

1992 Dry Bean Grower Survey

of Pest Problems and Pesticide Use in Minnesota and North Dakota

H.A. Lamey

D.R. Berglund

M.P. McMullen

J.L. Luecke

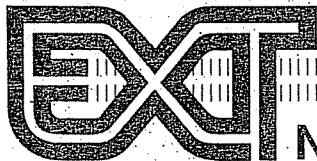
R.K. Zollinger

P.A. Glogoza

J.R. Venette

D.K. McBride

K.F. Grafton



NDSU EXTENSION SERVICE

North Dakota State University, Fargo, ND 58105

DECEMBER 1994

This is the sixth annual survey of pest problems, pesticide use and grower practices of the Northharvest Bean Growers Association, an association comprised of dry bean growers in Minnesota and North Dakota. Results of previous surveys have been published (1, 2, 3, 4, 7). The survey form (Figure 1, page 4) was designed with input from research and extension faculty at North Dakota State University, the University of Minnesota, and the directors of Northharvest Bean Growers Association. The survey was mailed on November 15, 1992 to all 5,331 growers in the two-state area. The surveys were sorted by Northharvest district, with the district number marked in the corner of the form. Except for district designation, the survey was anonymous. For purposes of this discussion, districts are identified as MN1 through MN5 and ND1 through ND5 (Figure 2).

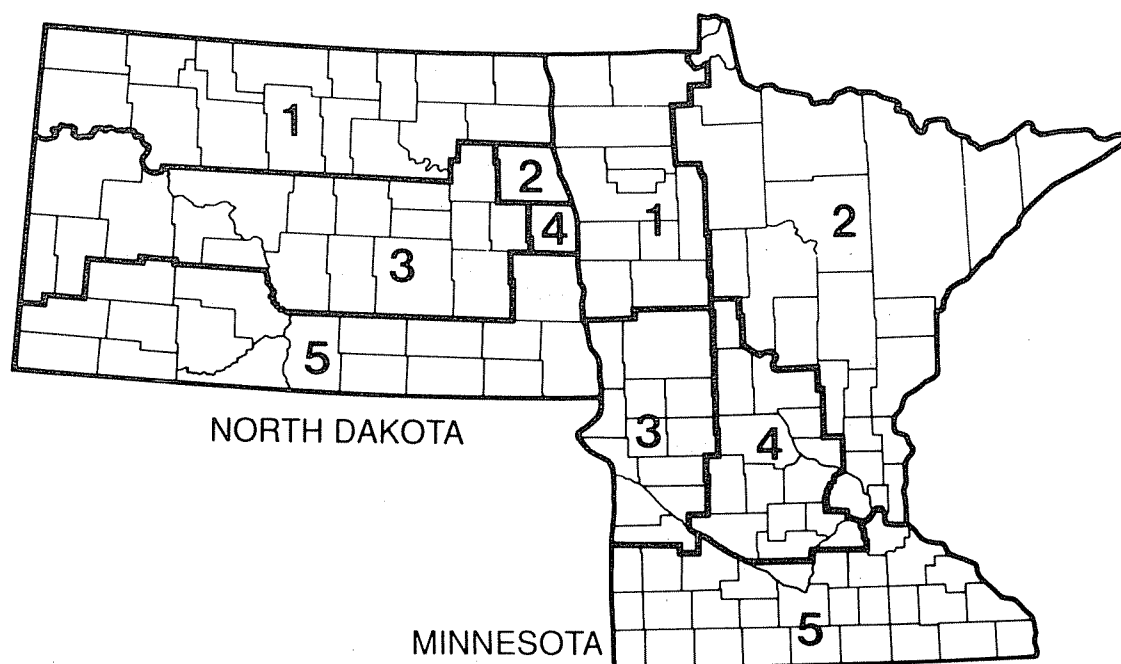


Figure 2. Northharvest bean grower districts.

Please circle or fill in the requested information on pest problems and pesticide use on your 1992 dry bean crop.

MN4

Total acres planted in 1992 _____
 Irrigated acres _____ Dryland acres _____
 Total acres harvested _____
 Acres with hail damage _____
 Acres with frost damage _____

STATE AND COUNTY WHERE GROWN
 If beans are grown in more than one county, list each county and acres)
 State County Acres
 MN _____
 ND _____
 SD _____

VARIETY GROWN IN 1992
 Variety Acres
 PINTO _____
 Fiesta _____
 Nodak _____
 Olathe _____
 Othello _____
 RS 101 _____
 Sierra _____
 Topaz _____
 Other (specify) _____
 Other (specify) _____
NAVY
 Agri 1 _____
 Fleetwood _____
 Hyden _____
 Mayflower _____
 Midland _____
 Norstar _____
 Pearl _____
 Schooner _____
 Stinger _____
 Upland _____
 Other (specify) _____
 Other (specify) _____
DARK RED KIDNEY
 Montcalm _____
 Other _____
LIGHT RED KIDNEY
 Sacramento _____
 Other _____
OTHER MARKET CLASS/VARIETY (specify) _____

SEED SOURCE IN 1992 AND ACRES bagged and tagged _____
 bin run _____
 Dome Tested _____

OTHER COMMENTS _____

BIGGEST WEATHER PROBLEM IN DRY BEANS IN 1992 (CIRCLE ONE)

Cold Weather _____
 Drought _____
 Flooding _____
 Frost _____
 Hail _____
 Wind/Sandblasting _____
 Other _____

BIGGEST PRODUCTION PROBLEM IN 1992 (CIRCLE ONE)

None _____
 Weeds _____
 Emergence/Stand _____
 Insects _____
 Disease _____
 Micronutrient deficiency _____
 Applied Herbicide Injury _____
 Herbicide Drift Injury _____
 Harvesting _____
 Other _____

INTEGRATED PEST MANAGEMENT

Did you hire a consultant to scout dry beans?
1992 prior to 1992
 a) yes a) yes
 b) no b) no
 Pesticide Use in 1992 Was:
 a) less b) more c) same
 If less or more _____% increase or decrease
 If less pesticide used in 1992, was due to (please circle one or more):
 a) fewer pests
 b) better application techniques
 c) better scouting for timely applications
 d) use of different chemicals with lower use rates
 e) not economically feasible
 f) used alternative pest management practices
 (Please specify below).
 1. Crop Rotation _____ # acres
 2. Preceding crop _____
 how long since previous dry beans? _____ ?
 3. Cultivation _____ # acres
 # times cultivated
 4. Resistant Variety _____ # acres
 5. Water Management (irrigators) _____ # acres
 6. Other (specify) _____ # acres

Results of survey will be published in **BEAN TALK**

Please return by December 15, 1992
 Thank You
Arthur Lamey
 Extension Plant Pathologist

EVALUATE WEED CONTROL AND DRY BEAN INJURY

Mark weed control used and indicate acres treated for each item. Count double applications, double cultivation, etc.

Weed Control Used	Acres Treated	WEED CONTROL		BEAN INJURY	
		1 = Excellent	2 = Good	1 = None	2 = Slight
Roundup (preplant)	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Eptam (fall)	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Eptam (spring)	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Trifluralin (fall)	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Trifluralin + Eptam	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Sonalan (fall)	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Sonalan (spring)	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Amiben	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Alachlor/Lasso	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Dual	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Prowl	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Bentazon/Basagran	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Poast	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
No Herbicide Used	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Cultivation	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Rotary Hoe	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Hand Weeding	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Other	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
DESICCANTS:					
Sodium Chlorate	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Gramoxone Extra	_____	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4

WORST WEED PROBLEMS IN DRY BEANS IN 1992

(Rank 1-3, 1 = worst)
 _____ Redroot pigweed
 _____ Wild oats
 _____ Foxtail (pigeongrass)
 _____ Eastern black nightshade
 _____ Wild mustard
 _____ Lambsquarters
 _____ Kochia
 _____ Cocklebur
 _____ Other (specify) _____

WORST INSECT/MITE PROBLEM IN 1992 (Rank 1-3, 1 = worst)

_____ Grasshoppers
 _____ Leafhoppers
 _____ Spider Mites
 _____ Seed Corn Maggot
 _____ Other (specify) _____

INSECTICIDES USED ON DRY BEANS IN 1992:

Insecticide	No. Acres	No. of Sprays
_____	_____	_____
_____	_____	_____
_____	_____	_____

FUNGICIDES(S) USED IN DRY BEANS IN 1992

Fungicide	No. Acres	No. of Sprays
Bravo	_____	_____
Champion/Champ	_____	_____
Kocide	_____	_____
Maneb	_____	_____
Top Cop	_____	_____
Thioux	_____	_____
Benlate (broadcast)	_____	_____
Benlate (banded)	_____	_____
Topsin (broadcast)	_____	_____
Topsin (banded)	_____	_____
Zinc (micro-nutrient, not a fungicide)	_____	_____

WORST DISEASE PROBLEMS IN 1992 (Rank 1-3, 1 = worst)

_____ None
 _____ White mold
 _____ Alternaria
 _____ Rust
 _____ Bacterial blight
 _____ Root Rot
 _____ Other _____

FOR IRRIGATORS ONLY
 Was chemigation (application of chemical through the irrigation system) used in 1992?
 _____ Fungicide
 _____ Insecticide
 _____ Fertilizer

Chemical Applied	Acres
_____	_____
_____	_____
_____	_____

Figure 1. Survey instrument.

