SURVEY OF WEED CONTROL AND PRODUCTION PRACTICES ON SUGARBEET IN MINNESOTA AND EASTERN NORTH DAKOTA IN 2016

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The forty-eighth annual weed control and production practices questionnaire was conducted electronically in 2016. The survey was linked to the websites of American Crystal Sugar Company, Minn-Dak Farmers Cooperative, and Southern Minnesota Beet Sugar Cooperative (SMBSC) from November to early December, 2016. Growers were asked to evaluate weed control and sugarbeet injury from specific herbicides, and to list the most important weed and production problems related to sugarbeet grown in 2016. In addition, growers were asked to indicate insecticide use, fungicide use, sugarbeet acreage, acres of hand-weeded sugarbeet, pesticide application methods, cost of hand weeding sugarbeet, and other questions relating to their 2016 sugarbeet crop. Insecticide use and fungicide use portions of the survey can be found in the Entomology and Plant Pathology sections of this book.

Sugarbeet growers planted 637,173 acres of sugarbeet in the Minnesota and eastern North Dakota in 2016. Ninety-two growers responded to the survey, representing 58,354 acres or 9% of the total acres planted. All of the acres reported were Roundup Ready® (RR) sugarbeet. This compared to 100% of reported acres being RR in 2015, 99% in 2014, 99% in 2013, 97% in 2012, 82% in 2011, 93% in 2010, 88% in 2009, and 49% in 2008. 2016 marked the fifth year the survey was conducted exclusively online.

A summary of herbicide use, weed control, and crop injury averaged across all counties is presented in Table 1. The number of responses for an herbicide treatment is listed and the acres treated are expressed as a percentage of the total acreage reported. Multiple herbicide treatments are tabulated for each grower; therefore, the number of responses for herbicide treatments exceeds the total number of survey respondents. Also, multiple herbicide treatments on the same acreage are listed separately in the tables; thus, acres treated exceeds 100%. Weed control and sugarbeet injury are presented as the percentage of growers evaluating weed control or sugarbeet injury according to the categories listed.

The herbicide trade names listed in the tables are original trade names. The original trade names also include the generic formulations of the same active ingredient. Thus, Nortron also includes Ethofumesate SC, Ethofumesate 4SC, and Ethotron; Betamix also includes Phen-Des 8+8 and Sugarbeet Mix; Stinger also includes Clopyr Ag, Garrison, and Spur; Dual Magnum applied early postemergence (POST) to sugarbeet (lay-by) also inlcudes Brawl, Cinch, and Charger Basic; Outlook also includes Commit, Establish, Propel, and Slider; and 'Grass Herbicide' includes Assure II, Select, Select Max, Arrow, Clethodim 2EC, Section Three, Intensity, Intensity One, Prism, Section, Shadow, Trigger, Volunteer, and Targa.

Total sugarbeet acreage treated with herbicides in 2016 was 259% (Table 1) compared to 260% in 2015, 236% in 2014, 232% in 2013, 208% in 2012, 287% in 2011, 256% in 2010, 230% in 2009, 308% in 2008, and 383% in 2007. The acres treated do not include "other weed control methods" which were non-herbicidal methods.

Nortron, Dual Magnum, and tank-mixes of Nortron+Dual Magnum were the pre-plant incorporated (PPI) and pre-emerge (PRE) soil-applied herbicides reported by respondents in 2016. PPI or PRE soil-applied herbicide use for all sugarbeet acreage was 8% in 2016 (Table 1), 18% in 2015, 4% in 2014, 3% in 2013, 2% in 2012, 6% in 2011, 2% in 2010, 5% in 2009, and 20% in 2008, 25% in 2007.

Early-POST (lay-by) soil-applied herbicides Outlook, Warrant, Nortron, and Dual Magnum were applied to 45% of reported acres in 2016 (Table 1) compared to 42% in 2015 and 15% in 2014. The increase in lay-by application from 2014 to 2016 is likely due to the increasing presence of glyphosate resistant waterhemp. Most lay-by applications were made as tank-mixes with glyphosate and/or other herbicides. Dual Magnum was the most common lay-by product being applied to nearly 22% of reported acres in 2016. Nortron, Outlook, and Warrant were applied to 13%, 13%, and 5% of reported acres, respectively, in 2016.

Postemergence (POST) herbicide use averaged across all sugarbeet was 206% in 2016 (Table 1) compared to 201% in 2015, 232% in 2014, 221% in 2013, 201% in 2012, 276% in 2011, 253% in 2010, 224% in 2009, 279% in 2008, and 340% in 2007.

