents on 10% of their acres, followed by bacterial blight for 4% of Minnesota respondents on 5% of their acres and rust for 4% of respondents on 3% of their acres. White mold was the worst disease problem for 71% of North Dakota respondents on 62% of their acres, followed by rust for 9% of North Dakota respondents on 7% of their acres, bacterial blight for 8% of respondents on 6% of their acres and root rot for 4% of respondents on 4% of their acres (Table 8).

White mold was ranked as one of the three worst diseases by Northharvest respondents on 75% of dry bean acres reported, nearly the same as in 1996 and 1995. Rust was ranked as one of the three worst diseases on 31% of respondents' acres, considerably less than in 1996. Bacterial blight was reported as one of the three worst disease problems on 25% of dry bean acres, somewhat higher than in 1996 and 1995. Root rot was reported as one of the three worst disease problems on 22% of Northharvest respondents' acres, which is twice the percentage reported for 1996 (Table 9).

Table 7. Worst production problem in 1997 for respondents in Minnesota and North Dakota.

Worst Production Problem Reported	Respondents		Acres Reported ^b			
	Number	% ^a	Number	%	Acres Lost	%
Minnesota						
Weather	23	50.0	11,245	45.9	720	2.9
Disease	11	23.9	4,325	17.6	140	0.6
Weeds	8	17.4	2,090	8.5	10	tr
Emergence/Stand	2	4.3	1,813	7.4	213	0.9
Harvest	2	4.3	350	1.4	0	0
North Dakota						
Weather	44	38.6	20,618	30.4	3,663	5.4
Disease	25	21.9	12,810	18.9	820	1.2
Emergence/Stand	14	12.3	6,075	8.9	345	0.5
Delayed Planting	8	7.0	4,885	7.2	115	0.2
Harvest	4	3.5	2,565	3.8	60	0.1
Weeds	7	6.1	1,976	2.9	0	0
Northharvest						
Weather	67	41.9	31,863	34.5	4,383	4.7
Disease	36	22.5	17,135	18.5	960	1.0
Emergence/Stand	16	10.0	7,888	8.5	558	0.6
Delayed Planting	8	5.0	4,885	5.3	115	0.1
Weeds	15	9.4	4,066	4.4	10	tr
Harvest	6	3.8	2,915	3.2	60	0.1

^a Based on 160 total responses to this question, 46 from Minnesota and 114 from North Dakota.

^b Based on acres of all respondents.

^c tr=trace

Table 8. Worst disease problem^a in 1997 in Minnesota and North Dakota.

Worst Disease Problem	Respondents ^b		Acres Reported ^c	
	Number	%	Number	%
Minnesota				
White mold	40	74.1	15,517	63.3
Root rot	6	11.1	2,525	10.3
Bacterial blight	2	3.7	1,330	5.4
Rust	2	3.7	770	3.1
None	4	7.4	1,194	4.9
North Dakota				
White mold	88	71.0	42,134	62.0
Rust	11	8.9	4,665	6.9
Bacterial blight	10	8.1	4,140	6.1
Root rot	5	4.0	2,780	4.1
Alternaria	1	0.8	400	0.6
None	9	7.3	4,850	7.1
Northharvest				
White mold	128	71.9	57,651	62.4
Bacterial blight	12	6.7	5,470	5.9
Rust	13	7.3	5,435	5.9
Root rot	11	6.2	5,305	5.7
Alternaria	1	0.6	400	0.4
None	13	7.3	6,044	6.5

^a Ranked as No. 1 disease problem by respondents.

^b Based on 54 responses from Minnesota and 124 responses from North Dakota.

^c Respondents' acres only.

Table 9. Diseases ranked as one of the three worst^a in 1997 in Minnesota and North Dakota.

No. 1, 2 or 3 Disease Problem	--- Respondents ---		- Acres Reported ^b -	
	Number	%	Number	%
Minnesota				
White mold	47	87.3	18,857	76.9
Root rot	18	33.3	9,130	37.2
Bacterial blight	13	24.1	6,373	26.0
Rust	13	24.1	6,310	25.7
None	4	7.4	1,194	4.9
North Dakota				
White mold	105	84.7	50,704	74.7
Rust	44	35.5	22,328	32.9
Bacterial blight	30	24.2	16,595	24.4
Root rot	18	14.5	11,115	16.4
Alternaria	3	2.4	2,600	3.8
None	9	7.3	4,850	7.1
Northharvest				
White mold	152	85.4	69,561	75.3
Rust	57	32.0	28,638	31.0
Bacterial blight	43	24.2	22,968	24.8
Root rot	36	20.2	20,245	21.9
Alternaria	3	1.7	2,600	2.8
None	13	7.3	6,044	6.5

^a Ranked as No. 1, 2 or 3 disease problem by respondents.