Responses

We received 779 useable responses, or a return of 15% (Table 1). These returned surveys represented 183,546 acres (A) or 34% of the Northharvest total of 540,000 A planted in 1992 (5). This is a similar response rate to previous surveys.

The responses by district are shown in Table 2. MN1, which comprises primarily the Red River Valley, represents 41% of Minnesota respondents' acres. ND2, which is restricted to Grand Forks county (North Dakota), represents nearly 22% of North Dakota respondents' acres.

Irrigation and Chemigation

Irrigation was used on nearly 10% of Northharvest respondents' acres (Table 3). It was used on 40% of Minnesota respondents' acres, with the percentage as high as 92% in MN2. By contrast, irrigation was used on less than 2% of North Dakota respondents' acres.

Fertilizers were the only chemical applied through the irrigation system (chemigation) (Table 4). Fertilizers applied via irrigation were applied to less than 4% of respondents' acres, although they were applied to 16% of Minnesota respondents' acres in this manner.

Table 1. Number of Northharvest dry bean growers contacted, respondents, total acres and acres planted by Minnesota and North Dakota respondents in 1992.

State	Growers			Acres Planted		
	Contacted	Responded	% Responded	Total ^a	Respondents	Respondents' Acres
	No.	No.	%	No.	No.	% of Total
Minnesota	1,244	201	16.2	100,000	38,518	35.5
North Dakota	4,087	578	14.1	440,000	145,028	33.0
Northharvest Total	5,331	779	14.6	540,000	183,546	34.0

^aTotal acres planted in state according to USDA data

Table 2. Number of respondents and acres planted in 1992 by respondents in each Northharvest district of Minnesota and North Dakota.

Northharvest District	Respondents		Acres Planted	
	No.	% of State Total	No. ^a	% of State Total ^a
Minnesota				
MN1	58	28.9	15,890	41.3
MN2	14	7.0	8,647	22.4
MN3	75	37.3	8,044	20.9
MN4	49	24.4	5,782	15.0
MN5	5	2.5	155	0.4
MN Total	201	100.0	38,518	100.0
North Dakota				
ND1	179	31.0	40,492	27.9
ND2	113	19.6	31,220	21.5
ND3	112	19.4	27,108	18.7
ND4	80	13.8	23,452	16.2
ND5	94	16.3	22,756	15.7
ND Total	578 ^b	100.0	145,028 ^c	100.0
Northharvest Total				
	779		183,546	

^aRespondents' acres only

^b74.2% of all respondents

^c79.0% of all respondents' acres

Table 3. Acres irrigated in 1992 by respondents in each Northharvest district of Minnesota and North Dakota.

Northharvest District	Acres Irrigated ^a	% of District Acres
Minnesota		
MN1	1,380	8.7
MN2	7,974	92.2
MN3	2,817	35.0
MN4	3,237	56.0
MN5	0 ^b	0
MN Total	15,408	40.0
North Dakota		
ND1	58	0.1
ND2	356	1.1
ND3	1,632	6.0
ND4	0	0
ND5	782	3.4
ND Total	2,428	1.7
Northharvest Total		
	17,836	9.7

^aRespondents' acres only

^bNo irrigated acres reported for this district

Zinc Usage

Zinc, a commonly used micronutrient on dry beans, was used on nearly 19% of survey respondents' acres, the same as in 1991 and up slightly from 1990 (2, 3). Use of zinc was the same in both states (Table 5).

Use of Bagged and Tagged Seed

The use of bagged and tagged seed was down from 1991 levels of 94% (2), with 85% of survey respondents' acres planted with bagged and tagged seed in 1992 (Table 6). Bagged and tagged seed was used on 91% of Minnesota respondents' acres and 83% of North Dakota respondents' acres. Use of bagged and tagged seed varied by district from a high of 100% of respondents' acres in MN5 to a low of 76% in ND5.

Use of the Dome Test

The dome test is a test designed to determine the relative amount of bacterial blight in the seed. This test was used on seed to plant 12% of Northharvest respondents' acres, or 5% of Minnesota respondents' acres and 14% of North Dakota respondents' acres (Table 7). Previous surveys did not request information on the dome test.

Varieties Grown

Othello pinto, which was the leading Northharvest variety in 1991 (2), continued to be the leading variety in 1992, as 37% of Northharvest survey respondents planted this variety on 22% of all dry bean acres reported (Table 8). Othello accounted for 40% of the pinto bean acres. Othello was the third most commonly planted variety in 1990, behind Upland navy and Topaz pinto (3), and was the fourth most commonly planted variety in 1989 (4). Topaz pinto moved from third to second, with 12% of survey respondents' dry bean acres planted to this variety, and Upland

Table 4. Chemigation use in 1992 by respondents in Minnesota and North Dakota.

	Chemical Applied	-- Respondents --		----- Acres ^a -----	
		No.	%	No.	%
Minnesota	Fertilizer	9	4.5	6,235	16.2
North Dakota	Fertilizer	2	0.3	195	0.1
Northharvest Total	Fertilizer	11	1.4	6,430	3.5

^aRespondents acres only

Table 5. Use of zinc in 1992 by respondents in Minnesota and North Dakota.

	Respondents		Acres Treated ^a	
	No.	%	No.	%
Minnesota	21	10.4	7,300	19.0
North Dakota	102	17.6	27,024	18.6
Northharvest Total	123	15.8	34,324	18.7

^aRespondents' acres only

Table 6. Use of bagged and tagged seed in 1992 by respondents in each Northharvest district of Minnesota and North Dakota.

Northharvest District	% of Respondents' Acres Planted with Bagged and Tagged Seed
Minnesota	
MN1	85.0
MN2	96.7
MN3	92.3
MN4	96.5
MN5	100.0
MN Total	90.9
North Dakota	
ND1	86.7
ND2	84.9
ND3	82.5
ND4	80.0
ND5	76.3
ND Total	82.8
Northharvest	84.5

Table 7. Respondents use of dome test on seed in 1992.

	% of Respondents Using Dome Test	% of Respondent Acres with Dome Tested Seed
Minnesota		
MN1	13.8	12.4
MN2	0	0
MN3	0	0
MN4	2.0	1.6
MN5	0	0
MN Total	5.3	5.3
North Dakota		
ND1	10.1	9.3
ND2	11.5	12.8
ND3	17.0	23.2
ND4	12.5	18.5
ND5	8.5	5.6
ND Total	11.8	13.6
Northharvest	9.9	11.9

navy moved from second to third, with 9% of respondents' dry bean acres. The Upland acres represent 27% of the navy acres reported. Other varieties commonly grown were Nodak pinto, Schooner navy, and Montcalm dark red kidney, planted on 8%, 6% and 5% of respondents' dry bean acres, respectively. Montcalm acres represent 66% of survey respondents' kidney bean acres.

Kidney beans were the most commonly grown bean type in Minnesota, with Montcalm dark red kidney and Sacramento light red kidney accounting for 35% of Minnesota respondents' acres (Table 9). Upland navy was the third most commonly grown dry bean variety in Minnesota.

In North Dakota, Othello pinto, Topaz pinto, Nodak pinto and Upland navy were the most commonly grown dry bean varieties (Table 9). The three pinto varieties accounted for 51% of North Dakota respondents' acres.

The class of bean varied by district, with 52% of respondents' dry bean acres in MN1 planted to pinto beans and 36% to navy beans, 93% of respondents' acres in MN2 planted to kidney beans, 65% of respondents' acres in MN3 planted to navy beans, 52% of respondents' acres in MN4

planted to kidney beans and 32% to navy beans, and 100% of respondents' acres in MN5 planted to navy beans (Table 10). Pinto beans were the dominant variety in ND1 (89% of respondents' acres), ND2 (58%) and ND3 (68%). Acreage was evenly split between pinto (49%) and navy (47%) in ND4 and navy beans were dominant (56%) in ND5 followed by pinto (44%).

Weather Problems

The worst weather problem in 1992 was cold weather, as reported for 77% of Minnesota respondents' acres, for 56% of North Dakota respondents' acres and for 61% of Northharvest respondents' acres (Table 11). Frost was the worst weather problem reported for 7% of Minnesota, 13% of North Dakota and 11% of Northharvest respondents' acres. This compares with 1991 when drought was the worst weather problem in North Dakota and flooding was the worst weather problem in Minnesota (2). Flooding was the worst weather problem reported in 1992 for 7% of Minnesota, 11% of North Dakota and 10% of Northharvest respondents' acres. Drought and hail were the other major problems.

