Soil Fertility for Corn Grown after Unharvested Sugar Beets

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Justification: The goal of SMBSC is to optimize the sugar refinery's capacity. To do this the grower's goal is to raise enough high quality sugar beets to meet the needs of the refinery. Some years this may mean some sugar beet acres will not be harvested due to greater than anticipated yield and a limited slice capacity. Little information exists on management practices for optimum corn production following unharvested sugar beets.

Objective: Determine what management practices are useful for optimum field corn production following unharvested sugar beets. Specifically answering the following questions: 1. Do the unharvested roots need to be removed? 2. Does the use of starter fertilizer help corn production, and 3. Does the corn crop need more N applied after unharvested roots compared to removed roots?

Materials and Method: A study was conducted near the SMBSC Murdock piling site on field corn grown in 2020 to answer the objective. This site was planted to sugar beets in 2019 and the beets were defoliated but not harvested except for selective treatments. The study included the treatments listed in Table 1. The experimental design was a randomize complete block with four replications. All but three treatments had unharvested sugar beets left in the plot. Treatments 7, 8, and 9 had the sugar beet roots harvested. Nitrogen fertilizer rates were based on the soil test to 2 feet. Since the soil nitrate-N was low, the MRTN recommendation for corn/corn was used at a price ratio of 0.10 = 155 lb N/A. 7 gallons of 10-34-0 plus 1 lb zinc/A was used as an infurrow starter on all but treatments 1 and 8. The corn was machine harvested on November 4, 2020.

Treatment	2019 Beets	Starter	N rate
1.	Not harvested	none	0
2.	Not harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	0
3.	Not harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	Recommended – 40 lb N/A (115 lb N/A)
4.	Not harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	Recommended (155 lb N/A)
5.	Not harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	Recommended + 40 lb N/A (195 lb N/A)
6.	Not harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	Recommended +80 N/A (235 lb N/A)
7.	Harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	Recommended (155 lb N/A)
8.	Harvested	None	0
9.	Harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	0

Results: The corn yields were good because of the ideal weather experienced in 2020. The statistics and corn yields are reported in Table 2 and Table 3. Grain yields were significantly affected by the treatments. There was a significant increase in corn yield of 31 bu/acre if the sugar beets were harvested. The difference in corn yield of 14 bu/acre with the use of starter (7 gallons 10-34-0 plus 1 lb Zn/acre) was significant at the P>0.07 level. The use of N fertilizer at

the recommended rate significantly increased corn grain yields by 100 bu/acre. The use of additional 40 lb N/acre fertilizer above the recommended increased grain yield 21 bu/acre, significant for corn grown where sugar beets were not harvested the previous fall. Applying 80 lb N/acre above the recommended amount did not increase the corn grain yield above the extra 40 lb N/acre application. It took 40 lb N/acre above the recommended N rate for the corn grain yield on the non-harvested treatment to be equal to the corn grain yield with recommended N application for the corn grown where the sugar beets were harvested the previous fall. Additional years of data is needed to devise a solid recommendation.

Table 2. Corn grain yield and statistical analysis for 2020.

Treatment	Beets	Starter	N rate	Grain yield (bu/A)
1.	Not harvested	none	0	107
2.	Not harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	0	126
3.	Not harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	Recommended – 40 lb N/A (115 lb N/A)	224
4.	Not harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	Recommended (155 lb N/A)	234
5.	Not harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	Recommended + 40 lb N/A (195 lb N/A)	255
6.	Not harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	Recommended +80 N/A (235 lb N/A)	241
7.	Harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	Recommended (155 lb N/A)	251
8.	Harvested	None	0	150
9.	Harvested	7 gallons 10-34-0 plus 1 lb Zn/acre	0	160
$LSD_{0.05}$				21
Grand mean				196
Trt				0.0001
Harvest vs No harvest				0.0001
Starter vs No starter				0.07
0 N vs Recemmended				0.0001
C.V. %				7.2

Table 3. Corn grain yield means for direct comparisons of Non-Harvested and Harvested sugar beet, use of starter fertilizer, and use of Recommended N fertilizer in 2020.

Comparison	Corn grain yield 15.5 % (bu/A)
Not Harvested	156 bu/A
Harvested	187 bu/A
No Starter	129 bu/A
Starter	143 bu/A
No N	143 bu/A
Recommended N	243 bu/A