^b Respondents' acres only.

Root rot was one of the three worst diseases on 37% of Minnesota respondents' acres, but only 16% of North Dakota respondents' acres. The data for all other diseases are fairly similar for both states and do not vary greatly from that of the combined data for both states (Northharvest total).

Disease Control Practices

Fungicides were used on 43% of Northharvest survey respondents' acres, down from 61% in 1996 and about the same as in 1995. Fungicides were used on 59% of Minnesota and 37% of North Dakota respondents' acres, down from 68% and 59%, respectively, in 1996. Benlate was the most widely used fungicide in Minnesota, applied to 28% of respondents' acres; followed by Topsin M, applied to 25% of respondents' acres; and Tilt, applied to 6% of respondents' acres. Topsin M was the most widely used fungicide in North Dakota, applied to 17% of respondents' acres, followed by Benlate, applied to 10% of respondents' acres, and Tilt, applied to 10% of respondents' acres. The percentage of acres treated by ground was about 2½ times the amount sprayed by air in North Dakota, 3 times

for all Northharvest respondents and 5 times for Minnesota respondents (Table 10).

Minnesota respondents sprayed 52% of their acres with the benzimidazole fungicides Benlate and Topsin M for white mold control, compared to 44% in 1996 and 21% in 1995. North Dakota respondents sprayed 28% of their acres with the benzimidazole fungicides, up from 22% in 1996 and 18% in 1995. In Minnesota, 13% of respondents' acres were band sprayed (directed spray with drop nozzles between the rows) with benzimidazole fungicides and 40% were broadcast sprayed, which is approximately the same ratio as in 1996 and 1995. In North Dakota, 10% of respondents' acres were band sprayed with benzimidazole fungicides and 18% were broadcast sprayed; this is a similar ratio to that for 1996. Wet conditions the past two years may have reduced the ability of respondents to band spray in a timely manner. Continued increases in sugarbeet acres have resulted in continued increase in the use of 22-inch row spacing for dry beans, a row spacing that makes band application difficult or impractical. Use of Benlate and Topsin M was nearly the same in Minnesota, but use of Topsin M in North Dakota was higher than that for Benlate (Table 11).

Table 10. Fungicides applied to dry beans in 1997 by respondents in Minnesota and North Dakota.

Fungicide ^a	Method of App. ^b	Total Acres Treated ^c		Acres Treated by Air ^d		Acres Treated by Ground	
		Number	%	Number	%	Number	%
Minnesota							
Benlate	Banded	1,855	7.6	—	—	1,855	7.6
Benlate	Broadcast	4,945	20.2	555	2.3	4,390	17.9
Bravo	—	180	0.7	180	0.7	0	0
Tilt	—	1,575	6.4	160	0.7	1,415	5.8
Topsin M	Banded	1,200	4.9	—	—	1,200	4.9
Topsin M	Broadcast	4,773	19.5	1,450	5.9	3,243	13.2
North Dakota							
Benlate	Banded	1,355	2.0	—	—	1,220	1.8
Benlate	Broadcast	5,648	8.3	1,860	2.7	3,788	5.6
Bravo	—	1,350	2.0	—	—	1,350	2.0
Maneb	—	300	0.4	—	—	—	—
Tilt	—	4,899	7.2	2,841	4.2	1,708	2.5
Topsin M	Banded	5,220	7.7	—	—	4,470	6.6
Topsin M	Broadcast	6,491	9.6	2,055	3.0	4,436	6.5
Northharvest							
Benlate	Banded	3,210	3.5	—	—	3,075	3.3
Benlate	Broadcast	10,593	11.5	2,415	2.6	8,178	8.8
Bravo	—	1,593	1.7	180	0.2	1,350	1.5
Maneb	—	300	0.3	—	—	—	—
Tilt	—	6,474	7.0	3,001	3.2	3,123	3.4
Topsin M	Banded	6,420	6.9	—	—	5,670	6.1
Topsin M	Broadcast	11,264	12.2	3,505	3.8	7,679	8.3

^a Mention of a trade name does not constitute an endorsement, recommendation nor preference over other similar fungicides.