The most common herbicide treatment reported by all respondents since 2009 has been glyphosate applied POST. Glyphosate, alone and when combined across all tank-mix combinations, was applied to 221% of all sugarbeet acreage reported in 2016 (Table 1), compared to 242% in 2015, 227% in 2014, 215% in 2013, 192 % in 2012, 198% in 2011, 224% in 2010, 190% in 2009, and 105% in 2008. Glyphosate plus Stinger (33% of acres) and glyphosate plus Nortron (11% of acres) were the most frequently reported herbicide tank-mix combinations by respondents planting sugarbeet in 2016 (Table 1). Stinger may be added to glyphosate to help control weeds such as common ragweed or volunteer RR soybean, while Nortron may be added as a synergist with glyphosate or lay-by to control small seeded broadleaf weeds like waterhemp.

The average cumulative rate of glyphosate applied POST per acre in RR sugarbeet in 2016 was 2.52 pounds acid equivalent per acre (lb ae/A), compared to 2.59 in 2015, 2.19 in 2014, 2.11 in 2013, 2.32 in 2012, 2.21 in 2011, 2.09 in 2010, 1.85 in 2009 and 1.95 lb ae/A in 2008. Since 2012, the average total rate of glyphosate applied per acre has been calculated using actual product names and use rates provided by the respondents who grew RR sugarbeet (data available upon request). In 2008 through 2011 the average total rate of glyphosate applied per acre was calculated by multiplying a glyphosate rate listed in Table 1 by the total percentage (in decimal form) of acres treated for that particular glyphosate rate listed in Table 1 and by the total acres reported in Table 1. The procedure was repeated for each glyphosate rate listed, the results were added, and then divided by the total RR sugarbeet acreage reported by all growers. Growers averaged 2.38 glyphosate applications per acre. The average glyphosate rate per acre per application in 2016 was 1.06 lb ae/A compared to 0.99 in 2015, 0.97 in 2014, 0.91 lb ae/A in 2013 (Table 2).

The use of postemergence grass herbicides alone or in combination was 18% of all sugarbeet acres in 2016 (Table 1) as compared to 11% in 2015, 24% in 2014, 23% in 2013, 30% in 2012, 56% in 2011, 32% in 2010, 29% in 2009, 104% in 2008, and 189% in 2007. The rapid decline in postemergence grass herbicide usage after 2007 is due to the rapid adoption of RR sugarbeet and the use of glyphosate to control grass weeds. In RR sugarbeet, grass herbicides are most commonly used to control volunteer RR corn.

The RR sugarbeet system continues to provide the most effective POST weed control reported by growers in the history of this survey. Forty-eight percent of respondents (Table 1) reported excellent POST weed control. Of those growers who reported weed control from glyphosate applied alone, 60% reported excellent weed control in 2016 compared to 60% in 2015, 63% in 2014, 75% in 2013, 77% in 2012, 80% in 2011, 81% in 2010, 87% in 2009, and 92% in 2008. This declining trend of excellent weed control by respondents with RR sugarbeet should be noted as it is likely an indicator of increasing levels of glyphosate-resistant weeds.

Sugarbeet acreage operated by survey respondents in 2016 varied from less than 50 acres to greater than 2,000 acres (Table 3) with the average being 634 acres. The most common range in acres of sugarbeet was 400 to 599 acres with 21% of the respondents. Fifteen percent of respondents reported producing 1,000 or more acres of sugarbeet in 2016.

Waterhemp was reported most frequently as the “worst weed” problem by 33% of respondents planting RR sugarbeet in 2016 (Tables 4 & 5) as compared to 46% in 2015 and 37% in 2014. Each year from 2008 to 2013, ‘none’ had been chosen most often as “worst weed” by RR sugarbeet growers. With waterhemp now being chosen more often than ‘none’ as “worst weed”, along with a declining trend in satisfaction from glyphosate applied alone, growers should closely monitor their farms for waterhemp escapes and create management strategies that do not rely upon glyphosate alone. Ragweed (27%), ‘None’ (13%), and common lambsquarters (9%) were the next most reported “worst weed” problems by survey respondents in 2016 (Table 5). Wild oat and biennial wormweed were write-in responses on the survey.

Cercospora Leaf Spot (CLS) was selected most often as the “most serious production problem” by survey respondents with 45% of respondents (Table 6) ending the previous six year period dominated by Rhizoctonia/Aphanomyces. From 1999 to 2008, weeds were the primary problem for respondents, but in 2016 only 2% of respondents selected weeds as their most serious production problem. Fourteen percent of respondents reported weeds as the “most serious production problem” in 2015. The 12% reduction from 2015 to 2016 may indicate adopted weed management strategies utilizing soil-applied herbicides are proving effective at controlling troublesome weeds. This reduction in

emphasis on weeds since 2008 is primarily due to the adoption of RR sugarbeet. Twenty-four percent of respondents wrote-in "emergence/stand" related issues as their worst production problem (Table 7).

Averaged across all counties, respondents reported hand-weeding on 4% of sugarbeet acres (Table 8) in 2016. Survey respondents from Renville, Richland, Chippewa, and Cass counties each reported greater than 9% hand-weeded acreage in 2016. One hundred percent, 100%, 100%, and 75% of Renville, Richland, Chippewa, and Cass county respondents, respectively, also reported waterhemp as their "worst weed." Waterhemp may likely be the cause for above average reports of hand-weeding in these counties.

