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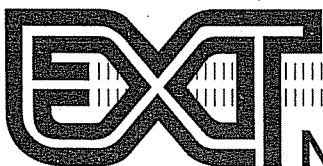
1990 DRY BEAN  
GROWER SURVEY

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OF PEST PROBLEMS AND  
PESTICIDE USE  
IN MINNESOTA AND  
NORTH DAKOTA

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JUNE 1992



An annual survey of production and pest problems, pesticide use and grower practices of Northharvest dry bean growers has been conducted since 1987. Results of the 1987, 1988 and 1989 surveys have been published (1, 2, 4). The Northharvest Bean Growers Association comprises the dry edible bean growers of Minnesota and North Dakota.

A single page survey form was designed with questions on production and pest problems, pesticide use, and non-chemical (alternative) control practices (Figure 1). The survey form was mailed in

October 1990 to all 4,537 growers on the mailing list of the Northharvest Bean Growers Association. Questionnaires were identified only by Northharvest district; otherwise it was an anonymous survey. The 10 Northharvest districts are shown in Figure 2. To simplify the discussion, Minnesota districts 1, 2, 3, 4, and 5 are referred to as MN 1, MN 2, MN 3, MN 4, and MN 5; similarly the five North Dakota districts are designated as ND 1, ND 2, ND 3, ND 4, and ND 5.

Results presented in this report are from actual responses. Values are not adjusted to represent the total dry bean crop.

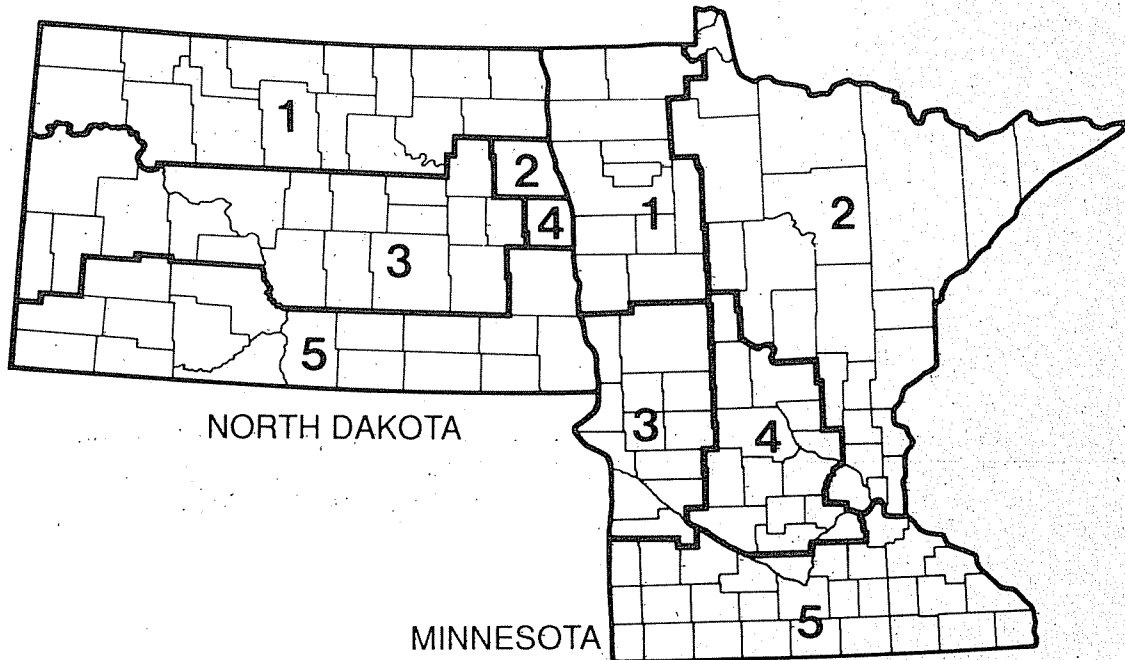


Figure 2. Northharvest bean grower districts.

PLEASE CIRCLE OR FILL IN THE REQUESTED INFORMATION ON PEST PROBLEMS AND PESTICIDE USE ON YOUR 1990 DRY BEAN CROP

Total acres planted in 1990 \_\_\_\_\_  
 Irrigated acres \_\_\_\_\_ Dryland acres \_\_\_\_\_  
 Total acres harvested \_\_\_\_\_  
 Acres with hail damage \_\_\_\_\_

**EVALUATE WEED CONTROL AND DRY BEAN INJURY**

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

| Acres treated | WEED CONTROL |        |        |        | BEAN INJURY |          |            |          |
|---------------|--------------|--------|--------|--------|-------------|----------|------------|----------|
|               | 1=Excellent  | 2=Good | 3=Fair | 4=Poor | 1=None      | 2=Slight | 3=Moderate | 4=Severe |

**STATE AND COUNTY WHERE GROWN. (IF BEANS GROWN IN MORE THAN ONE COUNTY, LIST EACH COUNTY AND ACRES.)**  

| State | County | Acres |
|-------|--------|-------|
| MN    | _____  | _____ |
| ND    | _____  | _____ |
| SD    | _____  | _____ |

**BIGGEST WEATHER PROBLEM IN DRY BEANS IN 1990 (CIRCLE ONE):**

- Drought \_\_\_\_\_
- Flooding \_\_\_\_\_
- Frost \_\_\_\_\_
- Hail \_\_\_\_\_
- Wind/Sandblasting \_\_\_\_\_
- Other (specify) \_\_\_\_\_

**Weed control used**

|                    |       |   |   |   |   |   |   |   |   |
|--------------------|-------|---|---|---|---|---|---|---|---|
| Roundup (preplant) | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Eptam (fall)       | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Eptam (spring)     | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Treflan (fall)     | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Treflan (spring)   | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Treflan + Eptam    | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Sonalan            | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Amiben             | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Lasso              | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Dual               | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Prowl              | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Basagran           | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Poast              | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Sodium Chlorate    | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Gramoxone Extra    | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| No herbicide used  | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Cultivation        | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Hand Weeding       | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Other              | _____ | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |

**BIGGEST PRODUCTION PROBLEM IN DRY BEANS IN 1990 (CIRCLE ONE):**

- None \_\_\_\_\_
- Weeds \_\_\_\_\_
- Emergence/Stand \_\_\_\_\_
- Insects (specify) \_\_\_\_\_
- Diseases \_\_\_\_\_
- Micronutrient deficiency \_\_\_\_\_
- Herbicide injury \_\_\_\_\_
- Other (specify) \_\_\_\_\_

**VARIETY GROWN IN 1990**

| Variety         | Acres |
|-----------------|-------|
| Pinto           | _____ |
| Fiesta          | _____ |
| Nodak           | _____ |
| Olathe          | _____ |
| Othello         | _____ |
| Topaz           | _____ |
| Other (specify) | _____ |

**INTEGRATED PEST MANAGEMENT**

Did you hire consultant to scout dry beans? yes/no  
 If yes, how many acres? \_\_\_\_\_  
 If yes, estimate economic return from using consultant  
 \_\_\_\_\_ \$20 + /acre  
 \_\_\_\_\_ \$15-20/acre  
 \_\_\_\_\_ \$10-15/acre  
 \_\_\_\_\_ \$5-10/acre  
 \_\_\_\_\_ \$0-5/acre  
 \_\_\_\_\_ 0  
 \_\_\_\_\_ other

**Navv** \_\_\_\_\_  
**C-20** \_\_\_\_\_  
**Fleetwood** \_\_\_\_\_  
**Hyden** \_\_\_\_\_  
**Midland** \_\_\_\_\_  
**Snowbunting** \_\_\_\_\_  
**Upland** \_\_\_\_\_  
**Other (specify)** \_\_\_\_\_

**Kidney (specify)** \_\_\_\_\_

**Other Market Class (specify class/variety)** \_\_\_\_\_

**SEED SOURCE IN 1990 AND ACRES:**  
 bagged and tagged \_\_\_\_\_  
 bin run \_\_\_\_\_

**Practices other than pesticides:**

Crop rotation \_\_\_\_\_ acres  
 Preceding crop \_\_\_\_\_  
 How long since previous dry beans? \_\_\_\_\_  
 Cultivation \_\_\_\_\_ (No. of times)  
 Resistant Variety \_\_\_\_\_ acres  
 Other (specify) \_\_\_\_\_ acres

**WORST WEED PROBLEMS IN DRY BEANS IN 1990 (RANK 1-3, 1=WORST):**

- Redroot pigweed \_\_\_\_\_
- Wild Oats \_\_\_\_\_
- Foxtail (pigeon grass) \_\_\_\_\_
- Eastern black nighshade \_\_\_\_\_
- Wild mustard \_\_\_\_\_
- Lambsquarters \_\_\_\_\_
- Kochia \_\_\_\_\_
- Cocklebur \_\_\_\_\_
- Other (specify) \_\_\_\_\_

**WORST DISEASE PROBLEMS 1990 (RANK 1-3, 1=WORST)**

- None \_\_\_\_\_
- White mold \_\_\_\_\_
- Rust \_\_\_\_\_
- Bacterial blight \_\_\_\_\_
- Alternaria \_\_\_\_\_
- Root Rot \_\_\_\_\_
- Other (specify) \_\_\_\_\_

**WORST INSECT/MITE PROBLEM in 1990**

List insecticide(s) used and acres treated in 1990:

| Insecticide | Acres treated | No. of sprays |
|-------------|---------------|---------------|
| _____       | _____         | _____         |
| _____       | _____         | _____         |
| _____       | _____         | _____         |

**FUNGICIDE(S) USED ON DRY BEANS IN 1990**

| Fungicide             | No. Acres Treated | No. of Sprays |
|-----------------------|-------------------|---------------|
| Bravo                 | _____             | _____         |
| Champion              | _____             | _____         |
| Kocide                | _____             | _____         |
| Benlate (brodcast)    | _____             | _____         |
| Benlate (banded)      | _____             | _____         |
| Topsin (brodcast)     | _____             | _____         |
| Topsin (banded)       | _____             | _____         |
| Zinc (micro-nutrient) | _____             | _____         |

**FOR IRRIGATORS ONLY**  
 Was chemigation\* used in 1990?  
 \_\_\_\_\_ yes \_\_\_\_\_ no  
 \_\_\_\_\_ herbicide  
 \_\_\_\_\_ fungicide  
 \_\_\_\_\_ insecticide  
 \_\_\_\_\_ fertilizer

**Chemicals Applied** \_\_\_\_\_ **Acres** \_\_\_\_\_

\*Application of chemical through the irrigation system.

Results of survey will be published in Bean talk. Thank you. Please return by November 20, 1990

Arthur Lamey  
 Extension Plant Pathologist

OTHER COMMENTS:

Figure 1. Survey instrument.

## RESULTS AND DISCUSSION

The survey response was 19 percent, or 851 returned forms. Eighty one respondents did not grow dry beans in 1990. The remaining 770 useable forms represented 17 percent of the growers contacted; 219 were from Minnesota and 551 from North Dakota. Respondents planted 176,735 acres or 25 percent of the bi-state total of 710,000 planted acres (3). Respondents planted 35,416 acres in Minnesota, or 25 percent of the state total of 140,000 acres, and 141,319 acres in North Dakota, also 25 percent of the state total of 570,000 acres (Table 1).

**Irrigated Acres.** Respondents reported that 28 percent and four percent of their Minnesota and North Dakota acres were irrigated, respectively. The percentage of irrigated acres varied with Northharvest district, ranging from 0 in MN 1, MN 5 and ND 4 to 16 percent in ND 5 and 95 percent in MN 2 (Table 2).

**Chemigation.** Application of agricultural chemicals through an irrigation system is called chemigation. Chemigation was used on 63 percent of respondents' irrigated acres, and was as high as 75 percent in ND 5 and 91 percent in MN 2. Over 100 percent of the irrigated acres in ND 1 were reported to be chemigated; this suggests that some respondents used chemigation more than once on their irrigated acres (Table 2).