^b Respondents were not asked method of application for Bravo, Maneb or Tilt.

^c Respondents' acres only.

^d Respondents' acres only. The sum of acres treated by air and acres treated by ground may be less than total acres treated because some respondents did not indicate if application was by air or ground.

Rust fungicides were used on 9% of Northharvest respondents' acres, compared to 34% in 1996. Tilt, available in both states under a specific exemption (Section 18), was used on 7% of respondents' acres, followed by Bravo on 2%. In Minnesota, Tilt was used on 6% of respondents' acres, followed by Bravo on 1%. In North Dakota, Tilt was used on 7% of respondents' acres, followed by Bravo on 2% (Table 12). The dramatic reduction in use of rust fungicides from 1996 is probably due more to increased use of pinto varieties that have resistance to the current rust races than to reduced rust potential.

Weed Problems

Nightshade was the worst weed problem for 14% of Northharvest respondents, on 18% of the acres reported. This percentage is up from 12% for both respondents and acres in 1996, when nightshade was the second worst weed problem behind wild mustard. In 1997, wild mustard was the fifth worst weed problem, following nightshade, foxtail, Canada thistle and redroot pigweed (Table 13).

Table 11. Fungicides and application methods for white mold control in 1997 in Minnesota and North Dakota.

Fungicide	Band Applied		Broadcast		Total	
	Acres	% ^a	Acres	% ^a	Acres	% ^a
Minnesota						
Benlate	1,855	7.6	4,945	20.2	6,800	27.7
Topsin M	1,200	4.9	4,773	19.5	5,973	24.4
Total ^b	3,055	12.5	9,718	39.6	12,773	52.1
North Dakota						
Benlate	1,355	2.0	5,648	8.3	7,003	10.3
Topsin M	5,220	7.7	6,491	9.6	11,711	17.2
Total ^b	6,575	9.7	12,139	17.9	18,714	27.6
Northharvest						
Benlate	3,210	3.5	10,593	11.5	13,803	14.9
Topsin M	6,420	6.9	11,264	12.2	17,684	19.1
Total ^b	9,630	10.4	21,857	23.6	31,487	34.1

^a percent of respondents' acres.

^b total of Benlate + Topsin M

Table 13. Worst weed problem in 1997 in Minnesota and North Dakota.

Worst Weed Problem ^a	Respondents		Acres reported ^c	
	Number	% ^a	Number	%
Minnesota				
Redroot pigweed	15	26.3	6,909	28.2
Foxtail	7	12.3	4,283	17.5
Nightshade	10	17.5	3,480	14.2
Ragweed	8	14.0	2,620	10.7
Lambsquarters	7	12.3	2,486	10.1
Kochia	3	5.3	1,265	5.2
Wild oat	1	1.8	1,200	4.9
Canada thistle	2	3.5	925	3.8
Cocklebur	3	5.3	356	1.5
None	1	1.8	710	2.9
North Dakota				
Nightshade	19	13.8	13,075	19.3
Foxtail	21	15.2	10,050	14.8
Canada thistle	24	17.4	9,864	4.5
Wild mustard	12	8.7	6,830	10.1
Cocklebur	14	10.1	5,615	8.3
Redroot pigweed	10	7.2	3,290	4.8
Lambsquarters	7	5.1	3,281	4.8
Kochia	6	4.3	3,243	4.8
Ragweed	6	4.3	2,600	3.8
Wild oat	4	2.9	1,190	1.8
Volunteer grain	2	1.4	480	0.7
Other	12	8.7	4,795	7.1
None	1	0.7	100	0.1
Northharvest				
Nightshade	29	14.1	16,555	17.9
Foxtail	28	13.6	14,333	15.5
Canada thistle	26	12.6	10,789	11.7
Redroot pigweed	25	12.1	10,199	11.0
Wild mustard	12	5.8	6,830	7.4
Cocklebur	17	8.3	5,971	6.5
Lambsquarters	14	6.8	5,767	6.2
Ragweed	14	6.8	5,220	5.6
Kochia	9	4.4	4,508	4.9
Wild oat	5	2.4	2,390	2.6
Volunteer grain	2	1.0	480	0.5
Other	12	5.8	4,795	5.2
None	2	1.0	810	0.9

^a Ranked as No. 1 weed problem on more than 0.5% of respondents' acres.