Table 8. Varieties grown^a in 1992 by all Northharvest respondents in Minnesota and North Dakota.

Variety	Type ^d	Respondents		Acres Planted ^b	
		No.	%	No.	%
Agassiz	P	23	3.0	1,995	1.1
Agri 1	N	58	7.4	4,441	2.4
Fiesta	P	66	8.5	7,651	4.2
Fleetwood	N	24	3.1	2,012	1.1
GT50686	N	29	3.7	1,618	0.9
Mayflower	N	46	5.9	5,070	2.8
Midland	N	28	3.6	4,855	2.6
Montcalm	DRK	49	6.3	9,630	5.2
Nodak	P	117	15.0	14,730	8.0
Norstar	N	80	10.3	5,312	2.9
Olathe	P	64	8.2	6,344	3.5
Othello	P	290	37.2	41,046	22.4
Pearl	N	13	1.7	1,014	0.6
RS 101	P	60	7.7	5,337	2.9
Sacramento	LRK	26	3.3	4,241	2.3
Schooner	N	93	11.9	10,826	5.9
Sierra	P	14	1.8	1,572	0.9
Topaz	P	172	22.1	21,615	11.8
Black turtle	BT	28	3.6	2,166	1.2
Upland	N	150	19.3	16,653	9.1
Vista	N	59	7.6	3,750	2.0
Other	—	43	5.5	3,373	1.8

^aIncludes all varieties reported grown on more than 1,000 acres.

^bRespondents' acres only

^cBT = Black Turtle; DRK = Dark Red Kidney; LRK = Light Red Kidney; N = Navy; P = Pinto

Table 9. Varieties most commonly grown in 1992 by respondents in Minnesota and North Dakota.

	Variety	Type	Acres Planted ^a	
			No.	%
Minnesota	Montcalm	DRK	9,212	23.9
	Sacramento	LRK	4,241	11.0
	Upland	N	3,627	9.4
	Fiesta	P	2,791	7.2
	Othello	P	2,254	5.9
North Dakota	Othello	P	38,792	26.7
	Topaz	P	20,773	14.3
	Nodak	P	14,338	9.9
	Upland	N	13,026	9.0
	Schooner	N	10,079	6.9
	Northharvest Total			
	Othello	P	41,046	22.4
	Topaz	P	21,615	11.8
	Upland	N	16,653	9.1
	Nodak	P	14,730	8.0
	Schooner	N	10,826	5.9
	Montcalm	DRK	9,630	5.2

^aRespondents' acres only

Table 10. Class of dry bean grown in 1992 by respondents in each district in Minnesota and North Dakota.

Northwest District	Acres Planted ^a									
	Black Turtle		Kidney		Navy		Pinto		Other	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Minnesota										
MN1	240	1.5	784	4.9	5,636	35.5	8,306	52.3	924	5.8
MN2	0	0	8,053	93.1	511	5.9	0	0	83	1.0
MN3	78	1.0	2,179	27.1	5,186	64.5	205	2.5	396	4.9
MN4	388	6.7	3,016	52.2	1,835	31.7	203	3.5	340	5.9
MN5	0	0	0	0	155	100.0	0	0	0	0
MN Total	706	1.8	14,032	36.4	13,323	34.6	8,714	22.6	1,743	4.5
North Dakota										
ND1	80	0.2	80	0.2	3,496	8.6	36,049	89.0	787	1.9
ND2	649	2.1	0	0	11,789	37.8	18,209	58.3	573	1.8
ND3	135	0.5	235	0.9	8,289	30.6	18,373	67.8	76	0.3
ND4	596	2.5	80	0.3	11,109	47.4	11,473	48.9	194	0.8
ND5	0	0	110	0.5	12,642	55.6	10,004	44.0	0	0
ND Total	1,460	1.0	505	0.3	47,325	32.6	94,108	64.9	1,630	1.1
Northarvest Total	2,166	1.2	14,537	7.9	60,648	33.0	102,822	56.0	3,373	1.8

^aRespondents' acres only

Hail damage in the Northarvest area was up from 7% of respondents' acres in 1991 (2) to 12% in 1992 (Table 12). Hail damaged a higher percentage of North Dakota respondents' acres in 1992 (14%) than in 1991 (6%), but a lower percentage of Minnesota respondents' acres in 1992 (7%) than in 1991 (12%).

Production Problems

The worst production problem for Northarvest survey respondents was weeds, followed by harvesting and diseases (Table 13). Weeds were reported to be the worst production problem by 33% of survey respondents representing 33% of the acres reported. Harvesting was reported to be the worst production problem by 12% of survey respondents representing 14% of the acres reported and diseases were reported to be the worst production problem by 12% of survey respondents representing 11% of the acres reported.

Harvesting was reported as the worst production problem in Minnesota by 17% of that state's respondents representing 29% of respondents' acres. Weeds were reported as the worst production problem in Minnesota by 26% of that state's respondents representing 19% of respondents' acres. Diseases were reported as the worst production problem in Minnesota by 22% of the state's respondents representing 16% of respondents' acres.

Table 11. Worst weather problem in 1992 for respondents in Minnesota and North Dakota.

Worst Weather Reported	--- Respondents ---		--- Acres Reported ^a ---	
	No.	%	No.	%
Minnesota				
Cold Weather	136	67.7	29,789	77.3
Flooding	28	13.9	2,740	7.1
Frost	15	7.5	2,643	6.9
Drought	8	4.0	1,360	3.5
Hail	7	3.5	1,144	3.0
No Response ^b	7	3.5	842	2.2
North Dakota				
Cold Weather	328	56.7	81,469	56.2
Frost	82	14.2	18,358	12.7
Flooding	52	9.0	15,575	10.7
Drought	58	10.0	14,254	9.8
Hail	0	6.9	11,791	8.1
No Response ^b	18	3.1	3,581	2.5
Northarvest				
Cold Weather	464	59.6	111,258	60.6
Frost	97	12.5	21,001	11.4
Flooding	80	10.3	18,315	10.0
Drought	66	8.5	15,614	8.5
Hail	47	6.0	12,935	7.0
No Response ^b	25	3.2	4,423	2.4

^a Respondents' acres only

^b None, no response, other

Weeds were reported as the worst production problem in North Dakota by 35% of that state's respondents representing 37% of the acres. Harvesting was reported as the worst production problem in North Dakota by 10% of that state's respondents representing 10% of the acres. Diseases were reported as the worst production problem by only 9% of North Dakota respondents representing 9% of the acres reported (Table 13).

Weed Problems

Wild mustard was the worst weed problem for 37% of Northharvest survey respondents representing 40% of the acres reported. Foxtail was the worst weed problem for 12% of respondents representing 11% of the acres reported, redroot pigweed for 7% of respondents representing 9% of the acres reported, common cocklebur for 7% of respondents representing 8% of the acres reported and eastern black nightshade for 8% of respondents representing 8% of the acres reported. Other commonly reported weed problems included kochia, common lambsquarters and wild oats (Table 14).

In Minnesota, redroot pigweed was the worst weed problem for 10% of survey respondents representing 22% of the Minnesota acres reported. Wild mustard was the worst weed for 15% of respondents representing 19% of Minnesota acres reported, eastern black nightshade was

Table 12. Hail damage in 1992 to respondents' beans in each Northharvest district of Minnesota and North Dakota.

Northharvest District	Respondents Reporting Hail		Area Damaged ^a	
	No.	% ^b	Acres	% ^b
Minnesota				
MN1	11	19.0	1,517	9.5
MN2	2	14.3	102	1.2
MN3	4	5.3	347	4.3
MN4	7	8.9	655	11.3
MN5	0	0	0	0
MN Total	24	11.9	2,621	6.8
North Dakota				
ND1	31	17.3	4,725	11.7
ND2	15	13.3	2,565	8.2
ND3	27	24.1	4,872	13.6
ND4	28	4.8	4,063	20.8
ND5	33	35.1	2,371	17.9
ND Total	134	23.2	19,906	13.7
Northharvest Total	158	20.3	22,527	12.3

^a Respondents' acres only

^b % of District respondents, except for state and Northharvest totals

Table 13. Worst production problem in 1992 for respondents in Minnesota and North Dakota.