The cost of hand weeding ranged from zero to $35/A in 2016 (Table 8). When averaged across growers who reported hand-weeded acres, the average cost of hand weeding in 2016 was $14.85/A compared to $15.04 in 2015, $17.11/A in 2014, $10.03 in 2013, $21.76 in 2012, $20.90/A in 2011, $29.06/A in 2010, $27.58/A in 2009, $27.41/A in 2008, and $29.40/A in 2007.

Seven percent of RR sugarbeet acreage was reportedly row crop cultivated in 2016 (Table 9) compared to 19% in 2015, 19% in 2014, 12% in 2013, 14% in 2012, 10% in 2011, 11% in 2010, 28% in 2009, and 32% in 2008. RR sugarbeet has reduced row crop cultivation for weed control. Twleve percent reduction in row crop cultivation from the 2015 to 2016 survey may indicate adopted weed management strategies utilizing soil-applied herbicides are proving effective at controlling troublesome weeds.

The percentage of respondents compared to the percentage of acres reported were very similar among factory districts (Table 10). Drayton growers represented 15% of all respondents and 13% of reported acres, East Grand Forks 15% and 16%, Crookston 20% and 16%, Hillsboro 9% and 13%, Moorhead 11% and 12%, Minn-Dak 20% and 21%, and SMBSC 10% and 9%, respectively.

Respondents indicated seeding cover crops in 40% of sugarbeet acres in 2016 compared to 49% in 2015 (Table 11). Barley was the most commonly reported cover crop specie on 25% of reported acres. Respondents from Norman and Richland counties reported 86% and 84%, respectively, of sugarbeet acres seeded with cover crop in 2016.

Wheat was the most common crop to precede sugarbeet in 2016 on 71% of reported acres as compared to 50% in 2015 (Table 12). Corn preceded sugarbeet on 18% of acres reported and soybean on 7% of reported acres.

Thirty-eight percent of respondents considered the NDAWN website and the Cercospora, Rhizoctonia, and Root Maggot models as their most used resource in 2016 (Table 13) as compared to 28% in 2015. Thirty-four percent of respondents considered a NDSU/U of MN extension publication their most used resource in 2016 as compared to 23% in 2015. Twenty-five percent of respondents utilize the NDSU Crop and Pest Report, the Univ of Minnesota Crop Management Report, and root fly maggot counts as their most used resource in 2016 as compared to 9% in 2015. Three percent of respondents indicated relying mainly on trials, agronomists, consultants, or all of the above as their most used resources in 2016 as compared to 13% in 2015. The majority of respondents selected more than one resource on the survey.

Nine percent of respondents indicated they plan to use a soil-applied (PPI or PRE) herbicide in the spring of 2017 (Table 14). Sixty-five percent do not plan to use a PPI or PRE in 2017 and 26% are undecided. When asked if they planned to use a lay-by herbicide in 2017, 36% said yes, 39% said no, 25% said maybe.

Fifty-eight percent of respondents applied elemental nitrogen at rates between 110 and 140 pounds per acre (Table 15) while 29% applied less than 110 and 13% applied greater than 140. Most growers follow the North Dakota State University nitrogen recommendation of 130 pounds N per acre. Growers in SMBSC and Minn-Dak factory districts applied lower rates as a result of nitrogen credits from soybean that preceded sugarbeet. Forty-nine percent of respondents seeded sugarbeet at a rate between 58,000 and 62,000 seeds per acre (Table 15) while 23% seeded at rates below 58,000 and 28% seeded at rates above 62,000. A majority of the respondents follow seed rate recommendations.

Glyphosate herbicide tolerance is engineered into multiple crops in the crop sequence including corn, alfalfa, soybean, and canola in this region. Troublesome weeds are easier to control without the use of glyphosate in other rotational crops. Reserving the glyphosate trait for sugarbeet is important to protect the longevity of the trait in sugarbeet. Sugarbeet growers used glyphosate in one or more RR crops within the crop sequence. Fifty-five percent of

respondents used glyphosate in their RR soybeans, 38% used glyphosate in their RR corn, and 2% used glyphosate in their RR alfalfa. No respondents reported RR canola and 7% of respondents do not use any other RR crops in the rotation.

Table 1. Summary of weed control methods used in sugarbeet reported in 2016. 92 growers reported on 58,354 acres.