^b Based on 59 responses from Minnesota and 147 responses from North Dakota.

^c Respondents' acres only.

Table 12. Fungicides used for rust control in 1997 in Minnesota and North Dakota.

State	Bravo		Maneb		Tilt		Total ^b	
	Acres	% ^a	Acres	% ^a	Acres	%	Acres	%
Minnesota	180	0.7	0	0	1,575	6.4	1,755	7.2
North Dakota	1,350	2.0	300	0.4	4,899	7.2	6,549	9.6
Northharvest total	1,530	1.7	300	0.3	6,474	7.0	8,304	9.0

^a Percent of respondents' acres

^b Total of Bravo, Maneb and Tilt.

Foxtail was the worst weed for 14% of Northharvest respondents, representing 16% of the acres reported. Canada thistle was the worst weed for 13% of respondents on 12% of the acres reported, and redroot pigweed was the worst weed for 12% of respondents on 11% of the acres reported. Wild mustard was the worst weed for 6% of respondents on 7% of the acres reported, followed by cocklebur for 8% of respondents on 7% of their acres, and lambsquarters and ragweed, each the worst weed for 7% of respondents on 6% of their acres. Other commonly reported weed problems included kochia and wild oat (Table 13). There was a shift in weed problems from 1996, with wild mustard moving from the worst weed problem to the fifth worst weed problem, nightshade moving from second to first, foxtail moving from fourth to the second, and Canada thistle moving from fifth to third.

In Minnesota, redroot pigweed was the worst weed problem for 26% of survey respondents on 28% of the Minnesota acres reported. This is a one-third higher percentage of acres than in 1996 even though redroot pigweed was the worst weed in that year, too. Foxtail was the worst weed for 12% of respondents on 18% of the acres reported. Foxtail was approximately twice the problem in 1997 than it was in 1996. Nightshade was the worst weed problem for 18% of respondents on 14% of the acres reported, similar to 1996. Ragweed was the worst weed problem for 14% of respondents on 11% of the acres reported and lambsquarters was the worst weed for 12% of respondents on 10% of the acres reported. Other commonly reported weed problems included kochia, wild oat, and Canada thistle (Table 13).

In North Dakota, nightshade was the worst weed problem for 14% of survey respondents on 19% of the North Dakota acres reported, a substantially higher percentage than in 1996, when nightshade was the third worst weed problem. Foxtail was the worst weed problem for 15% of respondents on 15% of the acres reported, which is similar to 1996. Canada thistle was the worst weed problem for 17% of respondents on 15% of acres reported, wild mustard was the worst weed for 9% of respondents on 10% of acres reported and cocklebur was the worst weed for 10% of respondents on 8% of acres reported. Other commonly reported weed problems included redroot pigweed, lambsquarters, kochia and ragweed (Table 13). Canada thistle was more commonly reported as a weed problem in 1997 than in 1996, but wild mustard was much less of a problem in 1997 than in 1996.

Canada thistle was ranked most frequently as one of the three worst weed problems for Northharvest respondents, with 32% of respondents' acres affected, followed

by foxtail on 32%, redroot pigweed on 32%, nightshade on 30%, kochia on 20%, ragweed on 19%, lambsquarters on 19%, cocklebur on 16%, wild mustard on 15% and wild oat on 13% (Table 14). Kochia was a more common weed problem in 1997 than in 1996 and wild mustard was a less common weed problem in 1997 than in 1996.

In Minnesota, redroot pigweed was ranked most frequently as one of the three worst weed problems on 52% of respondents' acres, followed by ragweed on 32%, lambsquarters on 28%, foxtail on 24%, nightshade on 23%, Canada thistle on 21%, kochia on 18%, wild oat on 14%, wild mustard on 12% and volunteer grain on 10% (Table 14). Wild mustard was less of a problem in 1997 than in 1996.

Table 14. Weeds ranked as one of the three worst in 1997 in Minnesota and North Dakota.

