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# EFFECT OF SMALL GRAIN STUBBLE LENGTH ON SUGARBEET PRODUCTION

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## Introduction

Small grain residue incorporated into the surface of the soil profile is beneficial in preventing soil erosion in the Red River Valley of the North located in Minnesota and North Dakota. This residue has been found to cause plugging problem during primary tillage operations and reduce the establishment of adequate sugarbeet plants when left following harvest in long lengths in large amounts. Previous work conducted on the performance of present sugarbeet seeding equipment with increased surface residue has shown a decline in sugarbeet stand establishment With the development of crop residue shredders, evaluation of the benefits of reducing the length of stubble and its effects on sugarbeet establishment and production is need.

## Materials and Methods

Field experiment was initiated on Bearden silty clay loam (Fine-silty, mixed, super active, frigid, Aeric Calciaquoll) on the Kirk Watt farm at Glyndon, MN in August 2001. Treatments were stubble left at harvest length and shredded to three-fourths, half, and one quarter of harvest length prior to primary tillage with a chisel plow. Each experiment was arranged in a randomized complete block design with six replications. Individual residue treatment plots measured 22 feet wide and 35 feet long. Soil nitrogen levels were adjusted with fertilizer to approximately 130 lbs/acre of available residual soil test (0-4 ft) plus added fertilizer N.

Following secondary spring tillage sugarbeet, Beta 6447, was planted on May 15 with a John Deere MaxEmerge 2 planter at 4 and 5 mph ground speed in each residue treatment. Sugarbeet was placed 1.25 inches deep at 3.5 and 5.5-inch in-row spacing at both ground speeds. A 22-inch row spacing was used. Counter was surfaced band applied at 11.9 lbs/a and incorporated with chain at planting. Post emergence herbicides, cultivation and hand labor was used as needed for weed control. Two applications each of Eminent and Super Tin were applied f Cercospora leafspot control.

Sugarbeet population of the 3.5-inch in-row seeding was hand thinned to 150 plants per 100 feet of row at the four-leaf stage.

Sugarbeet were harvested September 26. The middle two rows of each 6 row plot were harvested. Yield determinations were made and quality analysis performed at American Crystal Sugar Quality Tare Lab, East Grand Forks, MN.

## Results and Discussion

Surface residue measurements, taken at seeding time, decreased with decreased length of stubble resulting from the shredding operation (Table 1). This was observation was not expected, as the shredding operation had increased the number of residue pieces. The primary and secondary tillage operations had incorporated these smaller pieces into the soil profile to a larger degree than the longer uncut residue. Soil nitrate nitrogen levels in the surface 12 inches were higher on the shortest stubble treatment on July 30. This was perhaps the result of the quicker release of nitrogen through decomposition from the small grain residue during this part of the growing season because of the increased soil incorporation of the smaller stubble pieces.

Root and recoverable sugar yields decreased with reduction in grain stubble length (Table 2). Increased rate of decomposition of the smaller stubble pieces may have impacted availability of nitrogen during early season growth resulting in significant decreased root production. Harvest sugarbeet populations were similar for all treatments.

This reduction in stubble length had effect on the amount of surface residue measured at planting time, but not on sugarbeet stand establishment. The number of harvested beets was similar between the 5.5-inch and the hand thinned 3.5 inch seeded population of 150 beets per 100 ft of row , as was the root yield and sugar production (Table 3). The effect of imposed tillage treatments can occasionally be lost by hand thinning an overseeded sugarbeet population. Increasing planter ground speed resulted in a non-significant decreasing trend in root yield and sugar production, as well a decrease in harvestable sugarbeet per 100 feet. These one-year results need verification with additional years of data.

**Table 1. Effect of small grain residue height on surface residue percentage after planting and soil nitrate nitrogen levels in soil profile (July 30), Glyndon, MN, 2002.**

| TREATMENT Stubble Height | Surface Residue Percent | Soil Nitrate, ppm 0-6 inch | 6-12 inch | Total |
|---|---|---|---|---|
| One-fourth original | 32 | 9 | 14 | 23 |
| Half original | 42 | 5 | 4 | 9 |
| Three-fourth original | 41 | 5 | 4 | 9 |
| Full | 46 | 5 | 4 | 9 |

**Table 2. Effect of small grain residue height on root yields, sucrose percentage, sucrose loss to molasses, recoverable sugar production, and harvest population (September 26), Glyndon, MN, 2002.**

| TREATMENT Stubble Height | ROOT YIELD Tons/A | SUCROSE Percent | LOSS TO MOLASSES Percent | RECOVERABLE SUGAR Lbs/Acre | REC SUGAR Lbs/T | HARVEST BEETS /100 FT |
|---|---|---|---|---|---|---|
| One-fourth original | 17.7 | 17.15 | 2.20 | 5317 | 298.6 | 140 |
| Half original | 18.1 | 17.11 | 2.13 | 5434 | 299.6 | 138 |
| Three-fourth original | 18.4 | 16.71 | 2.36 | 5309 | 286.9 | 135 |
| Full | 19.1 | 17.03 | 2.14 | 5707 | 297.8 | 141 |
| LSD (.05) | 1.2 | NS | NS | NS | NS | NS |

**Table 3. Effect of plant population and planter ground speed over small grain residue height treatments on root yields, sucrose percentage, sucrose loss to molasses, recoverable sugar production, and harvest population (September 26), Glyndon, MN, 2002.**

| TREATMENT | ROOT YIELD Tons/A | SUCROSE Percent | LOSS TO MOLASSES Percent | RECOVERABLE SUGAR Lbs/Acre | REC SUGAR Lbs/T | HARVEST BEETS /100 FT |
|---|---|---|---|---|---|---|
| Seed spacing | | | | | | |
| 3 inch (thinned) | 18.4 | 17.01 | 2.20 | 5469 | 296.0 | 137 |
| 5.5 inch | 18.3 | 16.99 | 2.21 | 5415 | 295.6 | 139 |
| LSD (.05) | NS | NS | NS | NS | NS | NS |
| Planter Speed | | | | | | |
| 4 mph | 18.5 | 17.09 | 2.20 | 5514 | 297.9 | 143 |
| 5 mph | 18.2 | 16.91 | 2.22 | 5370 | 293.8 | 133 |
| LSD (.05) | NS | NS | NS | NS | NS | NS |