Treatment	No. of Responses	Acres Treated	Acres Treated % of Total	% of Responses Reporting Weed Control					% of Responses Reporting Crop Injury				
				NR*	Exc	Gd	Fr	Pr	NR	None	Slt	Mod	Sev
A. PPI AND PRE HERBICIDES													
Dual Magnum PPI	1	320	0.5	-	-	-	-	100	-	-	-	100	-
Dual Magnum PRE	4	2,230	3.8	-	75	25	-	-	-	100	-	-	-
Nortron PRE	2	710	1.2	-	-	100	-	-	-	50	50	-	-
Dual Magnum + Nortron PRE	2	1,600	2.7	-	50	50	-	-	-	50	50	-	-
Total-PPI & PRE	**9**	**4,860**	**8.3**	**-**	**44**	**44**	**0**	**12**	**0**	**67**	**22**	**11**	**0**
B. LAY-BY HERBICIDES													
Dual Magnum	12	5,273	9.0	-	33	25	33	9	-	67	25	8	-
Dual + Nortron	2	1,973	3.4	-	-	100	-	-	-	100	-	-	-
Dual + Nortron + Glyp	7	3,135	5.4	-	43	57	-	-	-	86	14	-	-
Dual + Nortron + Glyp + Grass**	1	336	0.6	-	-	100	-	-	-	-	100	-	-
Dual + Outlook + Glyp	4	2,262	3.9	-	50	50	-	-	-	100	-	-	-
Nortron + Glyp	2	836	1.4	-	50	50	-	-	-	100	-	-	-
Nortron + Warrant + Glyp	1	1,300	2.2	-	-	100	-	-	-	100	-	-	-
Outlook	12	3,525	6.0	-	17	83	-	-	-	83	17	-	-
Outlook + Glyp	2	1,580	2.7	-	50	50	-	-	-	50	50	-	-
Warrant	1	1,360	2.3	-	-	100	-	-	-	100	-	-	-
Other	3	3,040	5.2	-	67	33	-	-	-	67	33	-	-
Other + Glyp	3	1,500	2.6	-	-	100	-	-	-	100	-	-	-
Total-Lay-By	**50**	**26,120**	**44.8**	**0**	**31**	**60**	**7**	**2**	**0**	**81**	**17**	**2**	**0**
C. POST HERBICIDES													
Glyphosate	115	70,247	120.4	2	60	37	<1	-	-	94	6	-	-
Betamix	2	400	0.7	-	-	-	100	-	-	-	100	-	-
Stinger	2	285	0.5	-	50	50	-	-	-	50	50	-	-
UpBeet	2	1,390	2.4	-	-	-	50	50	-	100	-	-	-
Glyp + Betamix	1	791	1.4	-	100	-	-	-	-	100	-	-	-
Glyp + Grass**	6	3,688	6.3	-	33	67	-	-	-	100	-	-	-
Glyp + Nortron	9	6,159	10.6	-	78	22	-	-	-	89	11	-	-
Glyp + Stinger	26	19,432	33.3	-	58	42	-	-	-	85	15	-	-
Glyp + UpBeet	2	1,390	2.4	-	50	50	-	-	-	100	-	-	-
Glyp + Other	3	3,358	5.8	-	67	33	-	-	-	-	100	-	-
Betamix + Nortron	1	80	0.1	-	-	-	100	-	-	-	100	-	-
Glyp + Betamix + Grass**	1	300	0.5	-	-	100	-	-	-	-	100	-	-
Glyp + Betamix + Nortron	1	902	1.5	-	100	-	-	-	-	-	100	-	-
Glyp + Betamix + Stinger	1	273	0.5	-	-	100	-	-	-	100	-	-	-
Glyp + Nortron + Grass**	2	1,758	3.0	-	-	100	-	-	-	100	-	-	-
Glyp + Nortron + Stinger	6	4,686	8.0	-	-	83	17	-	-	67	33	-	-
Glyp + Stinger + Grass**	2	1,973	3.4	-	-	100	-	-	-	50	50	-	-
Glyp + Stinger + UpBeet	1	160	0.3	-	-	100	-	-	-	-	100	-	-
Glyp + Betamix + Stinger + UpBeet	2	595	1.0	-	50	50	-	-	-	-	50	50	-
Glyp + Nortron + Stinger + Grass**	3	1,967	3.4	-	-	100	-	-	-	75	25	-	-
Glyp + Beta + Sting + UpBeet + Grass**	1	415	0.7	-	-	100	-	-	-	-	100	-	-
Total-Post	**189**	**120,249**	**206.1**	**1**	**54**	**43**	**2**	**<1**	**0**	**86**	**14**	**<1**	**0**
D. OTHER WEED CONTROL METHODS													
Row Cultivation	16	4,325	7.4	-	1	80	18	1	100	-	-	-	-
Hand-Weeding	16	2,451	4.2	-	56	38	6	-	100	-	-	-	-
Total-Other Methods	**32**	**6,776**	**11.6**	**0**	**21**	**65**	**14**	**<1**	**100**	**0**	**0**	**0**	**0**
TOTAL ALL TREATMENTS	**280**	**158,005**	**270.8**	**<1**	**48**	**47**	**3**	**2**	**4**	**81**	**18**	**1**	**0**

*NR=No Response;Exc=Excellent;Gd=Good;Fr=Fair;Pr=Poor;Slt=Slight;Mod=Moderate;Sev=Severe
**Grass=Grass Herbicide

Table 2. Reported glyphosate use rate per application in sugarbeet by county in 2016.

