TURNING POINT SURVEY OF WEED CONTROL AND PRODUCTION PRACTICES IN SUGARBEET IN MINNESOTA AND EASTERN NORTH DAKOTA IN 2015

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The first annual weed control and production practices live polling questionnaire was conducted using Turning Point Technology at the 2016 Winter Growers' Seminar. Responses are based on production practices from the 2015 growing season. The survey focuses on responses from growers in attendance at the Grand Forks, ND, Wahpeton, ND, and Willmar, MN, Growers' Seminars. Growers represented the county that most of their sugarbeet were produced at each seminar (Tables 1, 2, 3). Survey represents approximately 183,350 acres reported by 272 growers (Table 4).

Growers were polled on production practices including previous crop to sugarbeet, seed lubricants used, and nurse crops seeded with sugarbeet in 2015 (Tables 5, 6, 7). Crops most frequently preceding sugarbeet in the sequence, were wheat (45% of respondents), corn (36% of respondents) and soybean (10% of respondents), averaged across meeting location, (Table 5). However, there was a bias to preceding crop at each meeting. For example, 78% of the respondents indicated 'corn' as the previous crop at the Willmar meeting and 91% of the respondents indicated 'wheat' at the Grand Forks meeting. Previous crop was more evenly distributed between wheat, corn, and soybean at the Wahpeton meeting. The most popular seed lubricant used by respondents, averaged across meeting location, was talc (Table 6). Seventy-two percent of growers attending the winter meetings used a nurse crop. Interestingly, nurse crop species seeded with sugarbeet was dependent on location. Oat (62%) and wheat (26%) were most commonly seeded as nurse crops by growers attending the Willmar meeting; whereas, barley (51%) and wheat (37%) were most commonly used by growers attending the meeting in Wahpeton and growers attending the Grand Forks meeting most commonly used barley (80%) and wheat (13).

Growers indicated rhizoctonia was the "most serious production problem" (Table 8) with 35% of all participants selecting this response. Rhizoctonia was selected as the most important or the second most important production challenge across all meetings. Across meetings, 17% of respondents indicate weeds as the most important production challenge. However, severity of weeds as a production challenge was dependent on meeting location. Weeds were indicated the most important production challenge at the Wahpeton meeting, but was selected as the 5th most important production challenge at the Grand Forks meeting. Cercospora leaf spot (16% or respondents), and stand/emergence (15% of respondents) were also identified as important production challenges in 2015 (Table 8).

Forty-five percent of growers attending seminars reported waterhemp as their worst weed problem, followed by common ragweed (18% of respondents), and common lambsquarters (14% of respondents) (Table 9). The increased presence of glyphosate-resistant waterhemp and common ragweed are likely the reason for these weeds being surveyed as the worst weeds. However, once again, there was a strong geographical bias to these data. Eighty percent and 66% of respondents at the Willmar and Wahpeton meetings, respectively, reported waterhemp as their worst weed. Although, not a single grower at the Grand Forks meeting reported waterhemp. Likewise, common ragweed and lambsquarters were frequently reported at the Grand Forks meeting, but were reported less frequently at the Willmar and Wahpeton meetings.

The 2015 survey of sugarbeet growers weed control and production practices indicated or reinforced two important points about weed control in sugarbeet. First, weed control using soil-applied herbicides increased from 19% (from 2014 survey) to 60% (2015 survey). Increased use of soil-applied herbicides is most likely due to the increased presence of glyphosate-resistant weeds. Second, the 2015 growers survey reinforces that glyphosate continues to be the most commonly used postemergence (POST) herbicide for weed control in the RR sugarbeet system. Growers participating in this survey generally indicated between two and three in-season glyphosate applications, regardless of growing region (Table 10).

University researchers advocate glyphosate applied in mixtures as a resistance management strategy. Thirty-seven

percent of growers indicated they applied glyphosate alone and 61% indicated glyphosate was applied in mixtures, either early post-emergence (lay-by) with a soil applied herbicide, a broadleaf herbicide or a grass herbicide (Table 11). However, there was a very strong spatial bias to responses. For example, growers attending the Grand Forks meeting indicated they applied glyphosate alone 63% of the time, in mixes with a grass or broadleaf herbicide 33% of the time, and with a soil-applied herbicide 1% of the time. Growers attending the Willmar or Wahpeton meeting indicated they applied glyphosate alone 22% and 16% of the time, in mixes with a grass or broadleaf herbicide 28% and 33% of the time, and with a soil applied herbicide 49% and 43% of the time, respectfully. The later practice is for control of waterhemp lay-by in sugarbeet. Likewise, a majority of respondents at the Grand Forks meeting indicated 'excellent' or 'good' weed control satisfaction with glyphosate. At the Willmar and Wahpeton meetings, the majority indicated 'good' or 'poor' weed control with glyphosate (Table 12).

