# EFFECT OF ELIMINATING SPRING TILLAGE ON SUGARBEET PRODUCTION AND EMERGENCE IN STALE SEEDBEDS

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## Introduction/Objectives

Stale seedbeds are seedbeds that receive primary tillage in the fall and are planted in the spring without any additional tillage. This is not a common practice in ND and MN for sugarbeet production for several reasons. In wet springs, fields are tilled lightly prior to planting in an effort to dry the soil. Some growers believe that they will not get good stand counts by planting into a stale seedbed because the soil is not fractured enough to provide adequate seed-to-soil contact to ensure germination. Another reason for a spring tillage operation is to kill early weed flushes in the field. However, pre-plant tillage operations can have negative consequences as well. In a dry spring, moisture is lost as a result of spring tillage. Another issue that is a considerable concern in recent years is that hard rains after a spring tillage event can create significant crusting problems on the surface of clay and clay loam, and silt loam soils. Crusting can significantly reduce sugarbeet stand establishment on these soil types. Yet another potential benefit of stale seedbed planting is that soils in fields that were not tilled in spring are less susceptible to wind erosion during wind events. Reduced wind erosion in stale seedbeds was observed during the severe wind event occurring on May 17$^{th}$, 2008 in the northern Red River Valley. An agronomist reporting the damage of this wind storm observed less wind erosion and no need for replanting in sugarbeet crops planted into stale seedbeds.

With the introduction of Roundup Ready sugarbeet, tillage for weed populations prior to planting is not necessary. Some agronomists and growers believe that planting into a stale seedbed may be a good management when Roundup is used to kill early weed flushes, especially on soils prone to crusting. By eliminating unnecessary tillage operations, farmers will save money on fuel and machinery wear, as well. The average cost for spring tillage operations in 2007 was $8.16/a (2007 American Crystal Grower Cost Survey – Red River Valley Averages).

**The objective of this study was to investigate differences in stand establishment and general production potential of sugarbeet planted into stale seedbeds compared to conventional spring-tilled seedbeds.** A research trial was established in 2008 at the Prosper Research Station in North Dakota to investigate the effect of eliminating spring tillage in sugarbeet production systems.

## Materials and Methods

The experiment was established on a Beardon Perella silt loam (coarse-silty, frigid Aeric Calciaquoll) at the Prosper Research Station. The trial was planted on May 05, 2008. Crop rows were oriented in a north-south direction. Individual treatment plots measured 11 feet wide and 30 feet long. Planting was arranged in a randomized complete block design with 6 replications. Soil nitrogen levels were adjusted with fertilizer to approximately 130 lbs/acre of available residual soil test plus added fertilizer N. Soil test levels indicated that no P or K fertilizer was required.

Three treatments were established: 1) sugarbeet planted into a conventionally fall chiseled and spring field cultivated seedbed (check); 2) sugarbeet planted directly into a stale or un-worked seedbed <u>without</u> employing residue managers (row cleaners) on the planter; and 3) sugarbeet planted into the un-worked seedbed <u>with</u> row cleaners installed on the planter.

A non-Roundup Ready Rhizomania resistant variety, Beta 1305R, regular pellet was planted at 4 mph on May 05, 2008 with a John Deere MaxEmerge II planter. Sugarbeet was placed 1.25 inches deep, and was planted to stand at a 5-inch in-row seed spacing. A 22-inch wide row spacing was used. Counter insecticide was surface band applied at 10.9 lbs/A, and incorporated with a drag chain at planting. Stand counts were taken on three dates after germination. Four post emergence micro-rate herbicides, two cultivations, and hand labor was used as needed for weed control. Three fungicide applications, Eminent, Supertin/Topsin and Headline were applied for Cercospora leaf spot control.

Harvest of the two middle rows of each six-row plot, was completed on September 29, 2008. Yield determinations were made and quality analysis performed at the American Crystal Sugar Quality Lab, East Grand Forks, MN.

**Results and Discussion**

Table 1 describes sugarbeet yield and quality parameters measured at harvest in the stale seedbed study. Three data points were removed as outliers from the tonnage data set because their values were statistically lower than other values in the data set. All three outliers came from the west end of the $5^{th}$ or $6^{th}$ replicate, where plots were more compacted and denitrification was more likely to be severe. All other data sets remained intact. There were no significant differences ($P<0.10$) among treatments for any of the sugarbeet yield and quality parameters measured.