Worst Production Problem	Respondents		Acres Reported	
	No.	%	No.	%
Minnesota				
Harvesting	35	17.4	11,297	29.3
Weeds	52	25.9	7,231	18.8
Diseases	44	21.9	6,311	16.4
Weather	10	5.0	2,446	6.4
Emergence/Stand	16	8.0	2,326	6.0
Herbicide Injury	7	3.5	1,000	2.6
Other ^b	3	1.5	605	1.6
None	23	11.4	3,927	10.2
No Response	11	5.5	3,375	8.8
North Dakota				
Weeds	203	35.1	52,921	36.5
Harvesting	56	9.9	13,965	9.6
Diseases	50	8.7	13,151	9.1
Weather	40	6.9	9,448	6.5
Emergence/Stand	38	6.6	9,241	6.4
Other ^b	11	1.9	3,398	2.3
None	157	27.2	37,902	26.1
No Response	23	4.0	5,002	3.4
Northharvest (MN & ND)				
Weeds	255	23.6	60,152	32.8
Harvesting	91	15.1	25,263	13.8
Diseases	94	10.3	19,462	10.6
Weather	50	5.7	11,894	6.5
Emergence/Stand	54	4.6	11,567	6.3
Herbicide Injury	9	2.3	1,520	0.8
Other ^b	14	1.5	4,003	2.2
None	180	30.8	41,829	22.8
No Response	34	4.8	8,377	4.6

^a Respondents' acres only

^b Includes insects

Table 14. Worst weed problem^a in 1992 for all Northharvest respondents in Minnesota and North Dakota.

Worst Weed Problem	Respondents		Acres Reported ^b	
	No.	%	No.	%
Wild Mustard	287	36.8	74,116	40.4
Foxtail	90	11.6	19,426	10.6
Redroot Pigweed	55	7.1	16,374	8.9
Common Cocklebur	57	7.3	15,238	8.3
E. Black Nightshade	59	7.6	15,015	8.2
Kochia	48	6.2	9,889	5.4
Common Lambsquarters	40	5.1	6,658	3.6
Wild Oats	36	4.6	6,228	3.4
Common Ragweed	16	2.1	3,907	2.1

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

^b Respondents' acres only

the worst for 14% of respondents representing 11% of the acres reported, common lambsquarters was the worst for 14% of respondents representing 11% of the reported acres and foxtail was the worst for 11% representing 10% of the acres reported (Table 15).

In North Dakota, wild mustard was the worst weed problem for 45% of survey respondents representing 46% of North Dakota acres reported (Table 15). Foxtail was the worst weed for 12% of respondents representing 11% of the acres reported and common cocklebur was the worst for 7% of respondents representing 10% of the acres reported.

Wild mustard was reported as the worst weed problem in five Northharvest districts. Based on percent of respondents' acres on which the problem was reported, wild mustard was the worst weed in MN1, ND1, ND2, ND3 and ND4 (Table 16). Redroot pigweed was reported as the worst weed in MN2, common lambsquarters in MN3, eastern black nightshade in MN4 and ND5 and foxtail in

Table 15. Worst weed problem^a in 1992 for respondents in Minnesota and North Dakota.

Worst Weed Problem	Respondents		Acres Reported ^b	
	No.	%	No.	%
Minnesota				
Redroot Pigweed	21	10.4	8,641	22.4
Wild Mustard	30	14.9	7,257	18.8
E. Black Nightshade	28	13.9	4,209	10.9
Common				
Lambsquarters	29	14.4	4,094	10.6
Foxtail	23	11.4	3,872	10.1
Common Ragweed	13	6.5	2,622	6.8
Kochia	5	2.5	1,921	5.0
Common Cocklebur	15	7.5	1,315	3.4
Wild Oats	3	1.5	632	1.6
None/Other/ No Response	34	16.9	3,955	10.3
North Dakota				
Wild Mustard	257	44.5	66,859	46.1
Foxtail	67	11.6	15,554	10.7
Common Cocklebur	42	7.3	13,923	9.6
E. Black Nightshade	31	5.4	10,806	7.5
Kochia	43	7.4	7,968	5.5
Redroot Pigweed	34	5.9	7,733	5.3
Wild Oats	33	5.7	5,596	3.9
Common				
Lambsquarters	11	1.9	2,564	1.8
Common Ragweed	3	0.5	1,285	0.9
Canada Thistle	5	0.9	1,164	0.8
None/Other/ No Response	52	9.0	11,576	8.0

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

^b Respondents' acres only

Table 16. Worst weed problem^a in 1992 for respondents in each Northharvest district of Minnesota and North Dakota.

Northharvest District	Worst Weed Problem	Respondents		Acres Reported ^b	
		No.	%	No.	%
Minnesota					
MN1	Wild Mustard	25	43.1	6,768	42.6
	Redroot Pigweed	5	8.6	1,945	12.2
	Kochia	5	8.6	1,921	12.1
	Foxtail	7	12.1	1,704	10.7
MN2	Redroot Pigweed	4	28.6	5,000	57.8
	E. Black				
	Nightshade	1	7.1	1,000	11.6
	Common				
MN3	Ragweed	2	14.3	932	10.8
	Common				
	Lambsquarters	3	21.4	885	10.2
	Common				
MN4	Lambsquarters	15	20.0	1,649	20.5
	E. Black				
	Nightshade	11	14.7	1,244	15.5
	Common				
MN5	Cocklebur	11	14.7	1,190	14.8
	Redroot Pigweed	7	9.3	1,112	13.8
	Foxtail	8	10.7	1,054	13.1
	E. Black				
North Dakota	Nightshade	13	26.5	1,366	23.6
	Common				
	Ragweed	4	8.2	1,340	23.2
	Common				
North Dakota	Lambsquarters	10	20.4	1,278	22.1
	Redroot Pigweed	5	10.2	584	10.1
	Foxtail	1	20.0	40	32.9
	E. Black				
North Dakota	Nightshade	1	20.0	29	18.7
	Common				
	Ragweed	1	20.0	25	16.1
	North Dakota				
ND1	Wild Mustard	100	55.9	23,930	59.1
	Foxtail	19	10.6	4,732	11.7
ND2	Wild Mustard	59	52.2	19,463	62.3
	Foxtail	15	13.3	3,315	10.6
ND3	Wild Mustard	31	27.7	7,380	27.2
	Common				
	Cocklebur	18	16.1	6,067	22.4
	E. Black				
ND4	Nightshade	16	14.3	4,687	17.3
	Foxtail	13	11.6	3,325	12.3
	Wild Mustard	41	51.3	12,471	53.2
	Foxtail	12	15.0	3,342	10.0
ND5	E. Black				
	Nightshade	10	10.6	4,979	21.9
	Common				
	Cocklebur	13	13.8	4,777	21.0
North Dakota	Wild Mustard	26	27.7	3,615	15.9
	Kochia	13	10.7	4,305	12.0

^a Ranked as the No. 1 weed problem on more than 10% of respondents' acres for that district

^b District respondents' acres only

MN5. Redroot pigweed was the second most commonly reported weed problem in MN1. Eastern black nightshade was the second most commonly reported weed in MN2, MN3 and MN5; ragweed was the second in MN4; foxtail was the second in ND1, ND2 and ND4; and common cocklebur was the second in ND3 and ND5.

Weeds that were most frequently ranked as one of the three worst weeds by Minnesota respondents included common lambsquarters on 54% of respondents' acres reported, followed by redroot pigweed on 41%, wild mustard on 37%, eastern black nightshade on 34% and foxtail on 30% (Table 17). Weeds ranked as one of the three worst weeds by North Dakota respondents were wild mustard on 67% of respondents' acres reported, followed by foxtail on 31%, kochia on 29%, common cocklebur on 28% and wild oats on 25%. Weeds ranked as one of the three worst weeds by all respondents in both states were wild mustard on 60% of respondents' acres reported, followed by foxtail on 30%, kochia on 25%, common cocklebur on 24% and redroot pigweed on 24%.

Table 17. Weeds ranked as one of the three worst^a in 1992 by respondents in Minnesota and North Dakota.

No. 1, 2 or 3 Weed Problem	Respondents		Acres Reported ^b	
	No.	%	No.	%
Minnesota				
Common				
Lambsquarters	83	41.3	20,968	54.4
Redroot Pigweed	65	32.3	15,849	41.1
Wild Mustard	56	27.9	14,333	37.2
E. Black Nightshade	61	30.3	12,993	33.7
Foxtail	68	33.8	11,486	29.8
Common Cocklebur	44	21.9	4,414	11.5
Kochia	18	9.0	3,978	10.3
Common Ragweed	20	10.0	3,978	10.3
North Dakota				
Wild Mustard	383	66.3	96,597	66.6
Foxtail	171	29.6	44,263	30.5
Kochia	156	27.0	41,681	28.7
Common Cocklebur	125	21.6	39,879	27.5
Wild Oats	145	25.1	35,769	24.7
Redroot Pigweed	104	18.0	27,691	24.7
E. Black Nightshade	62	10.7	21,571	14.9
Northharvest				
Wild Mustard	439	56.4	110,930	60.4
Foxtail	239	30.7	55,749	30.4
Kochia	174	23.3	45,740	24.9
Common Cocklebur	169	21.7	44,289	24.1
Redroot Pigweed	127	16.3	43,540	23.7
E. Black Nightshade	123	15.8	34,564	18.8
Common				
Lambsquarters	134	17.2	32,038	17.5

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

^b Respondents' acres only.