County	Applications Reported	lb ae/A <0.7	0.7 to 0.84	0.85 to1.0	>1.0
		----------% of applications----------			
Cass	5	-	20	60	20
Chippewa[1]	11	-	18	46	36
Clay[2]	11	9	-	56	35
Grand Forks[3]	27	-	22	30	48
Kittson	5	-	-	60	40
Marshall	14	-	-	21	79
Norman	7	-	14	57	29
Pembina	9	-	22	22	56
Polk[4]	48	-	8	38	54
Renville	9	-	22	11	67
Richland	10	-	30	50	20
Traverse[5]	14	-	29	14	57
Walsh	2	-	50	-	50
Wilkin	14	-	14	21	65
Total	186	<1	15	34	50

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties

Table 3. Total sugarbeet acreage operated by survey respondents in 2016.

County	Respondents	Acres of sugarbeet <50	50-99	100-199	200-299	300-399	400-599	600-799	800-999	1000-1499	1500-1999	2000+
		----------% of respondents----------										
Cass	4	-	-	-	25	-	-	25	50	-	-	-
Chippewa[1]	4	-	-	-	25	25	-	-	-	50	-	-
Clay[2]	7	-	-	-	13	-	29	29	-	29	-	-
Grand Forks[3]	14	7	7	7	-	14	14	22	7	22	-	-
Kittson	3	-	-	-	33	33	-	-	33	-	-	-
Marshall	5	-	20	-	20	-	20	20	-	20	-	-
Norman	3	-	-	-	33	-	33	-	-	-	-	33
Pembina	5	-	-	20	-	20	20	20	20	-	-	-
Polk[4]	23	-	4	4	18	4	27	31	4	-	8	-
Renville	4	-	-	-	25	50	-	-	-	25	-	-
Richland	4	-	-	-	-	50	25	-	-	25	-	-
Traverse[5]	6	-	-	-	17	-	17	-	17	50	-	-
Walsh	4	-	-	-	50	-	-	-	50	-	-	-
Wilkin	7	-	-	-	-	29	43	14	14	-	-	-
Total	92	1	3	3	15	13	21	18	11	12	2	1

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties

Table 4. A summary of the worst weed problem responses in RR sugarbeet for the past 9 years.

Year	Response	None	COCB[1]	KOCZ	COLQ	FXTL	PIWE	RAWE	SMWE	VELF	WIBW	WIOA	WAHE	RR Crops	Other
		----------% of responses----------													
2008	57	54	-	7	7	-	16	-	-	-	5	4	2	5	-
2009	178	39	2	3	30	-	12	2	1	1	2	2	3	2	-
2010	246	30	2	4	23	1	17	2	2	1	5	2	5	2	-
2011	205	29	1	4	16	2	20	7	1	-	3	2	11	3	-
2012	109	28	-	4	19	1	20	6	-	1	-	-	13	3	-
2013	180	36	<1	2	18	1	16	4	<1	-	2	2	13	3	-
2014	187	26	1	1	10	-	7	9	1	-	2	1	37	4	3
2015	90	10	-	6	10	1	2	16	1	-	1	1	46	4	2
2016	92	13	-	5	9	-	5	27	-	-	2	2	33	1	1

[1]COCB=common cocklebur; KOCZ=kochia; COLQ=common lambsquarters; FXTL=foxtail species; PIWE=pigweed species; RAWE=ragweed, common or giant; SMWE=smartweed; VELF=velvetleaf; WIBW=wild buckwheat; WIOA=wild oat; WAHE=waterhemp; RR Crops=Roundup Ready crops.

Table 5. A summary of the worst weed problem responses in RR sugarbeet by county in 2016.

County	Responses	None	KOCZ[6]	COLQ	PIWE	GIRA	CORA	WIBW	RR Can	WAHE	Other[7]
		% of responses									
Cass	4	-	-	-	-	-	25	-	-	75	-
Chippewa[1]	4	-	-	-	-	-	-	-	-	100	-
Clay[2]	7	-	14	14	-	-	14	-	14	44	-
Grand Forks[3]	14	21	14	36	-	-	29	-	-	-	-
Kittson	3	-	33	-	-	-	33	-	-	-	33
Marshall	5	40	-	-	-	20	20	-	-	20	-
Norman	3	-	-	-	-	-	66	-	-	33	-
Pembina	5	20	-	40	20	-	-	-	-	-	20
Polk[4]	23	23	4	-	13	4	40	8	-	4	4
Renville	4	-	-	-	-	-	-	-	-	100	-
Richland	4	-	-	-	-	-	-	-	-	100	-
Traverse[5]	6	-	-	-	-	-	50	-	-	50	-
Walsh	4	25	-	-	25	-	-	-	-	-	50
Wilkin	7	-	-	14	-	-	14	-	-	72	-
Total	92	13	5	9	5	2	25	2	1	33	5

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties
[6]KOCZ=kochia; RR Soy=Roundup Ready soybean; COLQ=common lambsquarters; PIWE=pigweed species other than waterhemp; GIRA=giant ragweed; CORA= common ragweed; WIBW=wild buckwheat; RR can=Roundup Ready canola; WAHE=waterhemp.
[7]Other=wild oat; biennial wormweed.