**Table 1. Number of respondents and acres planted in 1990 by respondents in each Northharvest district of Minnesota and North Dakota.**

| State              | Northharvest District | Respondents      |            | Acres Planted        |                         |
|--------------------|-----------------------|------------------|------------|----------------------|-------------------------|
|                    |                       | Number           | % of Total | Number <sup>a</sup>  | % of Total <sup>b</sup> |
| MN                 | MN1                   | 56               | 25.6       | 14,622               | 41.3                    |
|                    | MN2                   | 4                | 1.8        | 4,988                | 14.1                    |
|                    | MN3                   | 107              | 48.9       | 10,996               | 31.1                    |
|                    | MN4                   | 41               | 18.7       | 4,318                | 12.2                    |
|                    | MN5                   | 11               | 5.0        | 491                  | 1.4                     |
| MN Total           |                       | 219              | 100.0      | 35,416               | 100.0                   |
| ND                 | ND1                   | 179              | 32.5       | 40,523               | 28.7                    |
|                    | ND2                   | 109              | 19.8       | 29,558               | 20.9                    |
|                    | ND3                   | 93               | 16.9       | 23,489               | 16.6                    |
|                    | ND4                   | 76               | 13.8       | 22,641               | 16.0                    |
|                    | ND5                   | 94               | 17.1       | 25,107               | 17.8                    |
| ND Total           |                       | 551 <sup>b</sup> | 100.0      | 141,319 <sup>c</sup> | 100.0                   |
| Northharvest Total |                       | 770              |            | 176,735              |                         |

<sup>a</sup>Respondents' acres only

<sup>b</sup>71.6% of all respondents

<sup>c</sup>80.0% of all respondents' acres

Fertilizer was the chemical most commonly applied by chemigation in both states, with 51 and 52 percent of respondents' irrigated acres treated in Minnesota and North Dakota, respectively. Fungicide was applied by chemigation on 39 percent of irrigated acres in North Dakota, while insecticide was applied on 8 percent of irrigated acres in North Dakota (Table 3).

**Zinc Micronutrient Use.** Zinc was applied to 17 percent of respondents' acreage (Table 4). Use varied considerably among Northharvest districts. Zinc was applied to 35 percent of respondents' acres in MN 1 and very little was applied in other Minnesota districts. Zinc was applied to 27 percent

**Table 2. Irrigated acres and use of chemigation in 1990 for respondents in each Northharvest district of Minnesota and North Dakota.**

| State              | Northharvest District | Acres Irrigated <sup>a</sup> |                     | Acres Chemigated <sup>a</sup> |                      |
|--------------------|-----------------------|------------------------------|---------------------|-------------------------------|----------------------|
|                    |                       | Number                       | % of District Acres | Number                        | % of Irrigated Acres |
| MN                 | MN1                   | 0                            | 0                   | 500                           | 0 <sup>b</sup>       |
|                    | MN2                   | 4,740                        | 95.0                | 4,290                         | 90.5                 |
|                    | MN3                   | 3,621                        | 33.0                | 130                           | 3.6                  |
|                    | MN4                   | 1,468                        | 34.0                | 100                           | 6.8                  |
|                    | MN5                   | 0                            | 0                   | 0                             | 0                    |
| MN Total           |                       | 9,829                        | 27.8                | 5,020                         | 51.1                 |
| ND                 | ND1                   | 637                          | 1.6                 | 1,750                         | 100+ <sup>c</sup>    |
|                    | ND2                   | 56                           | 0.2                 | 0                             | 0                    |
|                    | ND3                   | 1,073                        | 4.6                 | 0                             | 0                    |
|                    | ND4                   | 0                            | 0                   | 0                             | 0                    |
|                    | ND5                   | 3,887                        | 15.5                | 2,923                         | 75.2                 |
| ND Total           |                       | 5,653                        | 4.0                 | 4,673                         | 82.7                 |
| Northharvest Total |                       | 15,482                       | 8.8                 | 9,693                         | 62.6                 |

<sup>a</sup>Respondents' acres only.

<sup>b</sup>No irrigated acres reported for this district.

<sup>c</sup>Indicates some multiple applications.

**Table 3. Type of chemigation used in 1990 by respondents in Minnesota and North Dakota.**

| State | Type of Chemigation | Acres Treated <sup>a</sup> |                      |
|-------|---------------------|----------------------------|----------------------|
|       |                     | Number                     | % of Irrigated Acres |
| MN    | Fertilizer          | 5,020                      | 51.1                 |
| ND    | Fertilizer          | 2,923                      | 51.7                 |
|       | Fungicide           | 2,180                      | 38.6                 |
|       | Insecticide         | 430                        | 7.6                  |

<sup>a</sup>Respondents' acres only.

of respondents' acres in ND 4, 22 percent in ND 2 and to lesser percentages in other North Dakota districts.

**Seed Source.** Bagged and tagged seed was used on 80 percent of respondents' acres in 1990 (Table 5), compared to 90 percent of acres in 1989 (2). Bagged and tagged seed was used on 82

**Table 4. Use of zinc micronutrient in 1990 by respondents in each Northharvest district in Minnesota and North Dakota.**

| State              | Northharvest District | Respondents |                | Acres Treated <sup>a</sup> |                |
|--------------------|-----------------------|-------------|----------------|----------------------------|----------------|
|                    |                       | Number      | % <sup>b</sup> | Number                     | % <sup>b</sup> |
| MN                 | MN1                   | 14          | 25.0           | 5,154                      | 35.3           |
|                    | MN2                   | 0           | 0              | 0                          | 0              |
|                    | MN3                   | 4           | 3.7            | 355                        | 3.2            |
|                    | MN4                   | 1           | 2.4            | 200                        | 4.6            |
|                    | MN5                   | 1           | 9.1            | 10                         | 2.0            |
| MN                 | Total                 | 20          | 9.1            | 5,719                      | 16.2           |
| ND                 | ND1                   | 27          | 15.1           | 4,946                      | 12.2           |
|                    | ND2                   | 24          | 22.0           | 6,526                      | 22.1           |
|                    | ND3                   | 19          | 20.4           | 4,129                      | 17.6           |
|                    | ND4                   | 16          | 21.1           | 6,167                      | 27.2           |
|                    | ND5                   | 14          | 14.9           | 3,032                      | 12.1           |
| ND                 | Total                 | 100         | 18.2           | 24,800                     | 17.6           |
| Northharvest Total |                       | 120         | 15.6           | 30,519                     | 17.3           |

<sup>a</sup>Respondents' acres only.

<sup>b</sup>% of District respondents, except for state and Northharvest totals.

**Table 5. Use of bagged and tagged seed in 1990 by respondents in each Northharvest district of Minnesota and North Dakota.**

| State        | Northharvest District | % of Respondents' Acres Planted With Bagged and Tagged Seed |
|--------------|-----------------------|---|
| MN           | MN1                   | 90.4  |
|              | MN2                   | 12.0 <sup>a</sup>   |
|              | MN3                   | 71.1  |
|              | MN4                   | 91.3  |
|              | MN5                   | 86.8  |
| MN           | Total                 | 73.4  |
| ND           | ND1                   | 80.2  |
|              | ND2                   | 82.8  |
|              | ND3                   | 81.2  |
|              | ND4                   | 84.1  |
|              | ND5                   | 82.7  |
| ND           | Total                 | 82.0  |
| Northharvest |                       | 80.3  |

<sup>a</sup>Data based on 4 respondents reporting on 4,988 acres.

percent of North Dakota respondents' acres, but only 73 percent of Minnesota respondents' acres. The low percentage for Minnesota is affected by the low percentage reported for MN 2, a statistic based on only four respondents who planted 4,998 acres and indicated that they used no bagged and tagged seed. It is possible that these large acreage growers planted a commercial company's seed that was sold in bulk, was from an inspected seed lot, and was not bin run seed. In spite of the low percentage of bagged and tagged seed for MN 2, the percentage of respondents' acres planted to bagged and tagged seed in the other Minnesota districts was lower than the 94 percent reported for Minnesota in 1989. Similarly, 82 percent use of bagged and tagged seed in 1990 by North Dakota respondents was also lower than the 90 percent reported in 1989.

**Varieties.** The most commonly grown varieties and percentage of respondents' total acres planted to that variety were: Upland (navy), 17 percent; Topaz (pinto), 17 percent; Othello (pinto), 15 percent; Fiesta (pinto), Nodak (pinto) and Olathe (pinto), 5 percent; and Montcalm (dark red kidney), 3 percent (Table 6).

**Table 6. Varieties grown<sup>a</sup> in 1990 by all Northharvest respondents in Minnesota and North Dakota.**

| Variety             | Type | Respondents |      | Acres Planted <sup>b</sup> |      |
|---------------------|------|-------------|------|----------------------------|------|
|                     |      | Number      | %    | Number                     | %    |
| Agri 1              | N    | 36          | 4.9  | 2,314                      | 1.3  |
| Albion              | N    | 11          | 1.4  | 1,357                      | 0.8  |
| Crestwood           | N    | 25          | 3.3  | 2,415                      | 1.4  |
| C20                 | N    | 41          | 5.3  | 4,707                      | 2.7  |
| Fiesta              | P    | 92          | 12.0 | 9,416                      | 5.3  |
| Fleetwood           | N    | 39          | 5.1  | 2,850                      | 1.6  |
| Hyden               | N    | 36          | 4.7  | 3,415                      | 1.9  |
| Mayflower           | N    | 21          | 2.7  | 1,498                      | 0.9  |
| Midland             | N    | 17          | 2.2  | 1,824                      | 1.0  |
| Montcalm            | DRK  | 19          | 2.5  | 5,599                      | 3.2  |
| Nodak               | P    | 92          | 12.0 | 9,308                      | 5.3  |
| Olathe              | P    | 79          | 10.3 | 7,931                      | 4.5  |
| Othello             | P    | 182         | 23.6 | 25,841                     | 14.6 |
| Pearl               | N    | 34          | 4.4  | 4,068                      | 2.3  |
| RS 101              | P    | 39          | 5.1  | 5,017                      | 2.8  |
| Sacramento          | L RK | 2           | 0.3  | 2,230                      | 1.3  |
| Snow-bunting        | N    | 24          | 3.1  | 2,996                      | 1.7  |
| Stinger             | N    | 25          | 3.3  | 1,568                      | 0.9  |
| Topaz               | P    | 248         | 32.2 | 29,909                     | 16.9 |
| Black turtle (T-39) | BT   | 27          | 3.5  | 2,717                      | 1.5  |
| Upland              | N    | 241         | 31.3 | 30,671                     | 17.4 |

<sup>a</sup>Includes all varieties reported grown on more than 1,000 acres.

<sup>b</sup>Respondants' acres only.

<sup>c</sup>BT = Black Turtle; DRK = Dark Red Kidney; L RK = Light Red Kidney; N = Navy; P = Pinto

Upland was the leading variety in 1987, the fourth year in a row (1987 to 1990) (1, 2, 4). Topaz was grown on nearly as many acres. Othello moved from fourth to third most commonly planted variety in 1990, with double the acres compared to 1989 (2).

The most commonly grown varieties in Minnesota in 1990 were Upland, Montcalm, Fiesta, Snow-bunting and Topaz (Table 7). The most commonly grown varieties in North Dakota were Topaz, Othello, Upland, Nodak and Olathe.

Sacramento (light red kidney) and Montcalm (dark red kidney) each were grown on over 40 percent of respondents' acres in MN 2 (Table 8). Upland was grown on over 50 percent of respondents' acres in MN 3 and MN 5, and was the leading navy variety in MN 1. Topaz was the leading pinto variety in ND 1 and ND 2, Othello (pinto) in ND 3, and Upland (navy) in ND 4 and ND 5.

