EFFECT OF CULTIVATION ON YIELD AND QUALITY OF SUGAR BEETS

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INTRODUCTION:

With the introduction of micro rate herbicide programs and pending introduction of Roundup Ready sugar beet technologies, the need for cultivations is being questioned in the absence of weeds. A three-year study was set up to look at the impact of no cultivation compared to different timing of cultivations on yield and quality of sugar beets.

MATERIALS AND METHODS:

Field experiments were established in 1999, 2000, and 2001 at different locations in the Great Lakes growing region. Three trials were conducted each year. Each trial was arranged in a randomized complete block and replicated three times. In an effort to mimic more closely grower conditions such as speed of cultivation, row length was increased on average to 300 feet. Harvest was conducted using grower equipment on four or six row strips. Yield was determined by utilizing a ten-ton beet cart with scales. All weights are reported as gross weight and include tare. Two quality samples were taken per strip with a total of six per treatment at each location.

In 1999, RH-3 RR, a Rhizoctonia resistant variety was used. In years 2000 and 2001 E-17 RR, a Rhizoctonia susceptible variety, was used. This change in variety was implemented to offer a better opportunity to see the effects cultivation might have on Rhizoctonia incidence.

Four treatments were used in1999; 1) No cultivation, 2) One time early cultivation (4 to 6 leaf stage), 3) One time late cultivation (prior to row closure), 4) Grower special (3 cultivations) timed similar to the grower. Starting in 2000, a fifth (5th) over cultivation treatment was implemented which was the same as the grower special, but on the last cultivation soil was deliberately thrown into the crown of the plants. This treatment was implemented to mimic what some growers are doing and to determine its effect on Rhizoctonia incidence. In all trials Roundup Ultra was applied at the rate of one quart per acre twice. Weed control was considered excellent with virtually no weeds present and no hand labor required. After yield measurements all beets were Roto-Tilled into the soil and destroyed.

RESULTS AND DISCUSSION:

In 1999 growing conditions were very good, with no high impact rains associated with early season plant establishment. No significant difference occurred in any measurement of yield and quality in any of the three trials (Table 1).

In 2000, high impact rains occurred at plant establishment or shortly thereafter. Rains caused tightening of the soil and plant distress particularly at one Huron County location. NO significant differences occurred for RWSA between no cultivation and any of other treatments in all three of the trials. There was a significant difference for RWSA at two locations when comparing the one time early cultivation to the three times over cultivation (soil thrown into crown). In these two trials Rhizoctonia Crown Rot was a factor. More Rhizoctonia tended to be present with a late cultivation and particularly with the over cultivation treatment with soil thrown into the crown. The (no) cultivation treatment was not significantly different when compared to any of the other cultivation treatments. The one-time early cultivation was significantly better in RWSA in two out of the three trials when compared to the three-time over cultivation when high impact early rains occur in combination with significant Rhizoctonia Crown Rot (Table 2).

The 2001 growing season was more of the norm. Good early season growing conditions and no packing rains early and very little Rhizoctonia. However, a mid-season drought did occur in the region. There were no significant differences that occurred in any trial for RWSA when comparing no cultivation to the four other cultivation treatments (Table 3).

Combined over multiple years locations, and environments produced no significant differences in yield and quality of sugar beets when comparing all treatments (Tables 4 - 5). Under conditions involving early season packing rain, a one-time (4-to 6-leaf) stage cultivation may be beneficial in some instances. In fields with significant Rhizoctonia pressure, a late cultivation (row closure) with soil thrown into the crown may reduce RWSA primarily from increased Rhizoctonia Crown Rot (Table 6). Overall, in three years and nine locations, a single or multiple cultivations has not shown any significant yield or quality enhancements when compared to no cultivation when weeds are not a concern.