Table 2 represents the sugarbeet emergence from three dates during the early and mid season and the final stand count at harvest. From first emergence until mid-July, the difference between treatments was visually obvious. The conventionally tilled treatment plots had lower stand counts and reduced vigor relative to the two stale seedbed treatments. For three weeks immediately following sugarbeet planting there were no significant rainfall events at this location. The most reasonable explanation for reduced seedling emergence and growth in the conventional treatment is that the conventionally tilled seedbeds were too dry to promote imbibition, germination, and emergence in the young sugarbeet seedlings early in the growing season. The stale seedbed treatments, however, had sufficient moisture to allow germination and early season emergence, providing an early-season advantage over the conventionally tilled treatment. Very high precipitation from June through October removed the drought stress in the conventionally tilled treatment and allowed final stand counts to be almost as high in the conventional treatment as in the stale seedbed treatments. The early season advantage in the stale seedbed treatments did not translate to greater sugarbeet yield or quality parameters at harvest. Economically, however, eliminating spring tillage operations resulted in a net economic gain of about $8.16 per acre for the stale seedbed treatments. The use of residue managers on the planter did give an early season advantage in the stale seedbed treatments, probably as a result of removing reside that might intercept light in the crop row or by creating a small degree of soil disturbance that served to remove crusts and make the soil more easily penetrated as the young seedling moved up through the soil to the surface.

These studies were conducted without the use of Roundup Ready seed varieties. Damage resulting from cultivation or weed competition may have affected the final outcome. Further research would provide greater information about the feasibility of stale seedbed planting in a Roundup Ready sugarbeet system.

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Table 1. Sugarbeet yield and quality parameters resulting from stale seedbed planting. 'Conventional' indicates standard spring tillage practice accomplished with a cultivator with a rolling crumbler bar; 'Stale – no res. mngrs' indicates that sugarbeet seed was planted into a stale seedbed employing a planter without residue managers; 'Stale – w/ res. mngrs" indicates that sugarbeet seed were planted into a stale seedbed using a planter equipped with residue managers. LSD values indicate the least significant statistical difference between treatments (P<0.10). If LSD is recorded as *NS*, then no treatment differences were significant.

| **Tillage Treatment** | **Root Yield (Tons/a)** | **Gross Sugar (%)** | **SLM (%)** | **Net Sugar (%)** | **RSA* (lb/a)** | **RST** (lb/ton)** | **Stand (Beets/100ft)** | **GRT† ($/Ton)** | **GRA‡ ($/a)** |
|---|---|---|---|---|---|---|---|---|---|
| CONVENTIONAL | 34.1 | 16.1 | 1.1 | 15.0 | 10157 | 297.2 | 170 | 39.70 | 1304.40 |
| STALE – NO RES. MNGRS | 33.2 | 16.0 | 1.2 | 14.8 | 9886 | 296.9 | 172 | 38.90 | 1296.50 |
| STALE – W/ RES. MNGRS | 32.7 | 15.9 | 1.1 | 14.8 | 9479 | 289.5 | 178 | 38.50 | 1184.90 |
| **LSD** | **NS** | **NS** | **NS** | **NS** | **NS** | **NS** | **NS** | **NS** | **NS** |

* Recoverable Sugar per Acre; ** Recoverable Sugar per Ton; † Gross Return per Ton; ‡ Gross Return per Acre

Table 2. Sugarbeet emergence during early, mid, and late season in three seedbed preparation treatments. Treatments are described in Table 1, above.

| **Date** | **Treatment** | **Plants (100 $ft^{-1}$)** |
|---|---|---|
| May 19th | Conventional | 112 |
| | Stale – No Res. Mngrs | 117 |
| | Stale – w/ Res. Mngrs. | 142 |
| May 23rd | Conventional | 150 |
| | Stale – No Res. Mngrs | 172 |
| | Stale – w/ Res. Mngrs. | 176 |
| June 25th | Conventional | 209 |
| | Stale – No Res. Mngrs | 216 |
| | Stale – w/ Res. Mngrs. | 216 |
| Sept. 29th (Harvest) | Conventional | 170 |
| | Stale – No Res. Mngrs | 172 |
| | Stale – w/ Res. Mngrs. | 178 |