No. 1, 2 or 3 Weed Problem ^a	- Respondents -		- Acres Reported ^b -	
	Number	%	Number	%
Minnesota				
Redroot pigweed	25	42.4	12,772	52.1
Ragweed	21	35.6	7,940	32.4
Lambsquarters	18	30.5	6,936	28.3
Foxtail	11	18.6	5,843	23.8
Nightshade	16	27.1	5,585	22.8
Canada thistle	12	20.3	5,015	20.5
Kochia	9	15.3	4,320	17.6
Wild oat	5	8.5	3,425	14.0
Wild mustard	5	8.5	2,928	11.9
Volunteer grain	7	11.9	2,480	10.1
North Dakota				
Canada thistle	51	34.5	24,609	36.2
Foxtail	53	36.1	23,703	34.9
Nightshade	43	29.3	22,281	32.8
Redroot pigweed	32	21.8	16,380	24.1
Cocklebur	32	21.8	14,215	20.9
Kochia	25	17.0	14,093	20.8
Wild mustard	17	11.6	10,580	15.6
Lambsquarters	19	12.9	10,211	15.0
Ragweed	16	10.9	9,445	13.9
Wild oat	24	16.3	8,651	12.7
Northharvest total				
Canada thistle	63	30.6	29,624	32.0
Foxtail	64	31.1	29,546	32.0
Redroot pigweed	57	27.7	29,152	31.5
Nightshade	59	28.6	27,866	30.1
Kochia	34	16.5	18,413	19.9
Ragweed	37	18.0	17,385	18.8
Lambsquarters	37	18.0	17,147	18.5
Cocklebur	41	19.9	14,925	16.1
Wild mustard	22	10.7	13,508	14.6
Wild oat	29	14.1	12,076	13.1

^a Ranked as No. 1, 2 or 3 weed problem on more than 10% of respondents' acres.

^b Respondents' acres only.

In North Dakota, Canada thistle was ranked most frequently as one of the three worst weed problems on 36% of respondents' acres, followed by foxtail on 35%, nightshade on 33%, redroot pigweed on 24%, cocklebur on 21%, kochia on 21%, wild mustard on 16%, lambsquarters on 15%, ragweed on 14% and wild oat on 13% (Table 14). Wild mustard was less of a problem in 1997 than in 1996.

Weed Control Practices

The most common chemical weed control practices were post-applied bentazon (Basagran, others), used by 78% of respondents on 49% of Northarvest respondent's acres, followed by spring applied trifluralin, used on 29% of respondents' acres, and spring applied Sonalan, used on 27% (Table 15). The use of post-applied bentazon was down from use on 62% of respondents' acres in 1996; use of spring applied Sonalan was down from 62% of respondents' acres in 1996. On the other hand, the use of spring-applied trifluralin was up from 17% of respondents' acres in 1996. Other common chemical weed control practices were post-applied Pursuit, applied on 21% of respondents' acres; fall applied Sonalan, applied on 21% of respondents' acres; post-applied Assure II, applied on 19% of respondents' acres; post applied Poast, applied on 9% of respondents' acres; spring applied Eptam, applied on 8% of respondents'

acres; Prowl, applied on 5% of respondents' acres; trifluralin + Eptam, applied on 4% of respondents' acres; Lasso, applied on 4% of respondents' acres; fall applied trifluralin, applied on 4% of respondents' acres, and preplant Roundup, applied on 3% of respondents' acres (Table 15).

The most common cultural weed control practice was row cultivation, used by 85% of Northarvest respondents on 84% of their acres. Rotary hoe was used by 23% of respondents on 23% of their acres. Both practices represent a slight increase over 1996 (Table 15).

In Minnesota, post-applied bentazon was applied by 80% of respondents on 52% of their acres, down slightly from 55% in 1996. Spring-applied trifluralin was applied to 30% of respondents' acres, up from 21% in 1996. Fall applied Sonalan was applied on 26% of respondents' acres, a great increase from 1996 when the practice was not even recorded. Assure II was applied on 22% of respondents' acres, followed by spring applied Eptam, applied on 19% of respondents' acres, up slightly from 1996; Lasso, applied on 14% of respondents' acres; and Prowl, applied on 13% of respondents' acres. Row cultivation was used by 85% of respondents on 81% of their acres, down from 85% in 1996. Rotary hoe was used on 33% of respondents' acres, up slightly from 30% in 1996 (Table 16).

Table 15. Weed control practices in 1997 by all Northarvest respondents in Minnesota and North Dakota.