**Hail.** Ten percent of respondents' acres were damaged by hail in 1990 (Table 9). Northarvest districts with above average hail damage included MN 5 (29 percent), ND 1 (21 percent), ND 5 (16 percent), and MN 2 (14 percent). The extent and amount of hail damage and insurance settlements were not reported.

**Weather Problems.** Drought was the worst weather problem on 83 percent of respondents' acres (87 percent in North Dakota and 68 percent in Minnesota). Excess moisture was the worst weather

**Table 7. Five varieties most commonly grown in 1990 by respondents in Minnesota and North Dakota.**

| State              | Variety      | Acres Planted <sup>a</sup> |      |
|--------------------|--------------|----------------------------|------|
|                    |              | Number                     | %    |
| MN                 | Upland       | 10,832                     | 30.6 |
|                    | Montcalm     | 3,795                      | 10.7 |
|                    | Fiesta       | 2,759                      | 7.8  |
|                    | Snow-bunting | 1,951                      | 5.5  |
|                    | Topaz        | 1,554                      | 4.4  |
| ND                 | Topaz        | 28,355                     | 20.1 |
|                    | Othello      | 25,197                     | 17.8 |
|                    | Upland       | 19,839                     | 14.0 |
|                    | Nodak        | 8,376                      | 5.9  |
|                    | Olathe       | 7,736                      | 5.5  |
| North-arvest Total | Upland       | 30,671                     | 17.4 |
|                    | Topaz        | 29,909                     | 16.9 |
|                    | Othello      | 25,841                     | 14.6 |
|                    | Fiesta       | 9,416                      | 5.3  |
|                    | Nodak        | 9,308                      | 5.3  |

<sup>a</sup>Respondents' acres only.

**Table 8. Varieties most commonly grown<sup>a</sup> in 1990 by respondents in each Northwest district of Minnesota and North Dakota.**

| State     | Northarvest District | Variety     | % of Acres <sup>b</sup> |
|-----------|----------------------|-------------|-------------------------|
| MN        | MN1                  | Upland      | 28.4                    |
|           |                      | Fiesta      | 18.3                    |
|           |                      | Sno-bunting | 12.8                    |
|           |                      | Topaz       | 10.2                    |
|           |                      | Sacramento  | 43.9                    |
|           | MN2                  | Montcalm    | 42.1                    |
|           |                      | Upland      | 55.1                    |
|           | MN3                  | Montcalm    | 17.5                    |
|           |                      | Fleetwood   | 12.8                    |
|           | MN4                  | Upland      | 50.7                    |
| Fleetwood |                      | 13.2        |                         |
| ND        | ND1                  | Topaz       | 36.6                    |
|           |                      | Othello     | 16.2                    |
|           |                      | Topaz       | 23.8                    |
|           | ND2                  | Upland      | 15.1                    |
|           |                      | Othello     | 10.4                    |
|           |                      | Othello     | 30.4                    |
|           | ND3                  | Nodak       | 12.5                    |
|           |                      | Topaz       | 11.3                    |
|           |                      | Upland      | 21.6                    |
|           | ND4                  | Topaz       | 15.6                    |
|           |                      | Othello     | 11.7                    |
|           |                      | Upland      | 27.7                    |
|           | ND5                  | Upland      | 27.7                    |
|           |                      | Othello     | 23.0                    |

<sup>a</sup>Grown on more than 10% of respondents' acres in each district.

<sup>b</sup>District respondents' acres only

**Table 9. Hail damage in 1990 to respondents' beans in each Northarvest district of Minnesota and North Dakota.**

| State             | Northarvest District | Respondents Reporting Hail |                | Acres Damaged <sup>a</sup> |                |
|-------------------|----------------------|----------------------------|----------------|----------------------------|----------------|
|                   |                      | Number                     | % <sup>b</sup> | Number                     | % <sup>b</sup> |
| MN                | MN1                  | 12                         | 21.4           | 1,308                      | 9.0            |
|                   | MN2                  | 1                          | 25.0           | 700                        | 14.0           |
|                   | MN3                  | 13                         | 12.2           | 729                        | 6.7            |
|                   | MN4                  | 3                          | 7.3            | 171                        | 4.0            |
|                   | MN5                  | 2                          | 18.2           | 142                        | 28.9           |
| MN Total          |                      | 31                         | 14.2           | 3,050                      | 8.6            |
| ND                | ND1                  | 65                         | 36.3           | 8,524                      | 21.0           |
|                   | ND2                  | 7                          | 6.4            | 817                        | 2.8            |
|                   | ND3                  | 11                         | 11.8           | 1,325                      | 5.6            |
|                   | ND4                  | 3                          | 4.0            | 130                        | 0.6            |
|                   | ND5                  | 30                         | 31.9           | 3,900                      | 15.5           |
| ND Total          |                      | 116                        | 21.1           | 14,696                     | 10.4           |
| Northarvest Total |                      | 147                        | 19.1           | 17,746                     | 10.0           |

<sup>a</sup>Respondents' acres only.

<sup>b</sup>% of District respondents, except for state and Northarvest totals.

problem on 18 percent of Minnesota respondents' acres (Table 10). Although hail damaged 10 percent of respondents' acres, it was the worst weather problem on only 5 percent of their acres.

Drought was the worst weather problem in all five North Dakota districts and in MN 1, MN 2 and MN 3 (Table 11). Excess moisture was the worst weather

**Table 10. Worst weather problem in 1990 for respondents in Minnesota and North Dakota.**

| State                   | Worst Weather Problem | Respondents |      | Acres Affected <sup>a</sup> |      |
|-------------------------|-----------------------|-------------|------|-----------------------------|------|
|                         |                       | Number      | %    | Number                      | %    |
| MN                      | Drought               | 111         | 50.7 | 24,019                      | 67.8 |
|                         | Excess Moisture       | 61          | 27.9 | 6,471                       | 18.3 |
|                         | Wind                  | 12          | 5.5  | 1,356                       | 3.8  |
|                         | None                  | 25          | 11.4 | 2,734                       | 7.7  |
| ND                      | Drought               | 474         | 86.0 | 123,298                     | 87.3 |
|                         | Hail                  | 32          | 5.8  | 7,530                       | 5.3  |
|                         | Excess Moisture       | 12          | 2.2  | 3,173                       | 2.3  |
|                         | Wind                  | 8           | 1.5  | 2,649                       | 1.9  |
|                         | None                  | 20          | 3.6  | 3,005                       | 2.1  |
| Northarvest (MN and ND) | Drought               | 585         | 76.0 | 147,317                     | 83.4 |
|                         | Excess Moisture       | 73          | 9.5  | 9,644                       | 5.5  |
|                         | Hail                  | 40          | 5.2  | 8,286                       | 4.7  |
|                         | Wind                  | 20          | 2.6  | 4,005                       | 2.3  |
|                         | None                  | 45          | 5.8  | 5,739                       | 3.3  |

<sup>a</sup>Respondents' acres only.

**Table 11. Worst weather problem<sup>a</sup> in 1990 for respondents in each Northarvest district of Minnesota and North Dakota.**

| State           | Northarvest District | Worst Weather Problem | % of Respondents | % of Acres Affected <sup>b</sup> |
|-----------------|----------------------|-----------------------|------------------|----------------------------------|
| MN              | MN1                  | Drought               | 92.3             | 94.2                             |
|                 |                      | Drought               | 50.0             | 86.6                             |
|                 | MN2                  | Excess Moisture       | 50.0             | 13.4                             |
|                 |                      | Drought               | 49.5             | 48.5                             |
|                 | MN3                  | Excess Moisture       | 23.4             | 26.3                             |
| Excess Moisture |                      | 58.5                  | 58.0             |                                  |
| MN4             | Excess Moisture      | 81.8                  | 68.0             |                                  |
|                 | Excess Moisture      |                       |                  |                                  |
| ND              | ND1                  | Drought               | 84.9             | 86.1                             |
|                 |                      | Hail                  | 11.7             | 11.6                             |
|                 | ND2                  | Drought               | 94.5             | 92.1                             |
|                 |                      | Drought               | 79.6             | 83.0                             |
|                 | ND3                  | Drought               | 93.4             | 92.5                             |
| Drought         |                      | 78.7                  | 82.6             |                                  |

<sup>a</sup>Reported as the worst weather problem by more than 10% of respondents in the district.

<sup>b</sup>Respondents' acres only.

problem in MN 4 and MN 5, and also was a significant problem in MN 3, where 26 percent of respondents' acres were affected.

**Production Problems.** Weeds were the worst production problem on 26 percent of respondents' acres, followed by insects on 12 percent, diseases on 6 percent and emergence on 6 percent (Table 12). No production problems were reported on 45 percent of respondents' acres.

In Minnesota, diseases were the worst production problem on 19 percent of respondents' acres, weeds on 18 percent and insects on 16 percent. By contrast, weeds were the worst problem on 28 percent of respondents' acres in North Dakota, insects on 12 percent and diseases on 3 percent (Table 12).

**Table 12. Worst production problem in 1990 for respondents in Minnesota and North Dakota.**

| State                    | Worst Production Problem | Respondents |      | Acres Affected <sup>a</sup> |        |      |
|--------------------------|--------------------------|-------------|------|-----------------------------|--------|------|
|                          |                          | Number      | %    | Number                      | %      |      |
| MN                       | Diseases                 | 20          | 9.1  | 6,861                       | 19.4   |      |
|                          | Weeds                    | 50          | 22.8 | 6,321                       | 17.9   |      |
|                          | Insects                  | 18          | 8.2  | 5,546                       | 15.7   |      |
|                          | Emergence                | 20          | 9.1  | 2,223                       | 6.3    |      |
|                          | Herbicide Injury         | 4           | 1.8  | 650                         | 1.8    |      |
|                          | Micronutrient Deficiency | 5           | 2.3  | 230                         | 0.7    |      |
|                          | None                     | 102         | 46.6 | 13,584                      | 38.4   |      |
|                          | ND                       | Weeds       | 137  | 24.9                        | 40,178 | 28.4 |
|                          |                          | Insects     | 66   | 12.0                        | 16,348 | 11.6 |
|                          |                          | Emergence   | 27   | 4.9                         | 8,534  | 6.0  |
| Diseases                 |                          | 17          | 3.1  | 4,330                       | 3.1    |      |
| Micronutrient Deficiency |                          | 3           | 0.5  | 1,020                       | 0.7    |      |
| Harvest                  |                          | 4           | 0.7  | 555                         | 0.4    |      |
| None                     |                          | 286         | 51.9 | 66,442                      | 47.0   |      |
| Northarvest (MN & ND)    |                          | Weeds       | 187  | 24.3                        | 46,499 | 26.3 |
|                          |                          | Insects     | 84   | 10.9                        | 21,894 | 12.4 |
|                          |                          | Diseases    | 37   | 4.8                         | 11,191 | 6.3  |
|                          | Emergence                | 47          | 6.1  | 10,757                      | 6.1    |      |
|                          | Herbicide Injury         | 5           | 0.7  | 1,350                       | 0.8    |      |
|                          | Micronutrient Deficiency | 8           | 1.0  | 1,250                       | 0.7    |      |
|                          | Harvest                  | 4           | 0.5  | 555                         | 0.3    |      |
|                          | None                     | 388         | 50.0 | 80,026                      | 45.3   |      |

<sup>a</sup>Respondents' acres only.