Table 6. A summary of the most serious production problem responses for the past 26 years.

	Production problem indicated as worst in sugarbeet									
Year	No Problem	Weeds	Weather	Emergence/ Stand	Labor mgmt.	Root maggot	Cercospora leaf spot	Rhizoctonia/ Aphanomyces	Rhizomania	Herbicide Injury
	% of responses									
1991	3	26	4	18	1	26	7	8	-	-
1992	11	45	9	15	5	9	1	3	-	-
1993	3	40	21	16	4	1	2	12	-	-
1994	3	56	12	13	4	1	3	8	-	-
1995	2	51	6	2	3	<1	24	11	-	-
1996	6	53	12	11	6	2	3	6	-	-
1997	15	34	13	12	3	1	5	14	2	-
1998	3	25	9	4	1	1	36	17	3	-
1999	14	39	14	12	2	1	6	9	2	-
2000	8	48	9	10	1	<1	3	18	2	-
2001	6	52	13	5	2	1	1	16	3	-
2002	4	53	11	19	1	<1	<1	9	3	-
2003	7	61	9	4	1	<1	1	11	2	4
2004	6	47	10	21	2	1	-	8	1	1
2005	3	36	22	3	3	-	-	22	11	-
2006	9	57	5	9	1	-	<1	13	3	1
2007	4	46	7	18	<1	<1	<1	18	2	1
2008	12	30	4	21	3	-	<1	24	2	1
2009	14	7	12	21	2	1	1	30	5	1
2010	14	6	8	5	2	1	3	53	5	1
2011	7	5	15	7	<1	1	1	54	3	<1
2012	11	11	7	8	3	-	7	43	1	-
2013	18	5	16	9	8	1	<1	30	1	<1
2014	7	7	31	13	4	2	-	33	1	1
2015	3	14	4	18	-	3	12	45	-	1
2016	2	2	5	24	-	-	45	21	-	-

Table 7. A summary of the most serious production problem responses by county in 2016.

County	Responses	No Prob.	Emerg/ Stand	Aphan- omyces	Rhizoc- tonia	CLS[6]	Root Maggot	Weeds	Herbicide Injury	Weather	Other[7]
		----------% of responses----------									
Cass	4	-	25	-	25	50	-	-	-	-	-
Chippewa[1]	4	-	-	-	-	100	-	-	-	-	-
Clay[2]	7	-	14	-	29	57	-	-	-	-	-
Grand Forks[3]	14	7	43	-	-	43	-	-	-	7	-
Kittson	3	-	-	33	66	-	-	-	-	-	-
Marshall	5	-	40	20	40	-	-	-	-	-	-
Norman	3	-	66	-	-	33	-	-	-	-	-
Pembina	5	-	-	-	40	-	-	20	-	40	-
Polk[4]	23	4	35	4	17	27	-	-	-	9	4
Renville	4	-	-	-	25	75	-	-	-	-	-
Richland	4	-	-	-	-	75	-	25	-	-	-
Traverse[5]	6	-	-	-	-	100	-	-	-	-	-
Walsh	4	-	25	50	25	-	-	-	-	-	-
Wilkin	7	-	14	-	-	86	-	-	-	-	-
Total	92	2	24	5	16	45	-	2	-	5	1

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties
[6]CLS=Cercospora leaf spot
[7]Other=Frost.

Table 8. Hand-weeded acres and cost of hand-weeding in sugarbeet by county in 2016.

County	RR acres planted	Hand-weeded	Responses	Dollars per acre: 0	1-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
		% of acres planted		----------% of respondents----------									
Cass	2,489	10	2	50	50	-	-	-	-	-	-	-	-
Chippewa[1]	3,296	9	1	-	-	-	-	-	-	100	-	-	-
Clay[2]	4,773	4	3	33	33	-	-	33	-	-	-	-	-
Grand Forks[3]	8,605	<1	3	-	-	-	100	-	-	-	-	-	-
Kittson	1,545	0	0	-	-	-	-	-	-	-	-	-	-
Marshall	2,648	0	0	-	-	-	-	-	-	-	-	-	-
Norman	3,290	0	0	-	-	-	-	-	-	-	-	-	-
Pembina	2,428	0	0	-	-	-	-	-	-	-	-	-	-
Polk[4]	13,364	0	0	-	-	-	-	-	-	-	-	-	-
Renville	1,820	58	2	-	50	50	-	-	-	-	-	-	-
Richland	2,564	9	2	-	-	-	-	50	-	50	-	-	-
Traverse[5]	5,665	2	1	-	-	-	-	100	-	-	-	-	-
Walsh	1,999	0	0	-	-	-	-	-	-	-	-	-	-
Wilkin	3,868	6	2	50	-	-	-	-	50	-	-	-	-
Total	58,354	4	16	19	19	6	19	19	6	12	0	0	0

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties

Table 9. Percent of sugarbeet acres planted that were cultivated to control weeds by county in 2016.