Weed Control Practice ^a	Respondents		Acres Treated ^b	
	Number	%	Number	%
Cultivation	174	84.5	77,835	84.2
Bentazon (Basagran, others)	160	77.7	45,229	48.9
Trifluralin, spring applied	89	43.2	26,599	28.8
Sonalan, spring applied	74	35.9	24,889	26.9
Rotary hoe	48	23.3	21,432	23.2
Pursuit	75	36.4	19,443	21.0
Sonalan, fall applied	72	35.0	19,420	21.0
Assure II	83	40.3	17,645	19.1
Poast	39	18.9	8,415	9.1
Eptam, spring applied	22	10.7	7,369	8.0
Prowl	19	9.2	4,345	4.7
Trifluralin + Eptam	18	8.7	3,630	3.9
Lasso	12	5.8	3,573	3.9
Trifluralin, fall applied	17	8.3	3,290	3.6
Roundup, preplant	15	7.3	2,800	3.0

^a Includes all practices or herbicides used on more than 1,000 acres.

^b Respondents' acres only.

Table 16. Common weed control practices in 1997 in Minnesota and North Dakota.

Weed Control Practice ^a	Respondents		Acres Treated ^b	
	Number	%	Number	%
Minnesota				
Cultivation	50	84.7	19,874	81.1
Bentazon (Basagran, others)	47	79.7	12,856	52.4
Rotary hoe	18	30.5	8,132	32.8
Trifluralin, spring applied	28	47.5	7,459	30.4
Sonalan, fall applied	24	40.7	6,437	26.3
Assure II	30	50.8	5,480	22.4
Eptam, spring applied	14	23.7	4,549	18.6
Lasso	11	18.6	3,468	14.1
Prowl	14	23.7	3,095	12.6
North Dakota				
Cultivation	124	84.4	57,961	85.3
Bentazon (Basagran, others)	113	76.9	32,373	47.7
Sonalan, spring applied	61	41.5	22,946	33.8
Trifluralin, spring applied	61	41.5	19,140	28.2
Pursuit	61	41.5	17,590	25.9
Rotary hoe	30	20.4	13,300	19.6
Sonalan, fall applied	48	32.7	12,983	19.1
Assure II	53	36.1	12,165	17.9
Poast	31	21.1	7,090	10.4

^a Practice or herbicide used on more than 10% of respondents' acres.

^b Respondents' acres only.

In North Dakota, post-applied bentazon was applied by 77% of respondents on 48% of their acres, down from 64% in 1996. Spring applied Sonalan was applied to 34% of respondents' acres, down from 65% in 1996. Spring applied trifluralin was applied to 28% of respondents' acres, up from 16% in 1996. Pursuit was applied to 26% of respondents' acres, up slightly from 1996. Fall applied Sonalan was applied on 19% of respondents' acres, followed by Assure II on 18% and Poast on 10%. Row cultivation was used by 84% of respondents on 85% of their acres, up from 77% in 1996. Rotary hoe was used on 20% of respondents' acres, up from 15% in 1996 (Table 16).

Gramoxone extra was the most commonly used desiccant by 48% of Minnesota, 52% of North Dakota and 51% of Northarvest respondents on 24%, 22% and 23% of their acres, respectively. Sodium chlorate was the most commonly used desiccant for 36% of Minnesota, 10% of North Dakota and 17% of Northarvest respondents on 9%, 2% and 4% of their acres, respectively (Table 17).

Post-applied bentazon was the most commonly used herbicide on 54% of Minnesota respondents' pinto acres, 52% of their kidney acres and 39% of their navy acres. Spring applied trifluralin was used on 42% of Minnesota respondents' pinto acres, 36% of their kidney acres and 11% of their navy acres. Fall applied Sonalan was used on 32% of respondents' kidney acres, 29% of their pinto acres and 18% of their navy acres. Assure II was used on 27% of respondents' kidney acres, 25% of their navy acres and 14% of their pinto acres. Spring applied Eptam was used on 20% of respondents' pinto, 15% of their navy and 10% of their kidney acres. Lasso was used on 51% of respondents' kidney, 8% of their navy and 2% of their pinto acres. Prowl was used on 31% of respondents' navy acres, 19% of their kidney acres and none of their pinto acres (Table 18).

Table 17. Desiccants used in 1997 in Minnesota and North Dakota.