**Table 13. Worst production problem<sup>a</sup> in 1990 for respondents in each Northharvest district of Minnesota and North Dakota.**

| State | Northharvest District | Worst Production Problem | % of Respondents | % of Acres Affected <sup>b</sup> |      |
|-------|-----------------------|--------------------------|------------------|----------------------------------|------|
| MN    | MN1                   | Insects                  | 28.6             | 36.7                             |      |
|       |                       | Weeds                    | 16.1             | 14.8                             |      |
|       | MN2                   | Diseases                 | 50.0             | 86.6                             |      |
|       |                       | MN3                      | Weeds            | 29.0                             | 22.7 |
|       | Emergence             |                          | 15.0             | 15.8                             |      |
|       | Diseases              | 12.2                     | 18.1             |                                  |      |
|       | MN4                   | Weeds                    | 22.0             | 23.2                             |      |
|       | MN5                   | None                     | 100.0            | 100.0                            |      |
|       | ND                    | ND1                      | Insects          | 13.4                             | 17.0 |
|       |                       |                          | Weeds            | 13.4                             | 11.9 |
| ND2   |                       | Weeds                    | 23.9             | 24.0                             |      |
|       |                       | Insects                  | 10.1             | 10.3                             |      |
| ND3   |                       | Weeds                    | 35.5             | 43.2                             |      |
| ND4   |                       | Weeds                    | 23.7             | 20.9                             |      |
|       |                       | Insects                  | 10.5             | 9.2                              |      |
| ND5   |                       | Weeds                    | 38.3             | 53.3                             |      |
|       |                       | Insects                  | 16.0             | 11.3                             |      |

<sup>a</sup>Reported as the greatest production problem by more than 10% of respondents in the district.

<sup>b</sup>Respondents' acres only.

**Table 14. Worst weed problem<sup>a</sup> in 1990 for all Northharvest respondents in Minnesota and North Dakota.**

| Worst Weed Problem       | Respondents |      | Acres Affected <sup>b</sup> |      |
|--------------------------|-------------|------|-----------------------------|------|
|                          | Number      | %    | Number                      | %    |
| Wild Mustard             | 128         | 16.6 | 38,799                      | 22.0 |
| Kochia                   | 114         | 14.8 | 27,393                      | 15.5 |
| Foxtail (Pigeon Grass)   | 111         | 14.4 | 21,364                      | 12.1 |
| Redroot Pigweed          | 67          | 8.7  | 17,192                      | 9.7  |
| Eastern Black Nightshade | 51          | 6.6  | 10,823                      | 6.1  |
| Common Cocklebur         | 64          | 8.3  | 10,457                      | 5.9  |
| Ragweed (Common & Giant) | 21          | 2.7  | 8,710                       | 4.9  |
| Marshelder               | 19          | 2.5  | 5,194                       | 2.9  |
| Wild Oats                | 20          | 2.6  | 3,681                       | 2.1  |
| Common Lambsquarter      | 18          | 2.3  | 2,958                       | 1.7  |
| Russian Thistle          | 10          | 1.3  | 2,250                       | 1.3  |
| Smartweed                | 4           | 0.5  | 1,823                       | 1.0  |
| Buffalobur               | 1           | 0.1  | 1,405                       | 0.8  |
| Wild Buckwheat           | 3           | 0.4  | 1,358                       | 0.8  |

<sup>a</sup>Ranked as No. 1 weed problem on more than 0.5% of respondents' acres.

<sup>b</sup>Respondents' acres only.

Diseases were the worst production problem in MN 2 with 87 percent of respondents' acres affected (Table 13). Insects were the worst production problem in MN 1, with 37 percent of respondents' acres affected and weeds in MN 3 and MN 4, with 23 percent affected in each district. No production problems were reported for MN 5.

Weeds were the worst production problem in ND 2, ND 3, ND 4, and ND 5 with 24, 43, 21 and 53 percent of respondents' acres affected (Table 13). Insects were the worst production problem in ND 1, with 17 percent of respondents' acres affected.

**Weed Problems.** Wild mustard was reported as the worst weed problem on 22 percent of respondents' acres (Table 14), and as one of the three worst on 49 percent (Table 17), figures almost

**Table 15. Worst weed problem<sup>a</sup> in 1990 for respondents in Minnesota and North Dakota.**

| State                    | Worst Weed Problem       | Respondents            |      | Acres Affected <sup>b</sup> |        |      |
|--------------------------|--------------------------|------------------------|------|-----------------------------|--------|------|
|                          |                          | Number                 | %    | Number                      | %      |      |
| MN                       | Ragweed (Common & Giant) | 5                      | 6.9  | 6,364                       | 18.0   |      |
|                          | Foxtail (Pigeon Grass)   | 41                     | 18.7 | 5,145                       | 14.5   |      |
|                          | Wild Mustard             | 19                     | 8.7  | 4,383                       | 12.4   |      |
|                          | Redroot Pigweed          | 14                     | 6.4  | 2,699                       | 7.6    |      |
|                          | Eastern Black Nightshade | 27                     | 12.3 | 2,284                       | 6.5    |      |
|                          | Kochia                   | 7                      | 3.2  | 1,934                       | 5.5    |      |
|                          | Common Lambsquarters     | 11                     | 5.0  | 1,695                       | 4.8    |      |
|                          | Common Cocklebur         | 25                     | 11.4 | 1,537                       | 4.3    |      |
|                          | Marshelder               | 3                      | 1.4  | 360                         | 1.0    |      |
|                          | Wild Oats                | 2                      | 0.9  | 190                         | 0.5    |      |
|                          | ND                       | Wild Mustard           | 109  | 19.8                        | 34,416 | 24.4 |
|                          |                          | Kochia                 | 107  | 19.4                        | 25,459 | 18.0 |
|                          |                          | Foxtail (Pigeon Grass) | 70   | 12.7                        | 16,219 | 11.5 |
| Redroot Pigweed          |                          | 53                     | 9.6  | 14,493                      | 10.3   |      |
| Common Cocklebur         |                          | 39                     | 7.1  | 8,920                       | 6.3    |      |
| Eastern Black Nightshade |                          | 24                     | 4.4  | 8,539                       | 6.0    |      |
| Marshelder               |                          | 16                     | 2.9  | 4,834                       | 3.4    |      |
| Wild Oats                |                          | 18                     | 3.3  | 3,491                       | 2.5    |      |
| Ragweed (Common & Giant) |                          | 6                      | 1.1  | 2,346                       | 1.7    |      |
| Russian Thistle          |                          | 9                      | 1.6  | 2,190                       | 1.6    |      |
| Smartweed                |                          | 3                      | 0.5  | 1,703                       | 1.2    |      |
| Wild Buckwheat           |                          | 3                      | 0.5  | 1,358                       | 1.0    |      |
| Common Lambsquarters     |                          | 7                      | 1.3  | 1,263                       | 0.9    |      |
| Volunteer Soybean        | 1                        | 0.2                    | 800  | 0.6                         |        |      |
| Canada Thistle           | 7                        | 1.3                    | 716  | 0.5                         |        |      |

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

<sup>b</sup>Respondents' acres only.



identical to those reported for 1989 (2). Kochia was the second most common weed problem, followed by foxtail, redroot pigweed, eastern black nightshade, common cocklebur and ragweed, a ranking similar to that for 1989.

Differences in weed problems between the two states occurred. Ragweed, foxtail, wild mustard and redroot pigweed were the worst weed problems in Minnesota, according to the percentage of respondents' acres affected, while wild mustard, kochia, foxtail, and redroot pigweed were most severe in North Dakota (Table 15).

Wild mustard was most commonly cited as the worst weed problem in MN 1, ragweed was the worst weed problem on 86 percent of respondents' acres in MN 2, foxtail was the worst weed problem in MN 3 and MN 4, and volunteer corn in MN 5 (Table 16).

**Table 16. Worst weed problem<sup>a</sup> in 1990 for respondents in each Northharvest district of Minnesota and North Dakota.**

| State                    | Northharvest District | Worst Weed Problem       | Acres Affected <sup>b</sup> |      |
|--------------------------|-----------------------|--------------------------|-----------------------------|------|
|                          |                       |                          | Number                      | %    |
| MN                       | MN1                   | Wild Mustard             | 4,112                       | 28.1 |
|                          |                       | Kochia                   | 1,879                       | 12.9 |
|                          |                       | Redroot Pigweed          | 1,858                       | 12.7 |
|                          |                       | Foxtail (Pigeon Grass)   | 1,836                       | 12.6 |
|                          |                       | Ragweed (Common & Giant) | 4,290                       | 86.0 |
|                          | MN2                   | Foxtail (Pigeon Grass)   | 2,272                       | 20.7 |
|                          |                       | Eastern Black Nightshade | 1,704                       | 15.5 |
|                          | MN4                   | Foxtail (Pigeon Grass)   | 1,027                       | 23.8 |
|                          |                       | Ragweed (Common & Giant) | 825                         | 19.1 |
|                          | MN5                   | Volunteer Corn           | 65                          | 13.2 |
| Eastern Black Nightshade |                       | 54                       | 11.0                        |      |
| ND                       | ND1                   | Kochia                   | 9,071                       | 22.4 |
|                          |                       | Wild Mustard             | 8,707                       | 21.5 |
|                          |                       | Redroot Pigweed          | 5,398                       | 13.3 |
|                          | ND2                   | Wild Mustard             | 10,787                      | 36.5 |
|                          |                       | Kochia                   | 3,535                       | 12.0 |
|                          |                       | Redroot Pigweed          | 3,007                       | 10.2 |
|                          | ND3                   | Kochia                   | 6,371                       | 27.1 |
|                          |                       | Common Cocklebur         | 3,845                       | 16.4 |
|                          |                       | Foxtail (Pigeon Grass)   | 2,343                       | 10.0 |
|                          | ND4                   | Wild Mustard             | 9,224                       | 28.1 |
|                          |                       | Foxtail (Pigeon Grass)   | 4,008                       | 17.7 |
|                          |                       | Redroot Pigweed          | 2,856                       | 12.6 |
|                          | ND5                   | Eastern Black Nightshade | 5,630                       | 22.4 |
|                          |                       | Kochia                   | 4,367                       | 17.4 |
|                          |                       | Foxtail (Pigeon Grass)   | 4,136                       | 16.5 |
| Wild Mustard             |                       | 3,978                    | 15.8                        |      |

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

<sup>b</sup>District respondents' acres only.

Kochia was most frequently cited as the worst weed problem in ND 1 and ND 3, wild mustard in ND 2 and ND 4, and eastern black nightshade in ND 5.

Dry bean producers were also asked which three weeds were the worst in 1990. Common lambsquarters, redroot pigweed, wild mustard and eastern black nightshade were among the three worst weeds in Minnesota; wild mustard, kochia, foxtail and common cocklebur were among the three worst weeds in North Dakota (Table 17).