Soil applied herbicide use varied by meeting and was influenced by the presence of waterhemp, presumably glyphosate resistant waterhemp. One hundred nine percent and 124% of the growers responded that they used soil residual herbicides applied PPI or PRE or soil residual herbicides applied early post-emergence (lay-by) at the Wahpeton and Willmar meetings, respectively (Table 13). However, only 14% of the respondents at the Grand Forks meeting used soil residual herbicides. Respondents were equally split between S-metolachlor, ethofumesate or S-metolachlor plus ethofumesate applied PPI or PRE; 82% indicated either excellent or good weed control from these applications (Tables 14 & 15). Outlook at Willmar and S-metolachlor at Wahpeton were the most commonly used lay-by herbicides and 91% of these growers reported either excellent or good weed control from these applications (Tables 16 & 17).

Other weed control methods reported in 2015 included hand and mechanical weeding. Of the growers in attendance, 23% used at least some row-crop cultivation and 23% used at least some hand-weeding while 47% used no other methods for weed control other than herbicide applications (Table 18). Forty-six percent reported row-crop cultivation on less than ten percent of their acres (Table 19). Row-crop cultivation and hand-weeding were reported more frequently in the Willmar meeting than in the Wahpeton or Grand Forks meeting. Fourteen percent and 27% of respondents at the Willmar meeting reported cultivation between 51 and 100% or greater than 100% of acres, respectively. Respondents cultivating once reported only fair or good weed control from cultivation (Table 20, 21).

Respondents indicated hand-weeding on less than ten percent of their acres when hand-weeding was used for weed control (Table 22). Once again, respondents attending the Willmar meeting reported a greater percentage of acres hand-weeded than at the Wahpeton or Grand Forks meetings. The cost of hand-weeding on a per acre basis ranged from less than $10, to $30 per acre with costs being greater from respondents attending the Willmar meeting (Table 23). For growers who utilized hand-weeding, 76% reported 'excellent' or 'good' hand-weeding control (Table 24).

Table 1. Grand Forks, ND, growers' seminar, survey respondents by county in 2016.

	Respondents	Respondents
	(Number)	(% of total)
Grand Forks	16	14
Marshall	18	16
Pennington[1]	1	1
Polk	59	51
Traill	7	6
Walsh	7	6
Other	7	6
Total	115	100

[1]Includes Red Lake County

Table 2. Wahpeton, ND, growers' seminar, survey respondents by county in 2016.

County	Respondents	Respondents
	(Number)	(% of total)
Cass	2	5
Clay	3	7
Grant	9	21
Otter Tail	1	2
Richland	7	16
Stevens	1	2
Traverse	1	2
Wilkin	19	44
Other	0	0
Total	43	100

Table 3. Willmar, MN, growers' seminar, survey respondents by county in 2016.

County	Respondents	Respondents
	(Number)	(% of total)
Chippewa	45	40
Kandiyohi	11	9
Pope	1	1
Redwood	6	5
Renville	37	32
Stearns	1	1
Stevens	5	4
Swift	5	4
Other	5	4
Total	116	100

Table 4. Total sugarbeet acreage operated by survey respondents by growers' seminar location in 2016.

Location		Acres of sugarbeet									
	Respondents	<99	100-199	200-299	300-399	400-599	600-799	800-999	1000-1499	1500-1999	2000+
		----------% of respondents----------									
Grand Forks	113	5	6	5	13	23	20	5	13	5	5
Wahpeton	42	2	-	5	17	21	19	12	14	10	-
Willmar	117	12	12	6	14	21	11	5	13	4	2
Total	272	7	8	6	14	22	15	6	13	6	3

Table 5. Preceding crop to sugarbeet, survey responses by growers' seminar location in 2016.

Location	Respondents	Previous Crop								
		Barley	Canola	Corn	Dry Bean	Potato	Soybean	Wheat	Fallow	Other
		% of respondents								
Grand Forks	113	2	-	1	2	2	2	91	-	-
Wahpeton	43	-	-	19	2	-	28	49	2	-
Willmar	115	-	-	78	2	-	10	-	1	9
Total	271	1	0	36	2	1	10	45	1	4

Table 6. Seed lubricants used by survey respondents by growers' seminar location in 2016.