Desiccant	Respondents		Acres Treated ^a	
	Number	%	Number	%
Minnesota				
Sodium chlorate	21	35.6	2,100	8.6
Gramoxone extra	28	47.5	5,915	24.1
North Dakota				
Sodium chlorate	14	9.5	1,645	2.4
Gramoxone extra	77	52.4	14,980	22.1
Northarvest total				
Sodium chlorate	35	17.0	3,745	4.1
Gramoxone extra	105	51.0	20,895	22.6

^a Respondents' acres only.

Post-applied bentazon was the most commonly used herbicide on 53% of North Dakota respondents' navy acres, 38% of their pinto acres and 29% of their kidney acres. Spring applied Sonalan was used on 36% of respondents' navy acres, 34% of their pinto acres and none of their kidney acres. Spring applied trifluralin was used on 31% of respondents' kidney acres, 28% of their pinto acres and 18% of their navy acres. Pursuit was used on 22% of respondents' pinto acres, 22% of their navy acres and 8% of their kidney acres. Fall applied Sonalan was used on 20% of respondents' pinto acres, 16% of their navy acres and none of their kidney acres. Assure II was used on 28% of respondents' kidney acres, 20% of their navy acres and 18% of their pinto acres. Poast was used on 16% of respondents' kidney acres, 12% of their navy acres and 11% of their pinto acres (Table 18).

Inter-row cultivation was used once by 30% of Minnesota respondents who answered the question, twice by 56%, three times by 12% and five times by 2%. Inter-row cultivation was used once by 31% of North Dakota respondents who answered the question, twice by 55%, and three times by 15% (Table 19).

Rotary hoe was used once by 67% of Minnesota respondents who answered the question, twice by 17%, three times by 11% and four times by 6%. Rotary hoe was used once by 70% of North Dakota respondents, twice by 23%, and three times by 7% (Table 20).

Table 18. Herbicide use by bean class in 1997 in Minnesota and North Dakota.

Herbicide	Kidney	Navy	Pinto	State
				Total
----- % of Acres Treated ^a -----				
Minnesota				
Bentazon				
(Basagran, others)	52.4	39.3	53.5	52.4
Trifluralin, spring applied	35.6	10.7	41.7	30.4
Sonalan, fall applied	32.1	18.2	29.4	26.3
Assure II	27.1	25.4	14.3	22.4
Eptam, spring applied	9.9	15.3	20.4	18.6
Lasso	51.1	7.7	1.6	14.1
Prowl	18.8	30.9	0	12.6
North Dakota				
Bentazon				
(Basagran, others)	28.9	53.3	37.5	47.7
Sonalan, spring applied	0	35.6	34.1	33.8
Trifluralin, spring applied	30.5	18.1	27.9	28.2
Pursuit	8.0	21.6	22.0	25.9
Sonalan, fall applied	0	16.3	19.9	19.1
Assure II	28.1	19.9	17.5	17.9
Poast	16.1	12.3	10.9	10.4

^a % of respondents' acres.

Insect Problems

Grasshoppers were the worst insect problem for 14% of Northharvest survey respondents representing 15% of the dry bean acres reported, up from 6% of acres reported in 1996. Grasshoppers were more of a problem for North Dakota respondents than for Minnesota respondents. The potato leafhopper was the worst insect problem for 8% of Northharvest survey respondents on 9% of their acres. The potato leafhopper was slightly more of a problem for Minnesota respondents than for North Dakota respondents (Table 21).

Micronutrient Usage

Zinc, a common micronutrient for dry beans, was applied to 57% of Northharvest respondents' acres, the same as in 1996. Zinc was applied to 67% of Minnesota and 53% of North Dakota respondents' acres, which is similar usage to 1996. Other micronutrients were used on 5% of Northharvest respondents' acres, down slightly from 1996. Use of other micronutrients was greater in Minnesota than in North Dakota (Table 22).

A single application of zinc was made by 93% of Minnesota and 92% of North Dakota respondents, with two applications made by 7% of Minnesota and 8% of North Dakota respondents. All respondents in both states made but a single application of other micronutrients (Table 23).

Table 21. Worst insect problem in 1997 in Minnesota and North Dakota.

Worst Insect Problem ^a	Respondents		Acres Reported ^b	
	Number	%	Number	%
Minnesota				
Grasshopper	7	38.9	3,394	13.8
Leafhopper	7	38.9	2,390	9.7
North Dakota				
Grasshopper	21	63.6	10,460	15.4
Leafhopper	9	27.3	5,560	8.3
Northharvest				
Grasshopper	28	13.6	13,854	15.0
Leafhopper	16	7.8	8,040	8.7

^a Insect problems reported on more than 1% of respondents' acres.