County	Responses	Acres Planted	Acres Cultivated	Acres Cultivated	Weed Control				
					NR*	Exc.	Good	Fair	Poor
				% of planted acres					
Cass	4	2,489	0	-	-	-	-	-	-
Chippewa[1]	4	3,296	2,025	61	-	-	61	-	-
Clay[2]	7	4,773	0	-	-	-	-	-	-
Grand Forks[3]	14	8,605	0	-	-	-	-	-	-
Kittson	3	1,545	260	17	-	-	17	-	-
Marshall	5	2,648	0	-	-	-	-	-	-
Norman	3	3,290	0	-	-	-	-	-	-
Pembina	5	2,428	0	-	-	-	-	-	-
Polk[4]	23	13,364	460	3	-	-	2	<1	<1
Renville	4	1,820	1,180	65	-	-	31	34	-
Richland	4	2,564	310	12	-	-	10	2	-
Traverse[5]	6	5,665	40	<1	-	-	<1	-	-
Walsh	4	1,999	50	3	-	3	-	-	-
Wilkin	7	3,868	0	-	-	-	-	-	-
Total	92	58,354	4,325	7	-	<1	6	1	<1

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties

Table 10. Breakdown of survey respondents and acres by factory district and county in 2016.

County	No. of Resp.	No. of Acres	Factory District													
			Drayton		E. Grand Forks		Crookston		Hillsboro		Moorhead		Minn-Dak		SMBSC	
			% of respondents / % of acres													
Cass	4	2,489	-	-	-	-	-	-	-	-	100	100	-	-	-	-
Chippewa[1]	4	3,296	-	-	-	-	-	-	-	-	-	-	-	-	100	100
Clay[2]	7	4,773	-	-	-	-	-	-	-	-	86	91	14	9	-	-
Grand Forks[3]	14	8,605	-	-	50	42	7	5	43	53	-	-	-	-	-	-
Kittson	3	1,545	100	100	-	-	-	-	-	-	-	-	-	-	-	-
Marshall	5	2,648	60	49	40	51	-	-	-	-	-	-	-	-	-	-
Norman	3	3,290	-	-	-	-	-	-	66	87	33	13	-	-	-	-
Pembina	5	2,428	100	100	-	-	-	-	-	-	-	-	-	-	-	-
Polk[4]	23	13,364	-	-	26	34	74	66	-	-	-	-	-	-	-	-
Renville	4	1,820	-	-	-	-	-	-	-	-	-	-	-	-	100	100
Richland	4	2,564	-	-	-	-	-	-	-	-	-	-	100	100	-	-
Traverse[5]	6	5,665	-	-	-	-	-	-	-	-	-	-	83	95	17	5
Walsh	4	1,999	100	100	-	-	-	-	-	-	-	-	-	-	-	-
Wilkin	7	3,868	-	-	-	-	-	-	-	-	-	-	100	100	-	-
Total	92	58,354	15	13	15	16	20	16	9	13	11	12	20	21	10	9

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties

Table 11. Percent of sugarbeet acres seeded with various cover crops by county in 2016.

County	No. of responses	Acres planted	Barley	Oat	Wheat	Rye	Other	None
			% of acres planted					
Cass	4	2,489	-	-	12	10	-	78
Chippewa[1]	4	3,296	-	55	6	-	-	39
Clay[2]	7	4,773	8	-	-	-	-	92
Grand Forks[3]	14	8,605	17	2	-	-	-	81
Kittson	3	1,545	-	-	-	-	-	100
Marshall	5	2,648	11	38	-	-	-	51
Norman	3	3,290	86	-	-	-	-	14
Pembina	5	2,428	30	-	-	-	-	70
Polk[4]	23	13,364	22	<1	3	2	-	72
Renville	4	1,820	-	41	59	-	-	-
Richland	4	2,564	61	10	13	-	-	16
Traverse[5]	6	5,665	49	5	7	-	-	39
Walsh	4	1,999	-	-	-	-	-	100
Wilkin	7	3,868	33	-	30	-	-	37
Total	92	58,354	25	8	7	<1	-	60

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties

Table 12. Percent of sugarbeet acres seeded in 2016 into various crop residues by county.