Wild mustard was ranked as one of the three worst weeds in MN1, ND1, ND2 and ND4 (Table 18). Common lambsquarters was ranked as one of the three worst weeds

Table 18. Weeds ranked as one of the three worst^a in 1992 in each Northharvest district in Minnesota and North Dakota.

Northharvest District	No. 1, 2 or 3 Weed Problem	Respondents		Acres Reported ^b		
		No.	%	No.	%	
Minnesota						
MN1	Wild Mustard	38	65.5	11,400	71.7	
	Redroot Pigweed	16	27.6	5,852	36.8	
	Foxtail	20	34.5	5,612	35.3	
	Common					
MN2	Lambsquarters	9	15.5	3,951	24.9	
	Kochia	11	19.0	3,424	21.5	
	Common					
MN3	Lambsquarters	12	85.7	8,377	96.9	
	E. Black Nightshade	8	57.1	7,060	81.6	
	Redroot Pigweed	6	42.9	5,235	60.5	
MN4	Common					
	Lambsquarters	39	52.0	5,030	62.5	
	E. Black Nightshade	28	37.3	3,231	40.2	
	Redroot Pigweed	24	32.0	3,137	39.0	
MN5	Foxtail	23	30.7	2,819	35.0	
	Common Cocklebur	26	34.7	2,582	32.1	
	Common					
	Lambsquarters	22	44.9	3,581	61.9	
	Common Ragweed	9	18.4	2,283	39.5	
North Dakota	E. Black Nightshade	19	38.8	1,763	30.5	
	Redroot Pigweed	18	36.7	1,615	27.9	
	Foxtail	18	36.7	1,505	26.0	
	Wild Mustard	3	6.1	1,231	21.3	
	Foxtail	3	60.0	105	67.7	
North Dakota	Common Cocklebur	2	40.0	35	22.6	
	ND1	Wild Mustard	133	74.3	31,897	78.8
	Wild Oats	54	30.2	13,313	32.9	
	Foxtail	54	30.2	12,338	30.5	
	Kochia	45	25.1	11,548	28.5	
North Dakota	Redroot Pigweed	30	16.8	8,979	22.2	
	ND2	Wild Mustard	87	77.0	26,094	83.6
	Wild Oats	37	32.7	11,403	36.5	
	Foxtail	33	29.2	9,211	29.5	
	Kochia	31	27.4	7,895	25.3	
North Dakota	Redroot Pigweed	25	22.1	6,771	21.7	
	ND3	Common Cocklebur	48	42.9	14,961	55.2
	Wild Mustard	51	45.5	12,943	47.7	
	Kochia	31	27.7	7,938	29.3	
	Foxtail	32	28.6	7,336	27.1	
North Dakota	E. Black Nightshade	25	22.3	7,257	26.8	
	ND4	Wild Mustard	62	27.7	11,637	51.1
	Foxtail	32	40.0	10,167	43.4	
	Redroot Pigweed	15	18.9	5,252	22.4	
	Kochia	23	28.8	5,050	21.5	
North Dakota	Wild Oats	19	23.8	4,886	20.8	
	ND5	E. Black Nightshade	26	27.7	11,637	51.1
	Common Cocklebur	29	30.9	11,592	50.9	
	Kochia	26	27.7	9,250	40.6	
	Wild Mustard	50	53.2	7,696	33.8	
North Dakota	Foxtail	20	21.3	5,211	22.9	

^a Ranked as No. 1, 2, or 3 on more than 20% of respondents' acres for that district

^b District respondents' acres only

in MN2, MN3 and MN4; foxtail was one of the three worst in MN5, common cocklebur was one of the three worst in ND3; and eastern black nightshade was one of the three worst in ND5.

Weed Control Practices

The most common chemical weed control practice was spring pre-plant incorporation of Sonalan, used on 59% of respondents' acres (Table 19). Other common chemical weed control practices included post-application of bentazon on 35% of their acres, post-application of Poast on 12% and spring pre-plant incorporation of trifluralin on 10%.

The most common cultural weed control practice was row cultivation, used by 83% of respondents on 166% of their acres, indicating an average of 1 2/3 cultivations by respondents (Table 19). Over 55% of respondents used two cultivations, nearly 30% used only one cultivation, and 14% used 3 or more cultivations (Table 20). The rotary hoe was used by 20% of respondents on 23% of their acres, which is similar to 1991 (2).

Table 19. Weed control practices^a in 1992 by all Northharvest respondents in Minnesota and North Dakota.

Weed Control Practice	Respondents		Acres Treated ^b	
	No.	%	No.	%
Cultivation	645	82.8	304,828	166.1
Sonalan, spring applied	496	63.7	108,713	59.2
Bentazon	318	40.8	64,597	35.2
Rotary Hoe	152	19.5	41,557	22.6
Poast	176	22.6	22,619	12.3
Hand Weeding	186	23.9	21,414	11.7
Trifluralin, spring applied	96	12.3	19,178	10.4
Trifluralin, Fall Applied	57	7.3	12,606	6.9
Glyphosate, Preplant	68	8.7	9,456	5.2
Alachlor	45	5.8	9,425	5.1
Sonalan, fall applied	30	3.9	7,267	4.0
Trifluralin + Eptam	24	3.1	6,877	3.7
Dual	22	2.8	4,928	2.7
Prowl	23	3.0	4,292	2.3
Eptam, spring applied	17	2.2	4,128	2.2
Amiben	12	1.5	3,779	2.1
No Herbicide	20	2.6	2,342	1.3

^aIncludes all practices or herbicides used on more than 1,000 acres

^bRespondents' acres only

Desiccants were used by 49% of survey respondents on 49% of their acres, with 37% of survey respondents' acres treated with sodium chlorate and 12% with Gramoxone Extra (Table 21). Consistent with the reported harvesting problems, Minnesota respondents used desiccants on 100% of their acres (sodium chlorate on 80% and Gramoxone Extra on 20%), compared to North Dakota respondents, who used desiccants on 35% of their acres.

Weed control practices in each state were similar except that spring pre-plant incorporated Sonalan was used on 33% of Minnesota respondents' acres and 66% of North Dakota respondents' acres, Poast on 23% of Minnesota respondents' acres and alachlor on 20% of Minnesota respondents' acres; by contrast, Poast and alachlor were used on less than 10% of respondents' acres in North Dakota (Table 22).

Respondents rated most weed control practices as providing good to excellent weed control. Sonalan, trifluralin, Poast and desiccants were among the herbicides rated as most effective (Table 23).

Table 20. Number of cultivations of dry beans in 1992 in Minnesota and North Dakota.

	Number of Cultivations				
	0	1	2	3	4
	----- % of Respondents -----				
Minnesota	0	31.3	57.8	10.9	0
North Dakota	0	29.5	55.4	13.3	1.8
Northharvest Total	0	29.9	56.0	12.7	1.4

Table 21. Desiccant use in 1992 by respondents in Minnesota and North Dakota.

Desiccant	Respondents		Acres Treated ^a	
	No.	%	No.	%
Minnesota				
Sodium chlorate	105	52.2	30,960	80.4
Gramoxone Extra	95	47.3	7,675	19.9
MN Total	200	99.5	38,635	100.3
North Dakota				
Sodium chlorate	130	22.5	36,560	25.2
Gramoxone Extra	55	9.5	14,440	10.0
ND Total	185	32.0	51,000	35.2
Northharvest (MN and ND)				
Sodium chlorate	235	30.2	67,520	36.8
Gramoxone Extra	150	19.3	22,115	12.0
Northharvest Total	385	49.4	89,635	48.8

Table 22. Common weed control practices^a in 1992 by respondents in Minnesota and North Dakota.

Weed Control Practice	Acres Treated ^b	
	No.	%
Minnesota		
Cultivation	64,442	167.3
Sonalan, spring applied	12,809	33.3
Bentazon	11,588	30.1
Rotary Hoe	9,872	25.6
Poast	8,702	22.6
Alachlor	7,756	20.1
Glyphosate, preplant	5,258	13.7
Hand Weeding	4,236	11.0
North Dakota		
Cultivation	236,830	163.3
Sonalan, spring applied	95,904	66.1
Bentazon	53,009	36.6
Rotary Hoe	31,685	21.8
Hand Weeding	17,178	11.8
Trifluralin, spring applied	16,005	11.0
Northarvest (MN & ND)		
Cultivation	304,828	166.1
Sonalan, spring applied	108,713	59.2
Bentazon	64,597	35.2
Rotary Hoe	41,557	22.6
Poast	22,619	12.3
Hand Weeding	21,414	11.7
Trifluralin, spring applied	19,178	10.4

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

^b Respondents' acres only

Table 23. Effectiveness of weed control practices in 1992 reported by all Northarvest respondents in Minnesota and North Dakota.