^b Respondents' acres only.

Table 22. Use of zinc and other micronutrients in 1997 in Minnesota and North Dakota.

Treatment	Acres Treated ^a	
	Number	%
Minnesota		
Zinc	16,307	66.5
Other micronutrients	1,810	7.4
North Dakota		
Zinc	35,957	52.9
Other micronutrients	2,625	3.9
Northharvest total		
Zinc	52,264	56.5
Other micronutrients	4,435	4.8

^a Respondents' acres only.

Table 23. Number of applications of zinc and other micronutrients in 1997 by respondents in Minnesota and North Dakota.

	No. of Applications		
	Zinc		Other Micronutrients
	1	2	1
- % of respondents ^a -			
Minnesota	92.6	7.4	100
North Dakota	91.7	8.3	100

^a Percent of those responding to question; includes only respondents who applied micronutrients.

Table 19. Number of cultivations of dry beans in 1997 in Minnesota and North Dakota.

	Number of Cultivations ^a				
	1	2	3	4	5
Minnesota	30.0	56.0	12.0	0	2.0
North Dakota	30.6	54.8	14.5	0	0

^a % of respondents answering question; excludes respondents who did not answer question.

Table 20. Number of times rotary hoe was used on dry beans in 1997 in Minnesota and North Dakota.

	Number of Times Rotary Hoe Used ^a			
	1	2	3	4
Minnesota	66.7	16.7	11.1	5.6
North Dakota	70.0	23.3	6.7	0

^a % of respondents answering questions; excludes respondents who did not answer question.

Crop Rotations

Crop rotations used by Northharvest respondents usually involved several years between dry bean crops. Nearly 45% of the dry beans planted in Minnesota followed wheat, another 25% followed corn and 12% followed sugarbeets. Dry beans were planted two years before dry beans on 31% of Minnesota respondents' acres, followed by barley and wheat, each planted on 15% of Minnesota respondents' acres (Table 24). Dry beans were planted three years before dry beans on 45% of Minnesota respondents' acres, followed by wheat on 25% and corn on 14%. Thus, two and three year rotations were common for Minnesota dry bean respondents, as indicated for 80% of respondents' fields.

Table 24. Crop rotation. Crop grown by respondents in Minnesota and North Dakota one, two, three and four years before the 1997 crop of dry beans.

Preceding Crop	Number of Years Before Dry BeanCrop		
	1	2	3
	----- % of Respondents ^a -----		
Minnesota			
Barley	4.8	14.8	6.8
Corn	25.3	12.3	12.3
Dry Bean	0	30.9	49.3
Potato	4.8	2.5	2.7
Soybean	3.6	9.9	1.4
Sugarbeet	12.0	12.3	4.1
Wheat	44.6	14.8	23.3
North Dakota			
Barley	5.1	21.0	11.3
Corn	12.8	8.2	6.7
Dry Bean	0.5	28.7	41.3
Flax	1.0	1.0	0
Potato	0.5	0.5	0.7
Soybean	6.2	11.8	2.7
Sugarbeet	3.6	3.6	5.3
Sunflower	1.0	0.5	0.7
Wheat	69.2	23.1	31.3

^a Percent of those responding to question.

Since respondents were requested to list crops grown over a period of four years in a crop rotation table (see Figure 1), some respondents with a two year rotation listed wheat, barley or corn for the third year. These crops actually represented the beginning of the next rotational cycle. Data from the fields with two year rotations were eliminated from the totals for the third year. Data for the fourth year was not used due to the confusion created by two and three year rotations.

Over 69% of the dry beans planted in North Dakota followed wheat, 13% followed corn and 6% followed soybeans. Dry beans were planted two years before dry beans on 29% of North Dakota respondents' acres, followed by wheat on 23%, barley on 21% and soybean on 12% (Table 24). Dry beans were planted three years before dry beans on 41% of North Dakota respondents' acres, followed by wheat on 31% and barley on 11%. Thus, two and three year rotations were common for North Dakota dry bean respondents, as indicated for 70% of respondents' fields.

The crop preceding dry beans was similar to that in 1996, except that fewer dry beans followed barley in North Dakota in 1997 than in 1996. There was also a reduction in the percent of dry beans that followed corn in Minnesota.

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