Location	Respondents	Seed Lubricant Used				
		Graphite	Talc	Fluency Agent	Other	None
		% of respondents				
Grand Forks	114	6	68	1	2	25
Wahpeton	42	10	73	5	5	7
Willmar	114	15	62	-	4	19
Total	270	10	67	1	3	19

Table 7. Nurse crop used sugarbeet survey responses by growers' seminar location in 2016.

Location	Respondents	Nurse Crop Used					
		Barley	Oat	Rye	Wheat	Other	None
		% of respondents					
Grand Forks	120	40	1	2	7	-	50
Wahpeton	43	51	-	-	37	-	12
Willmar	118	1	62	-	26	-	11
Total	281	25	26	1	20	0	28

Table 8. Most serious production problem, survey responses by growers' seminar location in 2016.

Location	Respondents	Production Problem								
		CLS[1]	Rhizomania	Aph[2]	Rhizoctonia	Fusarium	Weeds	Root Maggot	Springtails	Emergence/ Stand
		% of respondents								
Grand Forks	118	4	9	11	41	1	5	3	1	25
Wahpeton	42	19	5	7	29	-	35	-	-	5
Willmar	115	27	10	1	31	-	23	-	-	8
Total	275	16	9	6	35	<1	17	1	<1	15

[1]Cercospora Leaf Spot
[2]Aphanomyces

Table 9. Most serious weed problem, survey responses by growers' seminar location in 2016.

		Most Serious Weed Problem									
Location	Respondents	BIWW[1]	COLA[2]	CORA[3]	Foxtail spp.	Kochia	Mallow[4]	RRPI[5]	Smartweed[6]	RR Crop[7]	WAHE[8]
		----------% of respondents----------									
Grand Forks	115	1	25	33	1	11	3	13	1	12	-
Wahpeton	41	-	3	15	-	2	-	10	-	5	66
Willmar	114	-	8	4	-	-	-	1	4	3	80
Total	270	<1	14	18	<1	5	1	7	2	7	45

[1]Biennial Wormwood
[2]Common Lambsquarters
[3]Common Ragweed
[4]Mallow spp.
[5]Redroot Pigweed
[6]Smartweed spp.
[7]Volunteer RR Crops
[8]Waterhemp

Table 10. Total number of glyphosate applications during season, sugarbeet survey responses by growers' seminar location in 2016.

		Total Number of Glyphosate Applications					
Location	Respondents	0	1	2	3	4	5
		----------% of respondents----------					
Grand Forks	117	1	12	66	21	-	-
Wahpeton	45	-	2	53	38	7	-
Willmar	118	2	10	47	38	3	-
Total	280	1	10	56	31	2	0

Table 11. Glyphosate alone or as a component in a weed control systems approach, sugarbeet survey responses by growers' seminar location in 2016.

		Glyphosate Use					
Location	Respondents	Gly Alone	Gly+Lay-by	Gly+Broadleaf	Gly+Grass	Other	None Used
		----------% of respondents----------					
Grand Forks	121	63	1	30	3	2	1
Wahpeton	49	16	43	27	6	2	6
Willmar	146	22	49	16	12	1	-
Total	316	37	30	23	8	1	1

Table 12. Weed control from glyphosate, sugarbeet survey responses by growers' seminar location in 2016.

		Glyphosate Alone Weed Control Quality					
Location	Respondents	Excellent	Good	Fair	Poor	Unsure	Not Used Alone
		----------% of respondents----------					
Grand Forks	114	55	39	4	-	-	2
Wahpeton	44	14	54	21	9	-	2
Willmar	115	7	52	27	5	1	8
Total	273	28	47	16	4	<1	4

Table 13. Soil-applied herbicide use, sugarbeet survey responses by growers' seminar location in 2016.

Location	Respondents	PPI, Pre or Early Postemergence		
		Preplant Incorporated or Preemergence	Early Postemergence (lay-by)	Total Soil Applied Herbicides
		----------% respondents----------		
Grand Forks		0	14	14
Wahpeton		52	57	109
Willmar		41	83	124
Total				

Table 14. Preplant incorporated and preemergence herbicide use, sugarbeet survey responses by growers' seminar location in 2016.

Location	Respondents	PPI or PRE Use					
		S-metolachlor	ethofumesate	Ro-Neet SB	S-metolachor +ethofumesate	Other	None
		----------% of respondents----------					
Grand Forks	114	-	-	-	-	4	96
Wahpeton	46	20	15	-	17	2	46
Willmar	120	14	22	2	3	21	38
Total	280	9	12	1	4	11	63

Table 15. Weed control from preplant incorporated and preemergence herbicides, sugarbeet survey responses by growers' seminar location in 2016.