Weed Control Practice	No. of Respondents	Efficacy of Weed Control ^a			
		1	2	3	4
		----- % of Respondents -----			
Alachlor	44	15.9	45.5	25.0	13.6
Amiben	12	41.7	33.3	16.7	8.3
Bentazon	307	15.3	37.8	35.2	11.7
Cultivation	380	19.5	60.3	18.7	1.6
Desiccant	345	42.0	40.6	11.6	5.8
Dual	20	10.0	60.0	25.0	5.0
Eptam, spring applied	17	5.9	58.8	29.4	5.9
Glyphosate	67	37.3	38.8	14.9	9.0
Hand Weeding	164	48.8	32.9	14.6	3.7
Poast	166	40.4	38.0	18.1	3.6
Prowl	23	30.4	34.8	17.4	17.4
Rotary Hoe	134	18.7	41.8	35.8	3.7
Sonalan, fall applied	30	30.0	50.0	16.7	3.3
Sonalan, spring applied	482	28.4	46.9	20.3	4.4
Trifluralin + Eptam	24	29.2	50.0	16.7	4.2
Trifluralin, fall applied	55	25.5	40.0	30.9	3.6
Trifluralin, spring applied	91	26.4	46.2	20.9	6.6

^a 1=Excellent control, 2=Good, 3=Fair, 4=Poor control; includes all practices or herbicides used on more than 1,000 acres

Respondents rated most weed control practices as giving no injury or only slight injury. Trifluralin + Eptam, preplant glyphosate and Amiben were rated as providing the lowest level of bean injury (Table 24).

Insect Problems

Grasshoppers were the worst insect problem for 24% of Northarvest survey respondents representing 28% of the dry bean acres reported, down dramatically from the 1991 figures of 74% of respondents and 63% of the dry bean acres reported (2). The potato leafhopper was the worst insect problem for 6% of respondents representing 5% of the dry bean acres reported (Table 25). Grasshoppers were more frequently reported to be the worst insect problem by North Dakota respondents (28% of respondents representing 32% of North Dakota acres reported) than by Minnesota respondents (11% of respondents representing 14% of Minnesota acres reported), but the potato leafhopper was more frequently reported as the worst insect problem by Minnesota respondents (16% of respondents representing 12% of the acres reported) than by North Dakota respondents (2% of respondents representing 3% of the acres reported).

Table 24. Bean injury from weed control practices in 1992 reported by all Northarvest respondents in Minnesota and North Dakota.

Weed Control Practice	No. of Respondents	Degree of Bean Injury			
		1	2	3	4
		----- % of Respondents -----			
Alachlor	40	67.5	25.0	2.5	5.0
Amiben	10	90.0	10.0	0	0
Bentazon	265	46.4	49.8	2.6	1.1
Cultivation	322	46.6	49.4	4.0	0
Dual	15	60.0	33.3	6.7	0
Eptam, spring applied	13	76.9	15.4	7.7	0
Glyphosate	61	95.1	3.3	0	1.6
Hand Weeding	131	67.9	31.3	0.8	0
Poast	135	73.3	23.7	2.2	0.7
Prowl	23	73.9	17.4	4.3	4.3
Rotary Hoe	116	21.6	73.3	5.2	0
Sonalan, fall applied	21	52.4	38.1	9.5	0
Sonalan, spring applied	402	79.6	17.9	1.2	1.2
Trifluralin + Eptam	17	100.0	0	0	0
Trifluralin, fall applied	43	81.4	14.0	2.3	2.3
Trifluralin, spring applied	72	73.6	25.0	1.4	0

^a 1=No injury, 2=slight, 3=moderate, 4=severe injury; table includes all practices or herbicides used on more than 1,000 acres

Grasshoppers were reported as the worst insect problem in MN1 and all five North Dakota districts. The potato leafhopper was reported as the worst insect problem in MN2, MN3, MN4 and MN5 (Table 26). These insect

Table 25. Worst insect problem^a in 1992 for respondents in Minnesota and North Dakota.

Insect Problem	Respondents		Acres Reported ^b	
	No.	%	No.	%
Minnesota				
Grasshopper	22	10.9	5,323	13.8
Potato Leafhopper	32	15.9	4,546	11.8
None	57	28.4	14,809	38.4
North Dakota				
Grasshopper	161	27.9	46,622	32.1
Potato Leafhopper	13	2.2	4,023	2.8
Seed Corn Maggot	12	2.1	3,369	2.3
None	176	30.4	38,120	26.3
Northarvest (MN & ND)				
Grasshopper	183	23.5	51,945	28.3
Potato Leafhopper	45	5.8	8,569	4.7
Seed Corn Maggot	12	1.5	3,369	1.8
None	233	29.9	52,929	28.8

^aInsect problems reported on more than 3% of respondents' acres

^b Respondents' acres only

Table 26. Worst insect problem^a in 1992 in each Northarvest district for respondents in Minnesota and North Dakota.

Northarvest District	Worst Insect Problem	Respondents		Acres Reported ^b	
		No.	%	No.	%
Minnesota					
MN1	Grasshopper	19	32.8	5,089	32.0
MN2	Leafhopper	2	14.3	505	5.8
MN3	Leafhopper	10	13.3	1,454	18.1
	Grasshopper	3	4.0	234	2.9
	Seed Corn Maggot	3	4.0	230	2.9
MN4	Leafhopper	18	36.7	2,467	42.7
	Seed Corn Maggot	1	2.0	456	7.9
MN5	Leafhopper	1	20.0	40	25.8
North Dakota					
ND1	Grasshopper	38	21.2	10,513	26.0
	Seed Corn Maggot	4	2.2	1,279	3.2
	Leafhopper	4	2.2	1,254	3.1
ND2	Grasshopper	25	22.1	8,204	26.3
	Leafhopper	3	2.7	622	2.0
	Seed Corn Maggot	2	1.8	450	1.4
ND3	Grasshopper	40	35.7	9,509	35.1
	Leafhopper	3	2.7	1,233	4.5
	Seed Corn Maggot	1	0.9	350	1.3
ND4	Grasshopper	29	36.3	7,885	33.6
	Leafhopper	2	2.5	614	2.6
	Seed Corn Maggot	2	2.5	450	1.9
ND5	Grasshopper	29	30.9	10,511	46.2
	Seed Corn Maggot	3	3.2	840	3.7
	Leafhopper	1	1.1	300	1.3

^aInsect problems reported on more than 1% of respondents' acres; those reporting no problem are not included

^bDistrict respondents' acres only

problems are the same as reported in 1991, but the percent acres affected is much lower than in 1991 (2).

Insecticides were used on less than 1% of Northarvest survey respondents' dry bean acres, with use in Minnesota slightly higher than in North Dakota (Table 27). This is down dramatically from 1991, when 10% of respondents' acres in both states were treated with an insecticide and 26% were treated in Minnesota (2).

Disease Problems. White mold was the worst disease problem for 38% of Northarvest survey respondents representing 40% of their dry bean acres, followed by root rot for 7% of respondents and 10% of respondents' acres, rust for 8% of respondents and 9% of respondents' acres and bacterial blight for 4% of respondents and 5% of respondents' acres (Table 28). White mold was the worst disease problem on 52% of Minnesota respondents' acres and 37% of North Dakota respondents' acres. Root rot was the worst disease problem on 22% of Minnesota respondents' acres but only 6% of North Dakota respondents' acres. Rust was the worst disease problem on 11% of North Dakota respondents' acres and 4% of Minnesota respondents' acres.

White mold was ranked as one of the three worst disease problems by Northarvest survey respondents on 53% of dry bean acres reported, followed by rust on 25% and root rot on 20% (Table 29). White mold was more frequently cited as a problem in Minnesota (75% of respondents' acres compared to 48% in North Dakota), rust was more frequently cited by North Dakota respondents (29% of respondents' acres compared to 11% in Minnesota) and root rot was more frequently cited as a problem in Minnesota (38% of respondents' acres compared to 15% in North Dakota). Bacterial blight was ranked about equally in both states (20% of respondents' acres in Minnesota and 18% in North Dakota).

Table 27. Insecticide use^a in 1992 by respondents in Minnesota and North Dakota.

Insecticide	Respondents		Acres Treated ^b	
	No.	%	No.	%
Minnesota				
Sevin	2	1.0	425	1.1
Asana XL	6	3.0	340	0.9
Cygon	2	1.0	222	0.6
North Dakota				
Asana XL	4	0.7	820	0.6
Northarvest				
Asana XL	10	1.3	1,160	0.6

^aData includes any insecticide applied to over 0.5% of respondents' acres

^b Respondents' acres only

Table 28. Worst disease problem^a in 1992 for respondents in Minnesota and North Dakota.