**Table 17. Weeds ranked as one of the three worst<sup>a</sup> in 1990 by respondents in Minnesota and North Dakota.**

| State                    | No. 1, No. 2, or No. 3 Weed Problem | Respondents            |        | Acres Affected <sup>b</sup> |        |      |
|--------------------------|-------------------------------------|------------------------|--------|-----------------------------|--------|------|
|                          |                                     | Number                 | %      | Number                      | %      |      |
| MN                       | Common Lambsquarters                | 62                     | 28.6   | 14,978                      | 42.3   |      |
|                          | Redroot Pigweed                     | 73                     | 33.6   | 14,200                      | 40.1   |      |
|                          | Wild Mustard                        | 54                     | 24.9   | 12,362                      | 34.9   |      |
|                          | Eastern Black Nightshade            | 69                     | 31.8   | 11,540                      | 32.6   |      |
|                          | Foxtail (Pigeon Grass)              | 88                     | 40.6   | 10,486                      | 29.6   |      |
|                          | Common Cocklebur                    | 67                     | 30.9   | 7,824                       | 22.1   |      |
|                          | Ragweed (Common & Giant)            | 24                     | 11.1   | 7,366                       | 20.8   |      |
|                          | Kochia                              | 28                     | 12.9   | 6,650                       | 18.5   |      |
|                          | Wild Oats                           | 21                     | 9.7    | 3,725                       | 10.5   |      |
|                          | ND                                  | Wild Mustard           | 249    | 45.2                        | 73,995 | 52.4 |
|                          |                                     | Kochia                 | 250    | 45.4                        | 71,209 | 50.4 |
|                          |                                     | Foxtail (Pigeon Grass) | 193    | 35.0                        | 45,051 | 31.9 |
| Common Cocklebur         |                                     | 121                    | 22.0   | 38,070                      | 26.9   |      |
| Wild Oats                |                                     | 93                     | 16.9   | 22,888                      | 16.2   |      |
| Eastern Black Nightshade |                                     | 55                     | 10.0   | 20,388                      | 14.4   |      |
| Common Lambsquarters     |                                     | 57                     | 10.3   | 17,278                      | 12.2   |      |
| Northharvest (MN & ND)   |                                     | Wild Mustard           | 303    | 39.4                        | 86,617 | 48.9 |
|                          |                                     | Kochia                 | 278    | 36.1                        | 77,769 | 44.0 |
|                          |                                     | Foxtail (Pigeon Grass) | 281    | 36.5                        | 55,537 | 31.4 |
|                          |                                     | Redroot Pigweed        | 207    | 26.9                        | 52,290 | 29.6 |
|                          |                                     | Common Cocklebur       | 188    | 24.4                        | 45,893 | 26.0 |
|                          | Common Lambsquarters                | 119                    | 15.5   | 32,256                      | 18.3   |      |
| Eastern Black Nightshade | 124                                 | 16.1                   | 31,928 | 18.1                        |        |      |

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

<sup>b</sup>Respondents' acres only.

Among the three worst weeds in different Northharvest districts, wild mustard was cited on 74 percent of respondents' acres in MN 1, common lambsquarters and eastern black nightshade on 100 and 99 percent in MN 2, common cocklebur on 48 percent in MN 3, foxtail on 36 percent in MN 4 and eastern black nightshade on 25 percent in MN 5 (Table 18). In North Dakota, wild mustard was cited on the highest percentage of respondents' acres in

ND 1 (58 percent); ND 2 (65 percent) and ND 4 (72 percent). Kochia was cited on 62 percent of respondents' acres in ND 3 and foxtail on 53 percent of respondents' acres in ND 5.

**Table 18. Weeds ranked as one of the three worst<sup>a</sup> in 1990 in each Northharvest district in Minnesota and North Dakota.**

| State                    | Northharvest District | No. 1, No. 2, or No. 3 Weed Problem | Acres Affected <sup>b</sup> |       |
|--------------------------|-----------------------|-------------------------------------|-----------------------------|-------|
|                          |                       |                                     | Number                      | %     |
| MN                       | MN1                   | Wild Mustard                        | 10,788                      | 73.8  |
|                          |                       | Kochia                              | 4,381                       | 30.0  |
|                          |                       | Common Lambsquarters                | 3,988                       | 27.3  |
|                          | MN2                   | Common Lambsquarters                | 4,988                       | 100.0 |
|                          |                       | Eastern Black Nightshade            | 4,950                       | 99.2  |
|                          |                       | Ragweed (Common & Giant)            | 4,290                       | 86.0  |
|                          | MN3                   | Common Cocklebur                    | 5,248                       | 47.7  |
|                          |                       | Common Lambsquarters                | 4,446                       | 40.4  |
|                          |                       | Foxtail (Pigeon Grass)              | 4,247                       | 38.6  |
|                          | MN4                   | Eastern Black Nightshade            | 4,180                       | 38.0  |
|                          |                       | Foxtail (Pigeon Grass)              | 1,564                       | 36.2  |
|                          |                       | Eastern Black Nightshade            | 1,529                       | 35.4  |
|                          |                       | Common Lambsquarters                | 1,495                       | 34.6  |
|                          |                       | Redroot Pigweed                     | 1,370                       | 31.7  |
|                          | MN5                   | Ragweed (Common & Giant)            | 1,268                       | 29.4  |
| Eastern Black Nightshade |                       | 124                                 | 25.3                        |       |
| ND                       | ND1                   | Wild Mustard                        | 23,302                      | 57.5  |
|                          |                       | Kochia                              | 21,446                      | 52.9  |
|                          |                       | Redroot Pigweed                     | 12,160                      | 30.0  |
|                          |                       | Foxtail (Pigeon Grass)              | 9,972                       | 24.6  |
|                          |                       | Wild Mustard                        | 19,312                      | 65.3  |
|                          | ND2                   | Kochia                              | 13,251                      | 44.8  |
|                          |                       | Foxtail (Pigeon Grass)              | 7,836                       | 26.5  |
|                          |                       | Redroot Pigweed                     | 7,535                       | 25.5  |
|                          | ND3                   | Kochia                              | 14,444                      | 61.5  |
|                          |                       | Common Cocklebur                    | 12,167                      | 51.8  |
|                          |                       | Wild Mustard                        | 9,077                       | 38.6  |
|                          | ND4                   | Foxtail (Pigeon Grass)              | 5,003                       | 21.3  |
|                          |                       | Wild Mustard                        | 16,289                      | 71.9  |
|                          |                       | Kochia                              | 9,976                       | 44.1  |
|                          | ND5                   | Foxtail (Pigeon Grass)              | 9,035                       | 39.9  |
|                          |                       | Redroot Pigweed                     | 5,416                       | 23.9  |
|                          |                       | Foxtail (Pigeon Grass)              | 13,205                      | 52.6  |
|                          |                       | Common Cocklebur                    | 12,457                      | 49.6  |
|                          |                       | Kochia                              | 12,092                      | 48.2  |
|                          |                       | Eastern Black Nightshade            | 11,799                      | 47.0  |
| Common Lambsquarters     |                       | 9,780                               | 39.0                        |       |
| Redroot Pigweed          | 9,217                 | 36.7                                |                             |       |
| Wild Mustard             | 6,014                 | 24.0                                |                             |       |

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

<sup>b</sup>District respondents' acres only.

**Weed Control Practices.** Cultivation for weed control was used on 80 percent of the respondents' acres. Among herbicide treatments, Sonalan was the most commonly used, on 51 percent, bentazon was used on 36 percent and spring applied trifluralin on 26 percent (Table 19). Hand weeding was used on 9 percent of respondents' acres.

When weed control practices for each state were compared, cultivation was used on 82 percent of respondents' acres in North Dakota and 75 percent in Minnesota (Table 20). In North Dakota, Sonalan was applied to 56 percent of respondents' acres, followed by bentazon on 35 percent and spring applied trifluralin on 24 percent. In Minnesota, bentazon was applied to 40 percent of respondents' acres, followed by Sonalan and spring applied trifluralin each on 31 percent. Alachlor and Amiben were used on 21 and 20 percent of respondents' acres, respectively, in Minnesota, but were not used in North Dakota.

The three most common weed control practices varied by Northharvest district, with bentazon being used on the highest percentage of respondents'

**Table 19. Weed control practices<sup>a</sup> in 1990 by all Northharvest respondents in Minnesota and North Dakota.**

| Weed Control Practice       | Respondents |      | Acres Treated <sup>b</sup> |      |
|-----------------------------|-------------|------|----------------------------|------|
|                             | Number      | %    | Number                     | %    |
| Cultivation                 | 414         | 53.8 | 141,689                    | 80.2 |
| Sonalan                     | 435         | 56.5 | 89,978                     | 50.9 |
| Bentazon                    | 375         | 48.7 | 62,959                     | 35.6 |
| Trifluralin, Spring Applied | 265         | 34.4 | 45,426                     | 25.7 |
| Hand Weeding                | 195         | 25.3 | 15,447                     | 9.3  |
| Trifluralin, Fall Applied   | 46          | 6.0  | 10,479                     | 5.9  |
| Poast                       | 110         | 14.3 | 9,408                      | 5.3  |
| Alachlor                    | 24          | 4.9  | 8,678                      | 4.9  |
| Amiben                      | 23          | 3.0  | 7,612                      | 4.3  |
| Glyphosate                  | 56          | 7.3  | 6,961                      | 3.9  |
| Trifluralin + Eptam         | 25          | 3.3  | 5,723                      | 3.2  |
| Eptam, Spring Applied       | 26          | 3.4  | 4,248                      | 2.4  |
| Gramoxone Extra             | 35          | 4.6  | 3,464                      | 2.0  |
| Prowl                       | 26          | 3.4  | 2,788                      | 1.6  |
| Rotary Hoe                  | 9           | 1.2  | 2,396                      | 1.4  |
| Sodium Chlorate             | 19          | 2.5  | 2,390                      | 1.4  |
| Dual                        | 19          | 2.5  | 1,927                      | 1.1  |

<sup>a</sup>Includes all practices or herbicides used on more than 1,000 acres.

<sup>b</sup>Respondents' acres only.

**Table 20. Common weed control practices<sup>a</sup> in 1990 of respondents in Minnesota and North Dakota.**

| State                  | Weed Control Practice       | Acres Treated <sup>b</sup> |      |
|------------------------|-----------------------------|----------------------------|------|
|                        |                             | Number                     | %    |
| MN                     | Cultivation                 | 26,582                     | 75.1 |
|                        | Bentazon                    | 14,181                     | 40.0 |
|                        | Sonalan                     | 11,128                     | 31.4 |
|                        | Trifluralin, Spring Applied | 10,984                     | 31.0 |
|                        | Alachlor                    | 7,265                      | 20.5 |
|                        | Amiben                      | 7,008                      | 19.8 |
|                        | Hand Weeding                | 5,985                      | 16.9 |
|                        | Glyphosate                  | 4,377                      | 12.4 |
|                        | Poast                       | 3,798                      | 10.7 |
| ND                     | Cultivation                 | 115,107                    | 81.5 |
|                        | Sonalan                     | 78,850                     | 55.8 |
|                        | Bentazon                    | 48,778                     | 34.5 |
|                        | Trifluralin, Spring Applied | 34,442                     | 24.4 |
| Northharvest (MN & ND) | Cultivation                 | 141,689                    | 80.2 |
|                        | Sonalan                     | 89,978                     | 50.9 |
|                        | Bentazon                    | 62,959                     | 35.6 |
|                        | Trifluralin, Spring Applied | 45,426                     | 25.7 |

<sup>a</sup>Practice used on more than 10% of respondents' acres.

<sup>b</sup>Respondents' acres only.

**Table 22. Effectiveness of weed control practices in 1990 reported by all Northharvest respondents in Minnesota and North Dakota.**

| Weed Control Practice       | Number of Respondents | Efficacy of Weed Control <sup>a</sup> |      |      |      |
|-----------------------------|-----------------------|---------------------------------------|------|------|------|
|                             |                       | 1                                     | 2    | 3    | 4    |
| % of Respondents            |                       |                                       |      |      |      |
| Alachlor                    | 24                    | 20.8                                  | 58.3 | 16.7 | 0    |
| Amiben                      | 23                    | 26.1                                  | 39.1 | 30.4 | 0    |
| Bentazon                    | 375                   | 28.3                                  | 43.5 | 19.2 | 5.6  |
| Cultivation                 | 414                   | 22.0                                  | 50.7 | 11.6 | 0.2  |
| Dual                        | 19                    | 47.4                                  | 36.8 | 10.5 | 0    |
| Eptam, Spring Applied       | 26                    | 42.3                                  | 42.3 | 15.4 | 0    |
| Glyphosate                  | 56                    | 57.1                                  | 28.6 | 3.6  | 1.8  |
| Gramoxone Extra             | 35                    | 40.0                                  | 8.6  | 25.7 | 11.4 |
| Hand Weeding                | 195                   | 43.1                                  | 33.8 | 9.7  | 1.5  |
| Sodium Chlorate             | 19                    | 21.1                                  | 31.6 | 15.8 | 5.3  |
| Poast                       | 110                   | 52.7                                  | 29.1 | 10.9 | 2.7  |
| Prowl                       | 26                    | 34.6                                  | 30.8 | 23.1 | 7.7  |
| Rotary Hoe                  | 9                     | 33.0                                  | 33.0 | 0    | 0    |
| Sonalan                     | 435                   | 45.5                                  | 43.0 | 7.4  | 2.3  |
| Trifluralin + Eptam         | 25                    | 48.0                                  | 40.0 | 8.0  | 0    |
| Trifluralin, Fall Applied   | 46                    | 41.3                                  | 41.3 | 10.9 | 4.3  |
| Trifluralin, Spring Applied | 265                   | 35.5                                  | 41.9 | 15.1 | 4.2  |

<sup>a</sup>1=Excellent control, 4=Poor control; includes all practices or herbicides used on more than 1,000 acres.

acres in MN 3 and MN 5 and cultivation in the other three Minnesota districts (Table 21). Alachlor and Amiben were frequently used in MN 2. Cultivation was the weed control practice used on the highest percentage of respondents' acres in all five districts of North Dakota, ranging from 95 percent of respondents' acres in ND 1 to 66 percent in ND 5. Sonalan was the second most commonly used weed control practice in all North Dakota districts except ND 4, where post-applied bentazon was second, used on 44 percent of respondents' acres.