Location	Respondents	PPI or PRE Weed Control					
		Excellent	Good	Fair	Poor	Unsure	None Used
		----------% of respondents----------					
Grand Forks	114	1	1	-	1	1	96
Wahpeton	42	12	24	12	-	-	52
Willmar	113	22	29	4	2	1	42
Total	269	12	16	4	1	1	66

Table 16. Soil-applied herbicides applied early postemergence (lay-by), sugarbeet survey responses by growers' seminar location in 2016.

Location	Respondents	Early Postemergece (lay-by) Use					
		S-metolachlor	Ethofumesate	Outlook	Warrant	Other	None
		----------% of respondents----------					
Grand Forks	114	1	3	7	4	1	84
Wahpeton	46	26	11	15	4	2	42
Willmar	127	4	3	67	9	1	16
Total	287	6	4	35	6	1	48

Table 17. Weed control from soil-applied applied early postemergence (lay-by), sugarbeet survey responses by growers' seminar location in 2016.

Location	Respondents	Lay-by Weed Control					
		Excellent	Good	Fair	Poor	Unsure	None Used
		----------% of respondents----------					
Grand Forks	109	1	2	-	-	2	95
Wahpeton	42	10	41	5	-	-	45
Willmar	117	28	49	5	1	1	16
Total	268	14	28	3	<1	1	53

Table 18. Mechanical weed control methods used, by survey respondents by growers' seminar location in 2016.

Location	Respondents	Mechanical Weed Control Methods				
		Rotary Hoe	Row-Cultivation	Hand-Weeded	Other	None
		----------% of respondents----------				
Grand Forks	127	2	8	12	6	72
Wahpeton	47	9	13	11	2	65
Willmar	149	1	39	37	4	19
Total	323	3	23	23	4	47

Table 19. Percent of acres row-crop cultivated, by survey respondents by growers' seminar location in 2016.

Location	Respondents	% Acres Row-Cultivated				
		0	< 10	10-50	51-100	>100
		----------% of respondents----------				
Grand Forks	116	75	17	3	2	3
Wahpeton	43	77	14	9	-	-
Willmar	116	38	10	11	14	27
Total	275	59	14	7	7	13

Table 20. Number of row-crop cultivation passes, by survey respondents by growers' seminar location in 2016.

Location	Respondents	Number of Row-Cultivation Passes				
		1	2	3	4	No Row-Crop Cultivation
		----------% of respondents----------				
Grand Forks	113	19	-	-	3	78
Wahpeton	42	17	2	-	-	81
Willmar	115	50	6	1	-	43
Total	270	32	3	<1	1	64

Table 21. Weed control from row-crop cultivation, sugarbeet survey responses by growers' seminar location in 2016.

Location	Respondents	Row-Cultivation Weed Control					
		Excellent	Good	Fair	Poor	Unsure	No Row-Cultivation
		----------% of respondents----------					
Grand Forks	110	5	3	5	-	6	81
Wahpeton	41	5	10	7	-	2	76
Willmar	113	3	25	19	4	7	42
Total	264	4	13	11	2	6	64

Table 22. Percent of acres hand-weeded by survey respondents by growers' seminar location in 2016.

Location	Respondents	% Acres Hand-Weeded				
		0	< 10	10-50	51-100	>100
		----------% of respondents----------				
Grand Forks	113	80	16	1	3	-
Wahpeton	43	79	14	5	2	-
Willmar	117	44	31	17	3	5
Total	273	65	22	8	3	2

Table 23. Cost of hand-weeding per acre sugarbeet survey responses by growers' seminar location in 2016.

		Cost of Hand-Weeding per Acre					
Location	Respondents	<$9.99	$10-$19.99	$20-$29.99	$30-$39.99	$40+	No Hand-Weeding
		----------% of respondents----------					
Grand Forks	108	10	5	2	1	-	82
Wahpeton	42	14	7	-	-	2	77
Willmar	115	14	32	10	-	3	41
Total	265	12	17	5	<1	2	63

Table 24. Weed control from hand-weeding sugarbeet survey responses by grower seminar location in 2016.

		Hand-Weeding Weed Control					
Location	Respondents	Excellent	Good	Fair	Poor	Unsure	No Hand-Weeding
		----------% of respondents----------					
Grand Forks	106	12	7	1	-	2	78
Wahpeton	43	5	9	2	-	5	79
Willmar	116	14	33	9	3	-	41
Total	265	12	18	5	2	2	61