County	No. of responses	Sugarbeet Acres planted	Crop Preceding Sugarbeet					
			Corn	Dry Bean	Soybean	Wheat	Fallow	Other[6]
			% of acres planted					
Cass	3	1,265	47	-	-	53	-	-
Chippewa[1]	4	3,226	100	-	-	-	-	-
Clay[2]	6	3,920	56	-	-	44	-	-
Grand Forks[3]	12	6,962	6	-	-	75	-	19
Kittson	2	1,155	-	-	-	100	-	-
Marshall	4	2,383	-	-	-	100	-	-
Norman	3	3,290	-	-	-	100	-	-
Pembina	4	2,077	-	-	-	100	-	-
Polk[4]	22	12,882	-	-	-	98	-	2
Renville	4	1,520	59	-	21	-	-	20
Richland	4	2,104	-	-	64	36	-	-
Traverse[5]	6	5,305	31	-	22	47	-	-
Walsh	1	817	-	-	-	100	-	-
Wilkin	6	3,368	11	-	22	67	-	-
Total	81	51,589	18	0	7	71	0	4

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties
[6]Other=Sweet Corn; Potatoes; Barley.

Table 13. Most used resources for making field decisions by district in 2016.

Factory District	Number of Responses	Sugarbeet Production Guide[1]	Sugarbeet R. & E. Reports[1]	CLS Model[2]	Rhizoc. Model[2]	Root Maggot Model[2]	Root Maggot Fly Counts[3]	NDSU Crop and Pest Report[3]	NDSU Crop Manage. Report[3]	Other[4]
		% of responses								
Drayton	31	16	13	27	16	6	6	13	3	-
Grand Forks	54	12	11	17	17	11	17	7	4	4
Crookston	58	21	22	21	9	3	4	9	9	2
Hillsboro	32	18	16	16	9	9	13	16	3	-
Moorhead	18	6	22	22	16	-	6	22	-	6
Minn-Dak	34	18	21	31	-	-	3	9	12	6
SMBSC	19	32	21	16	5	-	-	-	21	5
Total	246	17	17	22	11	5	8	10	7	3

[1]NDSU/U of MN Extension Publication
[2]NDAWN Website
[3]NDSU Website
[4]Other=coop. trials; coop. agronomist; crop consultant.

Table 14. Percent of respondents in 2016 intending to use PPI/PRE or Lay-By herbicides in 2017 by county.

County	No. of responses	Acres planted	2017 PPI/PRE Use Intentions			2017 Lay-By Use Intentions		
			Yes	Maybe	No	Yes	Maybe	No
			% of respondents					
Cass	4	2,489	25	50	25	100	-	-
Chippewa[1]	4	3,296	50	25	25	75	25	-
Clay[2]	7	4,773	14	14	72	28	72	-
Grand Forks[3]	14	8,605	-	29	71	7	43	50
Kittson	3	1,545	-	-	100	-	-	100
Marshall	5	2,648	-	20	80	-	20	80
Norman	3	3,290	-	67	33	33	67	-
Pembina	5	2,428	-	-	100	-	-	100
Polk[4]	23	13,364	-	17	83	9	30	61
Renville	4	1,820	25	25	50	75	25	-
Richland	4	2,564	-	75	25	100	-	-
Traverse[5]	6	5,665	33	33	33	100	-	-
Walsh	4	1,999	-	-	100	-	-	100
Wilkin	7	3,868	14	43	43	100	-	-
Total	92	58,354	9	26	65	36	25	39

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties

Table 15. Fertilizer and seeding rate per acre by district in 2016.

Factory District	Number of Responses	Pounds elemental nitrogen			Sugarbeet seeds planted		
		<110	110-140	>140	<58,000	58,000-62,000	>62,000
		% of responses					
Drayton	10	10	70	20	30	70	-
Grand Forks	12	17	58	25	17	50	33
Crookston	16	19	69	12	6	75	19
Hillsboro	7	29	71	-	-	57	43
Moorhead	9	33	56	11	11	33	56
Minn-Dak	16	38	50	12	38	19	43
SMBSC	9	67	33	-	56	44	-
Total	79	29	58	13	23	49	28

Table 16. Percent of respondents using glyphosate in other rotational crops by county.

County	No. of responses	Other RR Crops in Rotation				
		Corn	Alfalfa	Soybean	Canola	None
		% of respondents				
Cass	4	25	-	50	-	25
Chippewa[1]	7	43	-	43	-	14
Clay[2]	10	50	-	50	-	-
Grand Forks[3]	19	53	-	42	-	5
Kittson	4	50	-	50	-	-
Marshall	5	20	-	80	-	-
Norman	5	40	-	60	-	-
Pembina	6	33	-	50	-	17
Polk[4]	28	19	4	75	-	4
Renville	7	43	-	57	-	-
Richland	8	38	13	51	-	-
Traverse[5]	10	40	-	50	-	10
Walsh	1	-	-	100	-	-
Wilkin	10	60	-	40	-	-
Total	124	38	2	55	0	5

[1]Includes Kandiyohi and Swift Counties
[2]Includes Becker County
[3]Includes Traill County
[4]Includes Pennington County
[5]Includes Grant and Stevens Counties