Respondents ranked most weed control practices as giving good to excellent control (Table 22). Amiben, Gramoxone Extra and Prowl reportedly gave slightly less weed control than most other

**Table 21. Three most common weed control practices in 1990 of respondents in each Northharvest district in Minnesota and North Dakota.**

| State    | Northharvest District | Weed Control Practice       | Acres Treated <sup>a</sup> |                    |
|----------|-----------------------|-----------------------------|----------------------------|--------------------|
|          |                       |                             | Number                     | %                  |
| MN       | MN1                   | Cultivation                 | 14,008                     | 95.8               |
|          |                       | Bentazon                    | 6,410                      | 43.8               |
|          |                       | Sonalan                     | 5,687                      | 38.9               |
|          | MN2                   | Cultivation                 | 6,090                      | 122.1 <sup>b</sup> |
|          |                       | Alachlor                    | 5,350                      | 107.3 <sup>b</sup> |
|          |                       | Amiben                      | 4,318                      | 86.6               |
|          | MN3                   | Bentazon                    | 5,955                      | 54.2               |
|          |                       | Trifluralin, Spring Applied | 4,989                      | 45.4               |
|          |                       | Cultivation                 | 2,729                      | 24.8               |
|          | MN4                   | Cultivation                 | 3,255                      | 75.4               |
|          |                       | Sonalan                     | 1,683                      | 39.0               |
|          |                       | Trifluralin, Spring Applied | 1,583                      | 36.7               |
|          | MN5                   | Bentazon                    | 197                        | 40.1               |
|          |                       | Trifluralin, Spring Applied | 175                        | 35.6               |
|          | ND                    | ND1                         | Cultivation                | 38,646             |
| Sonalan  |                       |                             | 23,134                     | 57.1               |
| Bentazon |                       |                             | 10,612                     | 26.2               |
| ND2      |                       | Cultivation                 | 22,359                     | 75.6               |
|          |                       | Sonalan                     | 18,107                     | 61.3               |
|          |                       | Bentazon                    | 9,491                      | 32.1               |
| ND3      |                       | Cultivation                 | 16,781                     | 71.4               |
|          |                       | Sonalan                     | 16,216                     | 69.0               |
|          |                       | Bentazon                    | 5,276                      | 22.5               |
| ND4      |                       | Cultivation                 | 18,887                     | 83.4               |
|          |                       | Bentazon                    | 10,019                     | 44.3               |
|          |                       | Trifluralin, Spring Applied | 8,506                      | 37.6               |
| ND5      |                       | Cultivation                 | 16,434                     | 65.5               |
|          |                       | Sonalan                     | 14,412                     | 57.4               |
|          |                       | Bentazon                    | 13,381                     | 53.3               |

<sup>a</sup>District respondents' acres only.

<sup>b</sup>Figures in excess of 100% indicates that some acres received more than one treatment or application.

products or practices. Respondents ranked most weed control practices as producing no or slight crop injury (Table 23):

**Insect Problems.** Grasshoppers were reported as the worst insect problem by 15 percent of all respondents on 20 percent of their acres (Table 24).

**Table 23. Bean injury from weed control practices in 1990 reported by all Northharvest respondents in Minnesota and North Dakota.**

| Weed Control Practice       | Number of Respondents | Degree of Bean Injury <sup>a</sup> |      |      |     |
|-----------------------------|-----------------------|------------------------------------|------|------|-----|
|                             |                       | 1                                  | 2    | 3    | 4   |
|                             |                       | % of Respondents                   |      |      |     |
| Alachlor                    | 24                    | 75.0                               | 16.7 | 0    | 0   |
| Amiben                      | 23                    | 73.9                               | 8.7  | 0    | 0   |
| Bentazon                    | 375                   | 47.2                               | 32.3 | 3.7  | 0.5 |
| Cultivation                 | 414                   | 41.8                               | 28.3 | 1.2  | 0   |
| Dual                        | 19                    | 36.8                               | 21.1 | 0    | 0   |
| Eptam, Spring Applied       | 26                    | 61.5                               | 15.4 | 0    | 0   |
| Glyphosate                  | 56                    | 73.2                               | 3.6  | 0    | 0   |
| Gramoxone Extra             | 35                    | 34.3                               | 2.9  | 11.4 | 0   |
| Hand Weeding                | 195                   | 54.4                               | 16.9 | 0.5  | 0   |
| Sodium Chlorate             | 19                    | 26.3                               | 5.3  | 0    | 0   |
| Poast                       | 110                   | 61.8                               | 16.4 | 4.5  | 0   |
| Prowl                       | 26                    | 57.7                               | 15.4 | 3.8  | 0   |
| Rotary Hoe                  | 9                     | 11.1                               | 33.3 | 0    | 0   |
| Sonalan                     | 435                   | 74.5                               | 12.0 | 0.9  | 0   |
| Trifluralin + Eptam         | 25                    | 64.0                               | 8.0  | 0    | 0   |
| Trifluralin, Fall Applied   | 46                    | 73.9                               | 0    | 0    | 2.2 |
| Trifluralin, Spring Applied | 265                   | 68.3                               | 9.8  | 0.8  | 0   |

<sup>a</sup>1=No injury, 4=severe injury; table includes all practices or herbicides used on more than 1,000 acres.

**Table 24. Worst insect problem<sup>a</sup> in 1990 for respondents in Minnesota and North Dakota.**

| State                  | Worst Insect Problem | Respondents |      | Acres Affected <sup>b</sup> |      |
|------------------------|----------------------|-------------|------|-----------------------------|------|
|                        |                      | Number      | %    | Number                      | %    |
| MN                     | Grasshopper          | 20          | 9.1  | 9,593                       | 27.1 |
|                        | Potato Leafhopper    | 8           | 3.7  | 2,414                       | 6.8  |
|                        | None                 | 181         | 82.7 | 21,096                      | 59.6 |
| ND                     | Grasshopper          | 95          | 17.2 | 26,320                      | 18.6 |
|                        | Potato Leafhopper    | 8           | 1.5  | 2,028                       | 1.4  |
|                        | None                 | 438         | 79.5 | 110,400                     | 78.1 |
| North-arvest (MN & ND) | Grasshopper          | 115         | 14.9 | 35,913                      | 20.3 |
|                        | Potato Leafhopper    | 16          | 2.1  | 4,442                       | 2.5  |
|                        | None                 | 619         | 80.4 | 131,496                     | 74.4 |

<sup>a</sup>Insect problems reported on more than 1% of respondents' acres.

<sup>b</sup>Respondents' acres only.

Grasshoppers were the worst insect problem on 19 and 27 percent of North Dakota and Minnesota respondents' acres, respectively. Potato leafhoppers were reported as the worst insect problem on 7 percent of Minnesota respondents' acres but only 1 percent of North Dakota respondents' acres (Table 24).

Grasshoppers were the worst insect problem in all five of the North Dakota districts and in MN 1 and MN 2 (Table 25). Grasshoppers were the worst insect problem on 86 percent of respondents' acres in MN 2. Grasshoppers and potato leafhoppers each were the worst insect problem on 12 percent of respondents' acres in MN 4 and potato leafhoppers were the worst insect problem on 6 percent of respondents' acres in MN 3. Potato leafhoppers were the worst insect problem on 8 percent of respondents' acres in ND 5. No insect problems were reported for MN 5.

**Table 25. Worst insect problem<sup>a</sup> in 1990 in each Northharvest district for respondents in Minnesota and North Dakota.**

| State | Northharvest District | Worst Insect Problem | Acres Affected <sup>b</sup> |      |
|-------|-----------------------|----------------------|-----------------------------|------|
|       |                       |                      | Number                      | %    |
| MN    | MN1                   | Grasshoppers         | 4,701                       | 32.2 |
|       |                       | Potato Leafhoppers   | 551                         | 3.8  |
|       | MN2                   | Grasshoppers         | 4,290                       | 86.0 |
|       |                       | Potato Leafhoppers   | 660                         | 13.2 |
|       | MN3                   | Potato Leafhoppers   | 685                         | 6.2  |
| MN4   | Grasshoppers          | 518                  | 12.0                        |      |
|       | Potato Leafhoppers    | 518                  | 12.0                        |      |
| MN5   | None                  | -                    | -                           |      |
| ND    | ND1                   | Grasshoppers         | 9,522                       | 23.5 |
|       | ND2                   | Grasshoppers         | 5,458                       | 18.5 |
|       | ND3                   | Grasshoppers         | 3,640                       | 15.5 |
|       |                       | Cutworms             | 300                         | 1.3  |
|       | ND4                   | Grasshoppers         | 4,964                       | 21.9 |
| ND5   | Grasshoppers          | 2,736                | 10.9                        |      |
|       | Potato Leafhoppers    | 2,028                | 8.1                         |      |

<sup>a</sup>Insect problems reported on more than 1% of respondents' acres; those reporting no problem are not included.

<sup>b</sup>District respondents' acres only.

**Insecticide Use.** Over 80 percent of respondents did not treat with an insecticide. Where insecticides were used, Asana XL was most common, with 12 percent of Minnesota respondents' acres treated and 3 percent of North Dakota respondents' acres treated (Table 26). Cygon, Sevin and Lorsban each were used on a small percentage of respondents' acres.

**Disease Problems.** White mold was cited as the worst disease problem on 13 percent of respondents' acres, followed by bacterial blight on 10 percent, and root rot on 5 percent (Table 27). White mold was the worst disease problem in Minnesota, affecting 36 percent of respondents' acres, followed by rust on 7 percent and root rot on 3 percent. Bacterial blight was the worst disease problem on 12 percent of North Dakota acres, followed by white mold and root rot on 7 and 6 percent, respectively (Table 27).

Diseases seldom occur singly, so a better estimate of disease problems may be obtained by ranking diseases as one of the three worst in the crop. When diseases were ranked among the three worst diseases, white mold was reported as one of the three worst on 41 percent of respondents' acres in Minnesota. Bacterial blight was reported as one of the three worst diseases on 17 percent of all North-arvest respondents' acres (Table 28).

