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Sugar Beet Demonstration

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Abstract
The sugar beet (*Beta vulgaris*) demonstration was conducted in response to the planned construction of an ethanol plant in Muscatine. Instead of corn, the facility will use sugarbased feedstocks such as molasses and, hopefully, locally grown crops like sugar beets. However, sugar beets are not currently grown in southeast Iowa and reliable production information is not available to make informed decisions on the merits of using this crop. Therefore, this project was conducted to determine if sugar beets could be grown in southeast Iowa, what production problems might be encountered, and establish potential yield levels. To achieve these goals half-acre trial plots were established at the Muscatine Island Research Farm, Fruitland, and at the Southeast Research Farm, Crawfordsville. Although less than 45 miles apart, the sites provided two contrasting growing environments available in southeast Iowa because of different soil types and the use of irrigation at Fruitland. The plantings were monitored through the growing season with yield and quality determinations made in the fall.

Disciplines
Agricultural Science | Agriculture

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Introduction

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Materials and Methods

Seed of five sugar beet genotypes was provided by Syngenta/Hilleshög for the project: EB0718RR, EB0801RR, EB0802RR, EB0803RR, and EB0804RR. Each genotype was planted in observational blocks approximately 0.1 acre in size with a John Deere 33 Vegetable Planter. Seed was spaced approximately 2.8 in. apart in rows spaced 30 in. apart and 0.75 in. to 1.0 in. deep. Harvest data was collected by randomly digging four 20 ft row sections of each genotype. Foliage was removed at crown and dirt knocked-off roots before weighing for yield determinations. A sample of roots from each plot was sent to Syngenta/Hilleshög for percent sugar and percent purity determinations. Harvest data were collected for each genotype but are averaged for presentation in Table 1.

Muscatine Island Research Farm, Fruitland

Planting. Seed was planted April 16 in Field G, which has coarse loamy-sand soil with 1.0% organic matter. Prior crop was soybeans.

Fertility and Tillage. Plot area was chisel plowed approximately 8 to 10 in. deep, disked, and harrowed before planting; 56 lb/acre nitrogen, 56 lb/acre phosphate, and 250 lb/acre potash was applied preplant incorporated. Additional nitrogen was sidedressed on May 16 (32 lb/acre), June 10 (24 lb/acre), and June 25 (65 lb/acre). Nitrogen rates were higher than planned because of leaching rainfall.

Irrigation. Plot was irrigated as needed with overhead sprinklers to supplement rainfall.

Pest Control. Beets were hand weeded and glyphosate herbicide was applied on May 16, June 23, and July 14. Quadris fungicide was applied on July 3 for Rhizoctonia crown rot. Quadris fungicide was applied on August 25 followed by Dithane DF + Kocide 2000 on September 2 for Cercospora leafspot.

Southeast Research Farm, Crawfordsville

Planting. Sugar beets were planted April 23 in the field north of the tower and directly south of the buildings. Soil type was a Mahaska silty clay loam with 1.9% organic matter. The prior crop was wheat.

Fertility and Tillage. Plot area was field cultivated approximately 4 to 6 in. deep and harrowed before planting. Soil test indicated good fertility so only nitrogen was sidedressed

on May 29 at 68 lb/acre and again on June 24 at 60 lb/acre.

Pest Control. Beets were hand weeded and glyphosate herbicide was applied on June 14 and July 15.

Results and Discussion

Harvest results in Table 1 clearly indicate sugar beets can be grown in southeast Iowa and good yields are possible. The USDA reports a national average sugar beet yield in 2008 of 26.6 ton/acre and a sucrose yield of 4.02 ton/acre. The October plot yield at Fruitland was 24.68 ton/acre containing 16.0% sugar and Crawfordsville was 35.36 ton/acre containing 15.6% sugar. Thirty-five tons of beets that are 15.6% sugar could yield, depending on extraction efficiencies, up to 5.4 tons of sugar/acre. Theoretically, 5.4 tons of sugar would make 880 gallons of ethanol. Although this theoretical yield won't be attainable in actual practice due to processing efficiencies, it should still be higher than the 450 to 550 gallons of ethanol normally derived from an acre of corn.

Sugar content of the roots is extremely important since it is sugar that is converted to ethanol. We measured concentrations of 14% to 16%, which is acceptable but leaves room for improvement. Better nitrogen management is called for in the future since dark green foliage at harvest indicated a surplus that would favor vegetative growth over maturation and root sugar accumulation.

A general rule is to let sugar beets grow as long as possible but to harvest before a killing freeze. We planted in mid-April, about as early as possible given spring weather conditions, and determined yield in late September and again in late October to explore harvest timing. Root yield increased almost 5 tons/acre and sugar content by 1.5% from September to October at both locations.

As with any new crop, production problems were encountered. Root heaving or roots pushing up as they grew larger occurred at both locations. This is undesirable because it makes leaf defoliation more difficult at harvest. Deeper tillage and better field preparation should prevent this in the future. Cercospora leafspot was seen at both locations by September and caused partial plant defoliation in the wetter areas of the field at Crawfordsville. Rhizoctonia crown and root rot, a soil borne pathogen, was identified at the Fruitland site causing considerable stand loss during June and July in portions of the planting. Another production problem observed on the sandy soil at Fruitland was a suspected nutrient imbalance, possibly involving boron, which caused leaf chlorosis and plant stunting. This problem probably limited yield the most at Fruitland and needs to be investigated further if sugar beets are to be grown on sandy soils.

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Table 1. Root and sugar yield of sugar beets grown at Southeast Research Farm, Crawfordsville, and Muscatine Island Research Farm, Fruitland, on two harvest dates.

	Plants/acre at harvest	Avg. root weight (lb)	Root yield[1] ton/acre	% Sugar	Sugar yield ton/acre
Crawfordsville					
September 23	33,715	1.8	29.94	14.0	4.19
October 22	34,616	2.1	35.36	15.6	5.52
Fruitland					
September 22	29,969	1.3	19.59	14.4	2.82
October 27	32,176	1.5	24.68	16.0	3.95

[1]Root yield is calculated from field weight of unwashed roots.