TABLE 1

AVERAGE OF THREE CULTIVATION TRIALS – 1999

Cooperators: Meylan – Fisher – Uebler

Locations: Bay – Gratiot – Saginaw

Variety: RH3 – Roundup Ready

Replicated: Three Locations – Total of 9 Replications

TREATMENT NAME	RWSA	ACTUAL YIELD T/A	RWST	% SUGAR	CJP %
Late Cultivation 1 X	5645	26.4	213	16.1	90.9
No Cultivation	5614	26.0	216	16.0	91.3
Early Cultivation 1 X	5547	26.2	213	16.0	90.6
Grower Special - 3 Cultivations	5523	25.9	213	16.0	90.7
AVERAGE	5582	26.1	214	16.0	90.9
LSD (5%)	NS	NS	NS	NS	NS

TABLE 2

AVERAGE OF THREE CULTIVATION TRIALS – YEAR 2000

Cooperators: Lutz – Starkey – Grekowicz

Locations: Huron – Tuscola - Huron

TREATMENT NAME	RWSA	ACTUAL YIELD T/A	RWST	% SUGAR	CJP %
1 X – Early Cultivation	5655	23.41	239	17.0	93.7
No Cultivation	5457	22.72	236	16.9	92.7
1X – Late Cultivation	5387	22.66	233	16.7	92.5
Grower Special – 3 Cultivations	5354	22.44	239	17.0	93.0
Over Cultivation	5246	21.91	236	16.8	92.7
Average	5420	22.63	237	16.9	92.8
LSD (5%)	400	1.18	NS	NS	0.9
CV (%)	3.9	2.8	2.2	1.2	0.5

Table 3

AVERAGE OF THREE CULTIVATION TRIALS – YEAR 2001

Cooperators: Fisher – Starkey - Lutz

Locations: Gratiot – Tuscola – Huron

Planting Date: 2001

TREATMENT NAME	RWSA	ACTUAL YIELD T/A	RWST	% SUGAR	CJP %
Over Cultivation	5173	23.02	225	16.4	92.2
Grower Special	5006	22.88	219	16.2	91.8
No Cultivation	4995	22.49	222	16.3	91.7
1 X Early Cultivation	4923	22.06	223	16.3	92.1
1 X Late Cultivation	4911	22.43	219	16.3	91.8
Average	5002	22.58	222	16.3	91.9
LSD (5%)	NS	NS	NS	NS	NS
CV (%)	3.2	2.4	2.7	.9	.4

TABLE 4

AVERAGE OF NINE CULTIVATION TRIALS – 1999 – 2000 – 2001 (3 YEARS)

Locations: Nine Locations

Variety: 1999 – RH3 Roundup Ready; 2000 & 2001 E17 Roundup Ready

Replicated: Total of 27 Replications

TREATMENT NAME	RWSA	ACTUAL YIELD T/A	RWST	% SUGAR	CJP %
1 X Early Cultivation	5375	23.89	225	16.4	92.1
No Cultivation	5355	23.74	224	16.4	91.9
1 X Late Cultivation	5314	23.83	222	16.4	91.7
Grower Special	5292	23.74	223	16.4	91.8
Average	5335	23.80	224	16.4	91.9
LSD (5%)	NS	NS	NS	NS	NS
CV (%)	1.9	1.7	1.0	.7	.4

Table 5

AVERAGE OF SIX CULTIVATION TRIALS – 2000 AND 2001 (2 YEARS)

Location: Six Locations

Variety: E17 Roundup Ready

Replicated: Total of 18 Replications

TREATMENT NAME	RWSA	ACTUAL YIELD T/A	RWST	% SUGAR	CJP %
1 X Early Cultivation	5289	22.74	231	16.7	92.9
No Cultivation	5226	22.60	229	16.6	92.2
Over Cultivation	5210	22.47	231	16.6	92.5
Grower Special	5180	22.66	229	16.6	92.4
1 X Late Cultivation	5149	22.55	226	16.5	92.2
Average	5211	22.60	229	16.6	92.4
LSD (5%)	NS	NS	NS	NS	NS
CV (%)	3.2	2.9	1.0	.7	.3

TABLE 6

EFFECT OF CULTIVATION ON RHIZOCTONIA

CULTIVATION TREATMENT ✱	STARKEY	GREKOWICZ	OBSERVATION MEAN +
	RHIZOCTONIA PLANTS ●		
1 X Early Cultivation	28	58	44
None	64	59	61
3 X Grower Special	104	84	94
3 X Soil in Crown	94	151	123
1 X Late Cultivation	68	179	129

✱ *Denotes number of times.*

\+ *Starkey and Grekowicz trials combined*

● *Total number of dead/dieing plants.*

Sugarbeet Adoancement / Hilleshog, Doug Ruppal - Year 2000