Worst Disease Problem	Respondents		Acres Reported ^b	
	No.	%	No.	%
Minnesota				
White Mold	118	58.7	19,866	51.6
Root Rot	15	7.5	8,447	21.9
Rust	5	2.5	1,365	3.5
Bacterial Blight	6	3.0	1,252	3.3
None	30	14.9	3,548	9.2
North Dakota				
White Mold	176	30.4	53,593	37.0
Rust	56	9.7	15,556	10.7
Root Rot	38	6.6	8,962	6.2
Bacterial Blight	23	4.0	7,213	5.0
Alternaria	6	1.0	1,733	1.2
None	203	35.1	39,194	27.0
Northarvest (MN & ND)				
White Mold	294	37.7	73,459	40.0
Root Rot	53	6.8	17,409	9.5
Rust	61	7.8	16,921	9.2
Bacterial Blight	29	3.7	8,465	4.6
Alternaria	6	0.8	1,733	0.9
None	233	29.9	42,742	23.3

^a Ranked as No.1 disease problem by respondents; root rot was omitted from questionnaire

^b Respondents' acres only

Table 29. Diseases ranked as one of the three worst^a in 1992 by respondents in Minnesota and North Dakota.

No. 1, 2 or 3 Disease Problem	Respondents		Acres Reported ^b	
	No.	%	No.	%
Minnesota				
White Mold	134	66.7	28,760	74.7
Root Rot	50	24.9	14,681	38.1
Bacterial Blight	39	19.4	7,545	19.6
Rust	19	9.5	4,394	11.4
Alternaria	2	1.0	690	1.8
None	30	14.9	3,548	9.2
North Dakota				
White Mold	231	40.0	69,302	47.8
Rust	139	24.0	41,981	28.9
Bacterial Blight	77	13.3	26,127	18.0
Root Rot	76	13.1	21,134	14.6
Alternaria	18	3.1	6,930	4.8
None	203	35.1	39,194	27.0
Northarvest (MN & ND)				
White Mold	365	46.9	98,062	53.4
Rust	158	20.3	46,375	25.3
Root Rot	126	16.2	35,815	19.5
Bacterial Blight	116	14.9	33,672	28.3
Alternaria	20	2.6	7,620	4.2
None	233	29.9	42,742	23.3

^a Ranked as No. 1, 2, or 3 disease problem by respondents; root rot was omitted from questionnaire

^b Respondents' acres only

White mold was ranked as the worst disease problem in MN1, MN3, MN4, MN5 and all districts in North Dakota. In general, districts that ranked white mold as the worst disease problem ranked it very high: 89% of respondents' acres in MN4, 77% in MN5, 75% in MN2 and MN3, 49% in ND4, 44% in MN1 and 40% in ND2. Root rot was ranked as the worst disease problem on 75% of respondents' acres in MN2 (Table 30).

In addition to being ranked as the worst disease in all but one Northarvest district, white mold was ranked as one of the three worst diseases in all Northarvest districts except MN2, with it being ranked as one of the three worst diseases on 91% of respondents' acres in MN4, 86% in MN2, 80% in MN3 and 77% in MN5 (Table 31). Root rot was ranked as one of the three worst diseases on 91% of respondents' acres in MN2, slightly ahead of white mold. Rust was the second most frequently cited in five districts and bacterial blight in three.

Table 30. Worst disease problem^a in 1992 in each Northarvest district for respondents in Minnesota and North Dakota.

Northarvest District	Worst Disease Problem	Respondents		Acres Reported ^b	
		No.	%	No.	%
Minnesota					
MN1	White Mold	19	32.8	6,925	43.6
	Rust	5	8.6	1,365	8.6
	Root Rot	2	3.4	1,142	7.2
	Bacterial Blight	3	5.2	857	5.4
MN2	Root Rot	6	42.9	6,450	74.6
	White Mold	5	35.7	1,572	18.2
MN3	White Mold	51	68.0	6,100	75.3
	Root Rot	5	6.7	575	7.1
MN4	White Mold	40	81.6	5,149	89.1
	White Mold	3	60.0	120	77.4
North Dakota					
ND1	White Mold	66	36.9	16,035	39.6
	Rust	32	17.9	9,408	23.2
ND2	White Mold	38	33.6	12,616	40.4
	Rust	16	14.2	3,986	12.8
	Bacterial Blight	7	6.2	2,962	9.5
ND3	White Mold	17	15.2	5,990	22.1
	Root Rot	12	10.7	3,387	12.5
	Bacterial Blight	5	4.5	1,383	5.1
ND4	White Mold	33	41.3	11,527	49.2
	Bacterial Blight	4	5.0	1,586	6.8
ND5	White Mold	22	23.4	7,425	32.6
	Root Rot	8	8.5	1,461	6.4
	Rust	5	5.3	1,132	5.0

^a Diseases reported on more than 5% of respondents' acres; those reporting no problem are not included

^b District respondents' acres only

Fungicides Used

Fungicides were used on 14% of Northharvest survey respondents' acres, but there were major differences in fungicide use between states. They were used on 32% of Minnesota respondents' acres but only 9% of North Dakota respondents' acres (Table 32).

The majority of fungicide use was either Benlate or Topsin for white mold control. In Minnesota, 28% of

respondents' acres were sprayed with the benzimidazole fungicides Benlate or Topsin, compared to 3% of respondents' acres in North Dakota. In Minnesota, 23% of respondents' acres received a band application of benzimidazole fungicide, compared to 1% of North Dakota respondents' acres (Table 33). The acres that were band sprayed represented 81% of Minnesota respondents' acres and 71% of

Table 31. Diseases ranked as one of worst three^a in 1992 in each Northharvest district in Minnesota and North Dakota.

Northwest District	No. 1, 2 or 3 Disease Problem	Respondents		Acres Reported ^b	
		No.	%	No.	%
Minnesota					
MN1	White Mold	25	43.1	9,514	59.9
	Rust	12	20.7	3,644	22.9
	Bacterial Blight	9	15.5	2,802	17.6
	Root Rot	8	13.8	2,749	17.3
MN2	Root Rot	9	64.3	7,860	90.9
	White Mold	11	78.6	7,457	86.2
	Bacterial Blight	3	21.4	1,295	15.0
MN3	White Mold	54	72.0	6,420	79.8
	Root Rot	21	28.0	2,544	31.6
	Bacterial Blight	11	14.7	1,471	18.3
MN4	White Mold	41	83.7	5,249	90.8
	Bacterial Blight	15	30.6	1,926	33.3
	Root Rot	12	24.5	1,528	26.4
MN5	White Mold	3	60.0	120	77.4
	Bacterial Blight	1	20.0	51	32.9
North Dakota					
ND1	White Mold	88	49.2	22,521	55.6
	Rust	67	37.4	20,019	49.4
	Root Rot	19	10.6	5,781	14.3
	Bacterial Blight	16	8.9	4,749	11.7
ND2	White Mold	50	44.2	16,650	53.3
	Rust	34	30.1	9,705	31.1
	Bacterial Blight	23	20.4	8,664	27.8
	Root Rot	13	11.5	3,520	11.3
ND3	White Mold	27	24.1	8,971	33.1
	Bacterial Blight	14	12.5	5,140	19.0
	Root Rot	14	12.5	4,147	15.3
ND4	Rust	10	8.9	3,000	11.1
	White Mold	39	48.8	12,869	54.9
	Rust	17	21.3	5,552	23.7
	Bacterial Blight	16	20.2	4,808	20.5
	Root Rot	16	20.2	4,590	19.6
ND5	Alternaria	7	8.8	2,862	12.2
	White Mold	27	28.7	8,291	36.4
	Rust	11	11.7	3,705	16.3
	Root Rot	14	14.9	3,096	13.6
	Bacterial Blight	8	8.5	2,766	12.2

^aDiseases reported on more than 10% of respondents' acres; those reporting no problem are not included

^bDistrict respondents' acres only

Table 32. Fungicide use^a in 1992 by respondents in Minnesota and North Dakota.

Fungicide and Method of Application	Respondents		Acres Treated ^b	
	No.	%	No.	%
Minnesota				
Maneb	5	2.5	1,390	3.6
Benlate, Broadcast	3	1.5	1,668	4.3
Benlate, Banded	5	2.5	6,480	16.8
Topsin, Broadcast	4	2.0	215	0.6
Topsin, Banded	6	3.0	2,515	6.5
North Dakota				
Maneb	29	5.0	8,408	5.8
Benlate, Banded	3	0.5	281	0.2
Topsin, Broadcast	9	1.6	2,269	1.6
Topsin, Banded	10	1.7	1,744	1.2
Northharvest (MN & ND)				
Maneb	34	4.4	9,798	5.3
Benlate, Broadcast	3	0.4	1,668	0.9
Benlate, Banded	8	1.0	6,761	3.7
Topsin, Broadcast	13	1.7	2,484	1.4
Topsin, Banded	16	2.1	4,259	2.3

^aData includes any fungicide applied to 0.5% of respondents' acres

^bRespondents' acres only

Table 33. Use of fungicides for White mold control in 1992 by respondents in Minnesota and North Dakota.

