OBSERVATIONS ON THE EFFECT OF STRAW MULCH ON SUGAR BEET STRESS AND PRODUCTIVITY

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Purpose

Straw mulch was evaluated on a furrow-irrigated sugar beet field to determine potential benefits In Increased yield, better soil moisture status, and reduced soil erosion.

Summary

Straw mulch applied at 650 pounds per acre in alternate furrows on a hill at 2 to 5 percent slope appeared to benefit sugar beet yields and sugar production. Soil moisture was enhanced by the mulch. On August 4, sugar beet leaf canopies averaged 7.0 degress F above air temperatures where the field was not strawed. Sugar beet canopies averaged 4.1 degress F less than air temperatures where straw was applied. Beet yields were 37.5 tons per acre on strawed furrows compared with 30.1 tons per acre on non-strawed furrows. Estimated sugar recovered was 10,030 pounds per acre from the strawed furrows compared with 7,540 pounds per acre in non-strawed furrows.

Experimental Site Description and Methods

Sugar beet variety Beta Seed 8654 was planted March 28, 1986, on a sloping bench soil near Ontario, Oregon. The soil was a Nyssa silt loam with 2 to 5 percent slope. Every other furrow in most of the field was mulched with wheat straw at the rate of 650 pounds per acre. Strips in the field were left without straw mulch. Throughout the season, the field was watered by furrow irrigation in every other row. The mulched parts of the field were watered only in the strawed furrows.

On August 4, observations were made on crop status and soil moisture. Soil moisture was determined by digging replicated samples representative of the first foot of soil. Stress on the crop was measured by use of a Standard Oil "Scheduler." The Scheduler measures the crop canopy temperature, air temperature, relative humidity, and solar radiation. The Scheduler calculates plant stress using the actual canopy temperature and compares it with maximum and minimum canopy temperatures at maximal and minimal moisture stress at the current ambient relative humidity and air temperature. Observations were replicated four times at each of four locations north to south through the field for both strawed and non-strawed treatments. The sugar beets were harvested October 29 and evaluated for sucrose and conductivity October 30 and 31 at the Amalgamated Sugar Company research laboratory at Nyssa, Oregon. Harvests were replicated in four rows each of three locations north to south throughout the field for both strawed and non-strawed treatments.

Results and Discussion

The first irrigation resulted in soil losses of 3 tons per acre from the straw mulched furrows and 17 tons per acre from the non-strawed furrows.

As the season progressed, the beets in the non-straw rows wilted in the afternoon. Soil moisture was less in the non- strawed rows (Table 1). The sugar beet leaves in the mulched rows were able to maintain evaporative cooling, but the leaves on plants in non-strawed rows were unable to maintain cool plant canopies (Table 1). Stress indices for crop without straw vere much higher than the crop with straw.

Beet yields and estimated recoverable sugar were enhanced 25 and 33 percent, respectively (Table 2). Recoverable sugar was found to be relatively correlated with August 4 observations of leaf temperature, leaf temperature from air temperature and the plant stress index. The sucrose content and conductivity varied more with location north and south and by harvested row than by mulching treatment.

Conclusions

The application of straw mulch to gently sloping (2 to 5 percent) furrows appeared to decrease soil loss, decrease plant stress, and increase sugar beet and sucrose yields. The promising results would justify testing the effects of straw mulch in a complete-block randomized design so that conclusions could be reached with greater confidence.

Acknowledgments

The sugar beet crop was planted and cared for by Dick Tipton of Ontario, Oregon. Sugar beet samples were analyzed by Don Oldemeyer of Amalgamated Sugar Company of Nyssa, Oregon. The Scheduler equipment used to measure sugar beet canopy temperature and plant stress was provided by Bronson Gardner of Standard Oil. Soil losses were calculated by Herb Putter of the Soil Conservation Service.

Table 1. Observations on the effect of straw mulch on the leaf canopy temperature and estimated relative stress of sugar beets, 1:30 to 2:30 p.m., August 4, 1986. Other parameters were measured at the same time. Dick Tipton's sugar beets, Ontario, Oregon.

Treatment	Air Temperature Degrees F	Beet Canopy Temperature Degrees F	Temperature Difference Degrees F	Relative Humidity %	Plant Stress Index PSI	Solar Radiation Watts	Wind Speed MPH	Soil Moisture in The Top Foot Inches/ft
No Straw	90.2	97.2	+ 7.0	22.9	1.27	1085	2.7	2.05
Straw	91.4	87.3	- 4.1	26.7	.44	1084	1.8	3.00

Table 2. Effects of straw mulch on sugar beet producitivity. Dick Tipton's sugar beets, harvested October 29, 1986, Ontario, Oregon.

Treatment	Beet Yield tons/ac	Sucrose Content %	Conductivity uohms	Estimated Sugar Recovered lbs/ac
No Straw	30.1	15.1	974	7,540
Straw	37.5	16.1	938	10,030