

# Crop Management Research Report

Penn State University  
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## Evaluation of Energy Beets as an Ethanol Feedstock in Pennsylvania

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**Locations:** State College and Gordonville, Pennsylvania

**Collaborators:** Steve Libsack, Betaseed, Paul Wheaton, Lancaster, Gene Martin, Gordonville and Don Rill, Penn State Farm Operations

**Research Objective:** To assess the agronomic potential of Energy Beets at two Pennsylvania locations and assess the potential of four experimental varieties.

**Background:** Energy Beets have been proposed as a feedstock for ethanol production in Pennsylvania. There has been little evaluation of these beet varieties and production issues and yield potential in our region associated with the crop is not well understood. There also has been no evaluation of the genetic material in the state to understand which commercial lines might be best adapted. These demonstrations were initiated to develop some baseline performance information on the crop, assess four experimental lines and demonstrate beet production methods and harvesting to ag professionals in the state.

**Study Description:** Four experimental Energy Beet lines were obtained from Betaseed Inc., Shakopee, MN. These lines were designated EAR022, ENR055, EER077, and EGR099 and represented diverse backgrounds of commercial beet genetics. Strip trials of the four beets were established at two locations in Pennsylvania representing potential production locations. The first was in State College, PA (Centre County) in conjunction with Penn State Farm Operations. The second site was located in Gordonville, PA (Lancaster County) in conjunction with a grain farmer, Gene Martin. Planting date, seeding rate, soil fertility and weed management tactics for each site are listed in Table 1. Both sites were planted in April in tilled seedbeds in 30 inch rows and weed control was achieved with sequential postemergent applications of Roundup. At both sites, a fungicide application of Headline at 9 ounces/acre was applied to control *Cercospora* leaf spot. Leaf spot was moderate at the Gordonville site and light at the State College site.

Table 1. Background data for the two energy beet demonstrations in 2010 in Pennsylvania.

Management	State College	Gordonville
Planting Date	April 15	April 19
Seeding Rate	56,000	56,000
Planter	Monesem	White
Starter Fertilizer	11 gallons/a 7-21-7	None
Manure	None	Dairy
N application	50 lb/a preplant, 100 lb/a Sidedress	80 lb/a N preplant
P and K Fertilizer	None	None
Herbicide	2 post applications glyphosate	2 post applications glyphosate
Fungicide	Headline @ 9 oz early August	Headline @ 9 oz early August
Harvest Date	Sept. 21, 2010	September 24, 2010
2 <sup>nd</sup> Harvest Date	November 11, 2010	November 15, 2010

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Yield samples were harvested by digging all beets from two 1/1000 acre row lengths and removing all top growth from the beets in late September and again in early November. Only two varieties were sampled at the Gordonville site. The beets from each sample were counted and weighed. Following the September harvest a tissue sample was collected from four beets in each variety and chopped with a blender. Juice of three samples of the chopped material was expressed using a garlic press and the sugar content of each was determined using a refractometer. Data reported are the mean of three observations for that variety. At the Gordonville site, the remaining beets were harvested with a used two row commercial equipment provided by Betaseed. First a defoliator was run over the beets to remove all leaf material. This was followed by a two row beet harvester with an unloading elevator. Beets were simultaneously harvested and unloaded into a wagon for transport. This aspect of the demonstration showed that beets could be harvested in small fields with smaller equipment and a modest investment if necessary.

**Results:** Emergence was good at both sites, despite a dry period for two weeks following planting in State College. Growth and development was good at both locations. Moderate mid season drought stress occurred at both location in early July with several days over 90F. Drought was relieved with rain in mid July at both locations. Cercospora leaf spot appeared in mid July at the Lancaster site and reached moderate levels of severity before treatment. A very low level of disease appeared at the State College site in early August. This site was treated to minimize the potential for a more severe outbreak developing. Other insect and vertebrate pest levels were relatively low. At the State College site, adjacent canola and sunflower plots were heavily grazed by woodchucks.

Plant stand, yield and degree Brix for the four varieties at both locations are listed in Table 2. Yields were good at both locations; with the Gordonville site averaging 36.3 tons/acre and the State College site averaging 31.4 tons per acre in the September harvests. Yields increased at both sites and averaged 49.0 tons/acre at Gordonville and 39.7 tons/acre at State College. During the 7 (Gordonville) or 8 week (State College) delay in harvest the beets gained from 0.7 to 1.8 tons/week in yield. The pattern of performance of the varieties was similar at both locations with the EER077 line yielding less than average at both locations. The ENR055 line had the highest yield at both locations. This line had the best vigor and appearance throughout the season.

Plant populations also varied among varieties and the pattern was similar at both locations with the EGR099 line having the highest populations, and the EAR022 and EER077 lines having the smallest stands. Sugar content of the lines varied among varieties but the ranking was different at each site. Degrees Brix were generally above 17, except for the EER077 line at Gordonville. Potential ethanol yields per acre from the Energy Beets at the September harvest were calculated using an estimate of 26.7 gallons of ethanol per ton. This resulted in potential ethanol yields of 838 and 925 gallons/acre for the State College and Gordonville sites, respectively. These are considerably higher than possible from corn; a 200 bushel/acre corn crop could potentially produce 540 gallons/acre using a conversion of 2.7 gallons/bushel.

**Conclusion:** This demonstration showed that high yields of Energy Beets can be produced in Pennsylvania using corn planting equipment with minimal modification. Yields appear to increase substantially as harvest is delayed in the fall. We also demonstrated the range in performance that is possible among elite Energy Beet lines. This study also showed that Cercospora leaf spot can be an issue in some environments in Pennsylvania and needs to be controlled with fungicides. Finally, we showed that harvesting could be accomplished using smaller scale equipment.

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Table 2. Yield, population and sugar content of energy beets grown in PA in 2010.

Variety	Yield (tons/acre)	Population (plants/acre)	Sugar (°Bx)	Yield increase (tons/acre)	Increase/week harvest delay (tons/acre)
		Gordonville (9/24)			
EAR022	36.5	37,000	17.5		
ENR055	39.2	42,000	19.5		
EER077	33.5	35,000	16.3		
EGR099	36.0	56,000	18.8		
		Gordonville (11/15)			
EAR022					
ENR055	49.6			10.4	1.5
EER077					
EGR099	48.5			12.5	1.8
		State College (9/21)			
EAR022	30.8	37,000	18.3		
ENR055	35.0	46,000	19.8		
EER077	28.4	31,500	19.8		
EGR099	31.5	49,000	18.7		
		State College (11/11)			
EAR022	41.1	34,000		10.3	1.3
ENR055	43.6	47,000		8.6	1.1
EER077	34.0	33,500		5.6	0.7
EGR099	40.0	48,000		8.5	1.1

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