**Table 26. Insecticide usage<sup>a</sup> in 1990 by respondents in Minnesota and North Dakota.**

| State                  | Insecticide       | Respondents |      | Acres Treated <sup>b</sup> |       |
|------------------------|-------------------|-------------|------|----------------------------|-------|
|                        |                   | Number      | %    | Number                     | %     |
| MN                     | Asana XL          | 18          | 8.3  | 4,097                      | 11.6  |
|                        | Cygon             | 4           | 1.8  | 1,026                      | 2.9   |
|                        | Sevin             | 1           | 0.5  | 200                        | 0.6   |
|                        | None <sup>b</sup> | 187         | 85.4 | 22,453                     | 63.4  |
|                        | ND                | Asana XL    | 46   | 8.3                        | 4,759 |
|                        | Sevin             | 12          | 2.2  | 900                        | 0.6   |
|                        | Lorsban           | 4           | 0.7  | 651                        | 0.5   |
|                        | None <sup>b</sup> | 443         | 80.4 | 112,779                    | 1.7   |
| North-arvest (MN & ND) | Asana XL          | 64          | 8.3  | 8,856                      | 5.0   |
|                        | Cygon             | 7           | 0.9  | 1,200                      | 0.7   |
|                        | Sevin             | 13          | 1.7  | 1,100                      | 0.6   |
|                        | None <sup>c</sup> | 630         | 81.8 | 135,232                    | 76.5  |

<sup>a</sup>Data includes any insecticide applied to over 0.5% of respondents' acres.

<sup>b</sup>Respondents' acres only.

<sup>c</sup>"None" means no acres treated by respondent.

**Table 27. Worst disease problem<sup>a</sup> in 1990 for respondents in Minnesota and North Dakota.**

| State                  | Worst Disease Problem | Respondents |      | Acres Treated <sup>b</sup> |      |
|------------------------|-----------------------|-------------|------|----------------------------|------|
|                        |                       | Number      | %    | Number                     | %    |
| MN                     | White Mold            | 44          | 20.1 | 12,769                     | 36.1 |
|                        | Rust                  | 6           | 2.7  | 2,497                      | 7.1  |
|                        | Root Rot              | 10          | 4.6  | 1,068                      | 3.0  |
|                        | Bacterial Blight      | 8           | 3.7  | 979                        | 2.8  |
|                        | Alternaria            | 1           | 0.5  | 500                        | 1.4  |
| ND                     | Bacterial Blight      | 58          | 10.5 | 17,298                     | 12.2 |
|                        | White Mold            | 24          | 4.4  | 9,982                      | 7.1  |
|                        | Root Rot              | 21          | 3.8  | 8,087                      | 5.7  |
|                        | Rust                  | 11          | 2.0  | 2,396                      | 1.7  |
|                        | Alternaria            | 2           | 0.4  | 1,065                      | 0.8  |
| North-arvest (MN & ND) | White Mold            | 68          | 8.8  | 22,751                     | 12.9 |
|                        | Bacterial Blight      | 66          | 8.6  | 18,277                     | 10.3 |
|                        | Root Rot              | 31          | 4.0  | 9,166                      | 5.2  |
|                        | Rust                  | 17          | 2.2  | 4,893                      | 2.8  |
|                        | Alternaria            | 3           | 0.4  | 1,565                      | 0.9  |

<sup>a</sup>Ranked as No.1 disease problem by respondents.

<sup>b</sup>Respondents' acres only

**Table 28. Diseases ranked as one of the three worst<sup>a</sup> in 1990 by respondents in Minnesota and North Dakota.**

| State                  | No.1, No.2 or No.3 Disease Problem | Respondents |      | Acres Affected <sup>b</sup> |      |
|------------------------|------------------------------------|-------------|------|-----------------------------|------|
|                        |                                    | Number      | %    | Number                      | %    |
| MN                     | White Mold                         | 58          | 26.7 | 14,487                      | 40.9 |
|                        | Rust                               | 15          | 6.9  | 4,707                       | 13.3 |
|                        | Root Rot                           | 25          | 11.5 | 4,134                       | 11.7 |
|                        | Bacterial Blight                   | 18          | 8.3  | 3,158                       | 8.9  |
|                        | Alternaria                         | 2           | 0.9  | 745                         | 2.1  |
| ND                     | Bacterial Blight                   | 73          | 13.2 | 24,016                      | 17.0 |
|                        | Root Rot                           | 42          | 7.6  | 16,554                      | 11.7 |
|                        | White Mold                         | 40          | 7.3  | 15,801                      | 11.2 |
|                        | Rust                               | 26          | 4.7  | 7,549                       | 5.3  |
|                        | Alternaria                         | 11          | 2.0  | 6,627                       | 4.7  |
| North-arvest (MN & ND) | White Mold                         | 98          | 12.7 | 30,288                      | 17.1 |
|                        | Bacterial Blight                   | 91          | 11.8 | 27,174                      | 15.4 |
|                        | Root Rot                           | 67          | 8.7  | 20,689                      | 11.7 |
|                        | Rust                               | 41          | 5.3  | 12,256                      | 6.9  |
|                        | Alternaria                         | 13          | 1.7  | 7,372                       | 4.2  |

<sup>a</sup>Ranked as No. 1, No. 2, or No. 3 disease problem by respondents.

<sup>b</sup>Respondents' acres only.

The worst disease problem by Northharvest district (Table 29) was rust in MN 1 (16 percent of respondents' acres); white mold in MN 2 (99 percent), MN 3 (35 percent), and MN 4 (46 percent); and root rot in MN 5 (8 percent). Bacterial blight was the worst disease problem in ND 1 (10 percent of respondents' acres), ND 2 (12 percent), ND 3 (21 percent), and ND 4 (15 percent); and white mold in ND 5 (24 percent).

**Fungicide Use.** Benlate and Topsin were used on a small percentage of respondents' acres (Table 30).

Benlate was banded on 13 percent of Minnesota respondents' acres and broadcast on 7 percent; Benlate was not used in North Dakota (Table 30). Topsin was banded on 1 percent and broadcast on 2 percent of respondents' acres in Minnesota and on 3 and 2 percent, respectively, in North Dakota. The Minnesota data represents a reversal from 1989 when 14 percent of Minnesota respondents' acres were broadcast with Benlate or Topsin and only 1 percent was band treated with either product (2).

Most of the fungicide use in Minnesota was in MN 2, where 90 percent of respondents' acres were band treated with Benlate, 43 percent broadcast treated with Benlate, 4 percent band treated with Topsin and 13 percent broadcast treated with Topsin (Table 31). The data indicate that many of the acres in MN 2 were treated more than once with Benlate or Topsin. The highest percentage of treated acres in North Dakota were in ND 1 and ND 2 where Topsin was band applied on 4 and 6 percent of acres and

**Table 29. Worst disease problem<sup>a</sup> in 1990 in each Northharvest district for respondents in Minnesota and North Dakota.**

| State | Northharvest District | Worst Disease Problem | Acres Affected <sup>b</sup> |      |
|-------|-----------------------|-----------------------|-----------------------------|------|
|       |                       |                       | Number                      | %    |
| MN    | MN1                   | Rust                  | 2,358                       | 16.1 |
|       | MN2                   | White Mold            | 4,950                       | 99.2 |
|       | MN3                   | White Mold            | 3,804                       | 34.6 |
|       | MN4                   | White Mold            | 2,003                       | 46.4 |
|       | MN5                   | Root Rot              | 40                          | 8.2  |
| ND    | ND1                   | Bacterial Blight      | 4,156                       | 10.3 |
|       | ND2                   | Bacterial Blight      | 3,505                       | 11.9 |
|       | ND3                   | Bacterial Blight      | 4,823                       | 20.5 |
|       | ND4                   | Bacterial Blight      | 3,386                       | 15.0 |
|       | ND5                   | White Mold            | 6,036                       | 24.0 |

<sup>a</sup>Ranked as No.1 disease problem on the largest % of respondents' acres for that district.

<sup>b</sup>District respondents' acres only.

**Table 30. Fungicide use<sup>a</sup> in 1990 by respondents in Minnesota and North Dakota.**

| State                  | Fungicide and Method of Application | Respondents |     | Acres Treated <sup>b</sup> |      |
|------------------------|-------------------------------------|-------------|-----|----------------------------|------|
|                        |                                     | Number      | %   | Number                     | %    |
| MN                     | Benlate, Banded                     | 4           | 1.8 | 4,615                      | 13.0 |
|                        | Benlate, Broadcast                  | 4           | 1.8 | 2,425                      | 6.9  |
|                        | Topsin, Broadcast                   | 2           | 0.9 | 800                        | 2.3  |
|                        | Topsin, Banded                      | 2           | 0.9 | 430                        | 1.2  |
| ND                     | Topsin, Banded                      | 20          | 3.6 | 3,483                      | 2.5  |
|                        | Topsin, Broadcast                   | 14          | 2.5 | 2,132                      | 1.5  |
|                        | Bravo,                              | 1           | 0.2 | 700                        | 0.5  |
| North-arvest (MN & ND) | Benlate, Banded                     | 5           | 0.7 | 4,815                      | 2.7  |
|                        | Topsin, Banded                      | 22          | 2.9 | 3,913                      | 2.2  |
|                        | Topsin, Broadcast                   | 16          | 2.1 | 2,932                      | 1.7  |
|                        | Benlate, Broadcast                  | 7           | 0.9 | 2,520                      | 1.4  |

<sup>a</sup>Data includes any fungicide applied to 0.5% of respondents' acres.

<sup>b</sup>Respondents' acres only.

**Table 31. Fungicide use<sup>a</sup> in 1990 by respondents in each Northharvest district in Minnesota and North Dakota.**

| State | Northharvest District | Fungicide and Method of Application | Acres Treated <sup>b</sup> |                |     |
|-------|-----------------------|-------------------------------------|----------------------------|----------------|-----|
|       |                       |                                     | Number                     | %              |     |
| MN    | MN1                   | Topsin, Banded                      | 230                        | 1.6            |     |
|       |                       | Topsin, Broadcast                   | 140                        | 1.0            |     |
|       |                       | Benlate, Banded                     | 125                        | 0.9            |     |
|       | MN2                   | Benlate, Banded                     | 4,490                      | 90.0           |     |
|       |                       | Benlate, Broadcast                  | 2,145                      | 43.0           |     |
|       |                       | Topsin, Broadcast                   | 660                        | 13.2           |     |
|       |                       | Topsin, Banded                      | 200                        | 4.0            |     |
|       | MN3                   | Benlate, Broadcast                  | 195                        | 1.8            |     |
|       | MN4                   | Benlate, Broadcast                  | 85                         | 2.0            |     |
|       | MN5                   | None <sup>c</sup>                   | - <sup>c</sup>             | - <sup>c</sup> |     |
|       | ND                    | ND1                                 | Topsin, Banded             | 1,429          | 3.5 |
|       |                       |                                     | Topsin, Broadcast          | 841            | 2.1 |
|       |                       |                                     | Bravo                      | 700            | 1.7 |
|       |                       | ND2                                 | Topsin, Banded             | 1,699          | 5.8 |
|       |                       |                                     | Topsin, Broadcast          | 200            | 0.7 |
| ND3   |                       | None <sup>c</sup>                   | - <sup>c</sup>             | - <sup>c</sup> |     |
| ND4   |                       | Topsin, Banded                      | 220                        | 1.0            |     |
| ND5   |                       | Topsin, Broadcast                   | 946                        | 3.8            |     |
|       |                       | Champion                            | 456                        | 1.8            |     |
|       |                       | Benlate, Banded                     | 200                        | 0.8            |     |
|       | Topsin, Banded        | 135                                 | 0.5                        |                |     |

<sup>a</sup>Data includes any fungicide applied to more than 0.5% of respondents' acres in the district.

<sup>b</sup>District respondents' acres only.

<sup>c</sup>Less than 0.5% of respondents' acres treated.

broadcast on 2 and 1 percent, respectively. Most use of fungicides in both states was for white mold control. A small amount of Bravo and Champion were used in North Dakota for other diseases.

**Non-Chemical Control Measures.** Resistant varieties were reportedly used on 19 percent of respondents' acres, although no definition of resistance was provided in the questionnaire (Table 32). However, NDSU Extension Circular A-654, *North Dakota Dry Bean Performance Testing*, lists varieties that are tolerant to rust (many navy and most dark red kidney and black turtle varieties), to white mold (some navy and most dark red kidney and black turtle varieties), and to halo blight (many pinto, navy, dark red kidney and black turtle varieties), so selection of tolerant varieties is possible based on available information.