Fungicide	Treatment				Total	
	Band Applied		Broadcast		Acres	%
	Acres	%	Acres	%		
Minnesota						
Benlate	6,481	16.8	1,667	4.3	8,148	21.2
Topsin M	2,515	6.5	215	0.6	2,730	7.1
Total (Benlate & Topsin)	8,996	23.4	1,882	4.9	10,878	28.2
North Dakota						
Benlate	281	0.2	0	0	281	0.2
Topsin M	1,744	1.2	2,269	1.6	4,013	2.8
Total (Benlate & Topsin)	2,025	1.4	2,269	1.6	4,294	3.0
Northharvest (MN & ND)						
Benlate	6,762	3.7	1,667	0.9	8,429	4.6
Topsin	4,259	2.3	2,484	1.4	6,743	3.7
Total (Benlate & Topsin)	11,021	6.0	4,151	2.3	15,172	8.3

North Dakota respondents' acres sprayed for white mold. These are the highest percentages treated by band spraying in the six years the survey has been conducted (1, 2, 3, 4, 7). Banded application reduces total fungicide per acre to approximately half that of the broadcast rate, limiting the amount of chemical applied to the soil, increasing the profit potential and providing a safer management practice for the environment.

Maneb fungicide was used in lesser amounts than the benzimidazole fungicides. Respondents in Minnesota used maneb on 4% of their acres compared to 6% in North Dakota (Table 32).

Crop Rotations

Crop rotations used by Northharvest respondents usually involved several years between dry bean crops (Table 34). The number of years since the previous dry bean crop had been grown was cited as two by 14% of respondents, three by 33%, four by 21%, five or more by 15% and never before (in that field) by 15%. More Minnesota respondents (32%) reported they had never planted dry beans in that field than North Dakota respondents (9%).

Wheat was the crop that preceded dry beans for 58% of survey respondents, followed by barley for 17% and corn for 17% (Table 35). There were differences between states, however, with wheat (68%) and barley (22%) used most frequently by North Dakota respondents and corn (49%) and wheat (31%) by Minnesota respondents (Table 35).

Use of Resistant Varieties

Resistant varieties were reported being used by 13% of Northharvest survey respondents, with 12% of their acres planted to resistant varieties (Table 36). Respondents reported using resistant varieties somewhat more frequently in North Dakota (13% of respondents' acres) than in

Table 34. Crop rotation in 1992 by respondents in Minnesota and North Dakota.

No. of Years Since Previous Dry Bean Crop	Minnesota	North Dakota	Northharvest
	----- % of Respondents -----		
1	3.0	2.5	2.6
2	16.2	12.6	13.5
3	24.0	35.7	32.5
4	9.6	25.6	21.2
5	7.2	9.0	8.5
6+	7.8	5.8	6.4
Never Before	32.3	8.7	15.2

Minnesota (9%). Since the questionnaire did not specify the class of pest resistance, no information is available as to whether the resistance was to a specific disease, or some other pest. Disease resistance would most likely be what respondents had in mind.

Use of Consultants

Consultants were hired to scout dry bean crops by 19% of Northharvest survey respondents (Table 37). This figure is up from 17% in 1991 (2) and 14% in 1990 (3). The percent of respondents using consultants was higher in Minnesota

Table 35. Crop rotation. Crop grown by respondents in Minnesota and North Dakota preceding the 1992 dry bean crop.

Preceding Crop	Minnesota	North Dakota	Northharvest
	----- % of Respondents -----		
Alfalfa	1.8	0	0.5
Barley	6.0	21.7	17.4
Corn	48.8	4.9	16.8
Oats	1.2	0.2	0.5
Rye	0	0.2	0.2
Sorghum/Willet	0.6	0	0.2
Soybeans	3.0	0	0.8
Sugarbeets	3.6	2.7	2.9
Summer Fallow	3.6	0.4	1.3
Sunflower	0	0.7	0.5
Wheat	31.3	68.3	58.3
Other	0	0.9	0.7

Table 36. Respondents' use of resistant varieties^a in 1992 in Minnesota and North Dakota.

	Respondents		Acres Planted ^b	
	No.	%	No.	%
Minnesota	21	10.4	3,631	9.4
North Dakota	80	13.8	19,181	13.2
Northharvest	101	13.0	22,812	12.4

^a Questionnaire indicated "resistant varieties" as one possible answer, but did not specify whether the resistance was to diseases or not; disease resistance is possibly what many respondents had in mind

^b Respondents' acres only

Table 37. Number of respondents in Minnesota and North Dakota who hired consultants in 1992.

	Respondents	
	Number	%
Minnesota	49	25.0
North Dakota	97	17.7
Northharvest Total	146	18.7

with 25% than in North Dakota with 18%. The increased use of consultants has occurred in both states, with percent of Minnesota respondents using consultants rising from 18% in 1990, to 20% in 1991 and 25% in 1992. There was a similar trend in North Dakota, with the percent of respondents using consultants rising from 12% in 1990, to 16% in 1991 and 18% in 1992.

Pesticide Use

In 1992, 22% of Northharvest survey respondents reported less pesticide use than in past years, 69% reported the same, and 10% reported more (Table 38). Nearly half of North Dakota respondents and over 75% of Minnesota respondents reported a decrease in pesticide use of 1-50%. Nearly 25% of Minnesota respondents and over half of North Dakota respondents reported a decrease in pesticide use of 51-100% (Table 39).

Reasons most frequently cited by survey respondents for less pesticide use were "fewer pests", reported by 56% of respondents, and that the application was "not economically justified", reported by 21% of respondents (Table 40). Respondents in North Dakota more frequently reported "fewer pests" than those in Minnesota. In contrast, Minnesota respondents more frequently reported "better application techniques" and "timely application" as reasons for reduced pesticide use.

Table 38. Pesticide use in 1992 compared with past years in Minnesota and North Dakota.

	Pesticide Use		
	Less	Same	More
	----- % of Respondents -----		
Minnesota	21.8	68.2	10.0
North Dakota	21.5	68.7	9.8
Northharvest Total	21.6	68.6	9.8

Table 39. Amount of decreased pesticide use in 1992 reported by respondents in Minnesota and North Dakota.

	Amount of Decreased Pesticide Use ^a			
	1-25%	26-50%	51-75%	76-100%
Minnesota	38.1	38.1	9.5	14.3
North Dakota	22.2	25.9	5.6	46.3
Northharvest Total	26.7	29.3	6.7	37.3

^aIncludes only those respondents reporting decreased use

Table 40. Reasons for reduced pesticide use by Minnesota and North Dakota respondents in 1992.

Reason for Decreased Use	% of Respondents ^a		
	Minnesota	North Dakota	Northharvest
Fewer Pests	35.6	64.3	56.3
Better Application Techniques	15.6	3.5	6.9
Timely Application	11.1	5.2	6.9
Lower Use Rates	4.4	2.6	3.1
Not Economically Feasible	22.2	20.0	20.6
Alternative Practices	11.1	4.3	6.3

Literature Cited

- Lamey, H.A., A.G. Dexter, D.K. McBride, R.C. Venette, and J.R. Venette. 1990. Problems and practices of Northharvest dry bean growers in 1988. N.D. Farm Res. 48(2):6-11, 14.
- Lamey, H.A., D.R. Berglund, M.P. McMullen, J.L. Luecke, J.R. Venette, D.K. McBride, R.K. Zollinger and K.F. Grafton. 1993. 1991 Dry Bean Grower Survey of Pest Problems and Pesticide Use in Minnesota and North Dakota. NDSU Extension Rpt. No. 13. 15 p.
- Lamey, H.A., D.R. Berglund, M.P. McMullen, R.K. Zollinger, J.R. Venette, D.K. McBride, S.J. Venette, and R.C. Venette. 1992. 1990 dry bean grower survey of pest problems and pesticide use in Minnesota and North Dakota. NDSU Extension Rpt. No. 10. 17 p.
- Lamey, H.A., R.K. Zollinger, D.K. McBride, R.C. Venette, and J.R. Venette. 1991. Production problems and practices of Northharvest dry bean growers in 1989. N.D. Farm Res. 49(2):17-24.
- USDA. 1992. USDA Planting Intentions Report - Mar. 1993. Bean Talk, April 1993:6.
- Venette, J.R., and H.A. Lamey. 1989. The Dome Test for Detecting Bacterial Blight Pathogens in Dry Edible Beans. NDSU Extension Circ. PP972. 7 p.
- Venette, J.R., H.A. Lamey, D.E. Peterson, and R.C. Venette. 1989. Problems and practices of dry edible bean production in North Dakota and Minnesota, 1987. N.D. Farm Res. 46(5):25-31.

Acknowledgements

The authors thank *Rita Lattimore* for manuscript preparation and *Agnes Vernon* for publication layout.

This study was supported by a ES/USDA NAPIAP grant. Labeling and mailing of the survey was supported by assistance from Northharvest Bean Growers Association.