Design and Evaluation of Cover Crop Systems for Sugarbeet Production Under Furrow Irrigation.

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Introduction

Wind erosion during sugarbeet establishment is of major concern in many sugarbeet producing areas. Cover crops are being used successfully to protect sugarbeets early in the season where center pivots are used for irrigation. Normally small grain is planted as a cover crop in the fall of the year. The cover crop is planted either in rows or broadcast. When planted in rows, the cover crop is spaced such that the following spring sugarbeets can be planted between the rows of spring grain. Prior to sugarbeet emergence, the cover crop is killed with a herbicide. When the cover crop is broadcast, herbicides are used to kill a strip of the cover crop prior to planting. The strips of cover crop between the planted rows of sugarbeets are killed when the cover crop plants are about 4 in. tall and before sugarbeet emergence. The cover crop is left standing in both systems to provide continued protection from the wind until such time that cultivation is necessary. When cultivation occurs, the sugarbeets are of adequate size to provide their own protection from wind erosion.

These cover crop systems developed for sugarbeets over the past ten years in center pivot irrigated areas have not been adapted for furrow irrigation systems because of several concerns.

1) The cover crop will deplete already limited soil moisture and retard or limit sugarbeet emergence.
2) The inability to furrow irrigate with the presence of the cover crop.
3) Retarded growth and subsequent yield due to competition of the cover crop.

Center pivot producers have developed these cover crop systems to provide a method to improve overall production by eliminating the potential for loss of top soil and crop injury due to wind erosion and reduce the environmental impact of wind erosion. Furrow irrigation producers are in need of this same protection from wind erosion.

In the furrow irrigated sugarbeet producing areas, a cover crop system is complicated by the need to construct furrows for irrigation. The majority of the sugarbeet fields are plowed and packed before seeding and have no crop residue to reduce wind and soil movement. The lack of crop residue and high wind potential

makes wind erosion a serious threat to these sugarbeet growers. A properly designed cover crop system for furrow irrigated sugarbeets will have the same wind erosion and cost reduction benefits as existing cover crop systems for center pivot irrigated sugarbeets. Once developed, this system may also have application for the establishment of dry beans.

Objectives

1) Design spring and fall planted sugarbeet cover crop systems with features to minimize inputs and reduce soil erosion in furrow irrigated fields.
2) Evaluate the performance of these cover crop systems for sugarbeet production in field scale settings by measuring the following:
   a) Plant stand
   b) Furrow irrigation performance
   c) Sugarbeet yield

Methods

A three year field study was initiated in the fall of 1995 at the University of Nebraska, Panhandle Research and Extension Center. The experimental design was a randomized complete block with four replications. Five cover crop treatments were used and include:

1) Conventional plow treatment
2) Fall cover crop drilled on beds
3) Fall cover crop broadcast on beds
4) Spring cover crop drilled on beds.
5) Spring cover crop broadcast on beds

The prior year crop was dry beans. For the first year of study a bedder was built using rolling cultivator parts to shape the beds. No tillage occured between harvest the previous year and construction of beds. Beds were constructed in the fall and spring for the different treatments. The conventional treatment was plowed in the fall following harvest. The remaining tillage for the conventional treatment was completed in the spring. For the following two years a Schlagel tillage system, a commercial unit manufactured in Wyoming, was used for primary tillage of all treatments. The conventional treatment was plowed following the Schlagel operation. A Schlagel bedder was used following the Schlagel tillage unit to prepare the fall and spring beds.

The study was set up in six, 22 inch row plots for all treatments. The conventional treatment was 12 rows wide to accomodate the plowing operation. Field length varied from 600-800 feet. John Deere 71 planters were used to seed the cover crop in the spring and fall drilled treatments. The planter units were spaced 11 inches apart and centered over each bed. This provided a row of cover 5.5 inches from each

side of where sugarbeets were to be planted.

For the broadcast treatment the cover crop was seeded using a hand held broadcast spreader prior to construction of the beds. The seed was planted at a rate of 50 lb/ac for both the drilled and broadcast treatments. The fall beds were seeded with winter rye as a cover crop. The spring beds were constructed in early March using spring barley for the cover crop.

The sugarbeet variety Halt was used in 1996 and 1997 and Beta 4546 in 1998. Field plots were planted to stand on May 3, 1996, May 1, 1997 and April 21, 1998. A John Deere Maxi-Merge II was used in 1996 and 1997. The German made Kliene planter was used in 1998. Field strips were furrow irrigated following planting to aid germination and emergence.

Control of the cover crops varied based on growth and climatic conditions. In 1996, the herbicide Select (8oz/Ac) was applied on May 10 followed by split applications of Betamix. Roundup was used in 1997 prior to sugarbeet emergence followed by split applications of Betamix. In 1998, Select (8oz/Ac) was again used on May 20 followed by split applications of Betamix. All plots were cultivated twice and hand weeded once.

Results

Stand counts were taken in mid-June of each year and are given in Table 1. Significant difference was found among the treatments for final plant population. The plow treatment had the greatest population at 41,600 plants/A, Plant population in all treatments were above 32,900 plants/A and averaged 37,000 plants/A.

Yield results from the three-year cover crop study are given in Table 1. There were no significant differences in tare, sugar content, root yield or sugar yield among the plow with conventional seedbed preparation, fall cover crop drilled on beds, spring cover crop drilled on beds, and spring cover crop broadcast on beds treatments.

The fall broadcast cover crop treatment was not done during the first year of this three-year study and is therefore not part of the overall analysis. An analysis to compare 1997 and 1998 indicated no significant difference between the yield parameters for the different treatments when the fall broadcast treatment was included.

Conclusions

Cover crops, as a method to control sugarbeet loss due to spring wind erosion, is a viable alternative for furrow irrigation systems. Control of the cover crop must be timely to eliminate the cover crop easily and to retain soil moisture for use by the sugarbeet seedlings. In many cases irrigation may be necessary to allow for good

germination, emergence and early seedling growth.

Table 1. Results of Cover Crop Study combined over years 1996, 1997 & 1998.

Treatment	Plant Population (plants/acre)	Tare (%)	Sugar (%)	Root Yield (tons/acre)	Sugar Yield (lbs/acre)
Plow - Conventional Seedbed Preparation	41600	9.5	15.9	19.4	6210
Spring Cover Crop Planted on Beds	37300	8.5	15.5	20.4	6360
Spring Cover Crop Broadcast on Beds	37700	8.6	15.4	19.4	6030
Fall Cover Crop Planted on Beds	35400	8.7	15.7	22.0	6940
Fall Cover Crop Broadcast on Beds*	32900	8.9	15.7	20.1	6380

*In 1996, the fall cover crop broadcast on beds treatment was not conducted. The results for that treatment are for 1997 & 1998 only.