Crop Rotation was used by most respondents (Table 33). Most respondents reported three or four years since the previous bean crop; a few reported two years since the previous bean crop. Twenty nine percent of Minnesota respondents and 13 percent of North Dakota respondents reported they had planted beans on land with no previous history of beans. A significant number of respondents (17 percent) reported "0" years since the previous dry bean crop. This would seem to imply that beans had been planted the previous year. It is not clear if some of these respondents intended to indicate that they had never planted beans previously on that land. It seems likely that at least some respondents may have intended "never" to be their answer since this

high a percentage of respondents with beans two years in a row seems unlikely.

Wheat was the crop that most commonly preceded a bean crop, being planted on 33 percent of Minnesota respondents' acres and 42 percent of North Dakota respondents' acres (Table 34). Corn was also planted on 33 percent of Minnesota respondents' acres. Barley was planted on 15 percent of respondents' acres in North Dakota. No crop was planted prior to dry beans on about 20 percent of all Northharvest respondents' acres; this would seem to imply that a fairly substantial amount of beans is planted on fallow land.

**Table 33. Crop rotation in 1990 by respondents in Minnesota and North Dakota.**

| No. of Years Since Previous Dry Bean Crop | Minnesota                  | North Dakota | Northharvest |
|---|----------------------------|--------------|--------------|
|   | ---- % of Respondents ---- |              |              |
| 0 <sup>a</sup>                            | 18.3                       | 17.1         | 17.4         |
| 1   | 2.7                        | 1.6          | 2.0          |
| 2   | 6.9                        | 11.4         | 10.1         |
| 3   | 12.3                       | 27.6         | 23.3         |
| 4   | 13.2                       | 18.2         | 16.8         |
| 5   | 6.9                        | 6.9          | 6.9          |
| 6+  | 9.6                        | 4.0          | 5.6          |
| Never                                     | 28.8                       | 12.9         | 17.4         |

<sup>a</sup>A "zero" on the survey form was intended to signify dry beans following dry beans. The high number of "zero" responses suggests there may have been confusion among some growers as to the interpretation of this entry on the form (possibly some growers intended "zero" to mean that they had never before grown dry beans on the land).

**Table 32. Use of resistant varieties in 1990 by respondents in Minnesota and North Dakota.**

| State        | Northharvest District | % of Respondents' Acres Planted to Resistant Varieties |
|--------------|-----------------------|--|
| MN           | MN1                   | 9.1  |
|              | MN3                   | 14.5   |
|              | MN4                   | 14.2   |
|              | <u>MN5</u>            | <u>12.2</u>  |
|              | Total                 | 10.2   |
| ND           | ND1                   | 15.8   |
|              | ND2                   | 19.7   |
|              | ND3                   | 18.8   |
|              | ND4                   | 33.8   |
|              | <u>ND5</u>            | <u>20.2</u>  |
| ND           | Total                 | 20.8   |
| Northharvest |                       | 18.6   |

**Table 34. Crop rotation: crop grown by respondents in Minnesota and North Dakota preceding the 1990 dry bean crop.**

| Preceding Crop | Minnesota                  | North Dakota | Northharvest |
|----------------|----------------------------|--------------|--------------|
|                | ---- % of Respondents ---- |              |              |
| Barley         | 5.9                        | 15.4         | 12.7         |
| Canola         | 0.5                        | 0            | 0.1          |
| Corn           | 33.3                       | 6.4          | 14.0         |
| Durum          | 0                          | 1.3          | 0.9          |
| Fallow         | 0                          | 0.4          | 0.3          |
| Oats           | 1.4                        | 0.5          | 0.8          |
| Potatoes       | 1.4                        | 0.9          | 1.0          |
| Rye            | 0.5                        | 0.2          | 0.3          |
| Small Grains   | 1.8                        | 6.9          | 5.5          |
| Soybeans       | 4.1                        | 0            | 1.2          |
| Sugarbeets     | 3.7                        | 2.7          | 3.0          |
| Wheat          | 32.9                       | 42.3         | 39.6         |
| None           | 14.2                       | 22.7         | 20.3         |

The most common crop preceding beans varied with the district: wheat or barley in MN 1; corn, potatoes, or rye in MN 2; corn or wheat in MN 3, and corn in MN 4 and MN 5 (Table 35). Wheat was the most common crop to precede beans in all five North Dakota districts; barley was the second most common crop to precede beans in ND 1, ND 2, ND 3, and ND 4; corn was the second most common crop to precede beans in ND 5. Use of a small grain or corn crop preceding dry beans helps reduce the carryover of root diseases such as Rhizoctonia root rot.

**Crop Consultants.** Crop consultants were used by 14 percent of respondents on 13 percent of their acres (Table 36). However, the percentage of respondents using crop consultants was as high as 75 percent in MN 2 where 107 percent of acres were reported scouted to a low of 4 percent of respondents in ND 3. Minnesota had a much higher percentage of acres scouted by crop consultants than North Dakota.

Although 63 percent of respondents using a crop consultant reported \$5.00/acre or less economic

**Table 35. Crop rotation: crops most commonly grown preceding the 1990 dry bean crop by respondents in each Northharvest district of Minnesota and North Dakota.**

| State | Northharvest District | Preceding <sup>a</sup> Crop | % of Respondents |   |
|-------|-----------------------|-----------------------------|------------------|---|
|       |                       |                             | Number           | % |
| MN    | MN1                   | Wheat                       | 62.5             |   |
|       |                       | Barley                      | 19.6             |   |
|       | MN2                   | Corn                        | 25.0             |   |
|       |                       | Potatoes                    | 25.0             |   |
|       |                       | Rye                         | 25.0             |   |
| MN3   | Corn                  | 42.1                        |                  |   |
|       | Wheat                 | 28.0                        |                  |   |
| MN4   | Corn                  | 43.9                        |                  |   |
|       | MN5                   | Corn                        | 81.8             |   |
| ND    | ND1                   | Wheat                       | 48.0             |   |
|       |                       | Barley                      | 14.0             |   |
|       | ND2                   | Wheat                       | 39.5             |   |
|       |                       | Barley                      | 17.4             |   |
|       |                       | Small Grains                | 11.9             |   |
|       | ND3                   | Wheat                       | 46.2             |   |
|       |                       | Barley                      | 14.0             |   |
|       | ND4                   | Wheat                       | 30.3             |   |
|       |                       | Barley                      | 27.6             |   |
|       |                       | Small Grains                | 19.7             |   |
|       | ND5                   | Wheat                       | 40.4             |   |
|       |                       | Corn                        | 25.5             |   |

<sup>a</sup>Crop grown by more than 10% of respondents in a district.

**Table 36. Consultants: number of respondents in each Northharvest district of Minnesota and North Dakota who hired consultants and acres scouted in 1990.**

| State              | Northharvest District | Respondents Who Hired a Consultant |      | Acres Scouted <sup>a</sup> |       |
|--------------------|-----------------------|------------------------------------|------|----------------------------|-------|
|                    |                       | Number                             | %    | Number                     | %     |
| MN                 | MN1                   | 13                                 | 23.2 | 3,093                      | 20.2  |
|                    | MN2                   | 3                                  | 75.0 | 5,350                      | 107.3 |
|                    | MN3                   | 14                                 | 13.1 | 1,237                      | 11.3  |
|                    | MN4                   | 7                                  | 17.1 | 1,173                      | 27.2  |
|                    | MN5                   | 2                                  | 18.2 | 75                         | 15.3  |
| MN                 | Total                 | 39                                 | 17.8 | 10,928                     | 30.9  |
| ND                 | ND1                   | 25                                 | 14.0 | 4,073                      | 10.1  |
|                    | ND2                   | 9                                  | 8.3  | 1,387                      | 4.7   |
|                    | ND3                   | 4                                  | 4.3  | 0                          | 0     |
|                    | ND4                   | 13                                 | 17.1 | 2,140                      | 9.5   |
|                    | ND5                   | 16                                 | 17.0 | 4,174                      | 16.6  |
| ND                 | Total                 | 67                                 | 12.2 | 11,774                     | 8.3   |
| Northharvest Total |                       | 105                                | 13.8 | 22,702                     | 12.8  |

<sup>a</sup>District respondents' acres only except for state and Northharvest totals.

**Table 37. Economic return from use of a crop consultant in 1990 for respondents in Minnesota and North Dakota.**

| State        | Economic Return, \$/A | Respondents |                    | Acres <sup>a</sup> |      |
|--------------|-----------------------|-------------|--------------------|--------------------|------|
|              |                       | Number      | % Using Consultant | Number             | %    |
| MN           | 0                     | 7           | 18.4               | 4,781              | 13.5 |
|              | 0-5                   | 17          | 44.7               | 4,400              | 12.4 |
|              | 5-10                  | 3           | 7.9                | 291                | 0.8  |
|              | 10-15                 | 7           | 18.4               | 398                | 1.1  |
|              | 15-20                 | 4           | 10.5               | 397                | 1.1  |
|              |                       | 38          |                    |                    |      |
| ND           | 0                     | 13          | 20.0               | 2,099              | 1.5  |
|              | 0-5                   | 28          | 43.1               | 4,972              | 3.5  |
|              | 5-10                  | 14          | 21.5               | 2,829              | 2.0  |
|              | 10-15                 | 2           | 3.1                | 80                 | 0.1  |
|              | 15-20                 | 8           | 12.3               | 1,474              | 1.0  |
|              |                       | 65          |                    |                    |      |
| Northharvest | 0                     | 20          | 19.4               | 6,880              | 3.9  |
|              | 0-5                   | 45          | 43.7               | 9,372              | 5.3  |
|              | 5-10                  | 17          | 16.5               | 3,120              | 1.8  |
|              | 10-15                 | 9           | 8.7                | 478                | 0.3  |
|              | 15-20                 | 12          | 11.7               | 1,872              | 1.1  |
|              |                       | 103         |                    |                    |      |

<sup>a</sup>All respondents' acres.



return from use of a consultant (Table 37), 20 percent reported an economic return of \$10.00-20.00/acre. The data from both states were fairly similar. Economic returns of \$10.00/acre or more were reported primarily in MN 3, MN 4 and ND 5 (Table 38).

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**Table 38. Economic return from use of a crop consultant in 1990 for respondents in each Northarvest district in Minnesota and North Dakota.**

| State                           | Northarvest District | Number of Respondents*<br>(Used Consultant) | Economic Gain |         |          |         |         |
|---------------------------------|----------------------|---|---------------|---------|----------|---------|---------|
|                                 |                      |   | 0             | \$0-5/A | \$5-10/A | \$10-15 | \$15-20 |
| ----- % of district acres ----- |                      |   |               |         |          |         |         |
| MN                              | MN1                  | 13  | 1.4           | 18.2    | 1.2      | 0.2     | 0.3     |
|                                 | MN2                  | 3   | 86.0          | 8.0     | 0        | 0       | 0       |
|                                 | MN3                  | 14  | 1.7           | 2.9     | 1.1      | 2.3     | 3.3     |
|                                 | MN4                  | 7   | 1.2           | 23.2    | 0        | 2.9     | 0       |
|                                 | MN5                  | 2   | 10.2          | 5.1     | 0        | 0       | 0       |
| ND                              | ND1                  | 25  | 2.3           | 3.6     | 3.7      | 0       | 0.5     |
|                                 | ND2                  | 9   | 0             | 3.7     | 1.0      | 0       | 0       |
|                                 | ND3                  | 4   | 0             | 0       | 0        | 0       | 0       |
|                                 | ND4                  | 13  | 2.9           | 1.5     | 3.3      | 0.4     | 0       |
|                                 | ND5                  | 16  | 2.1           | 8.4     | 1.1      | 0       | 5.0     |

\*Number in district responding that they had used a crop consultant.





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