Heating your greenhouse with grain corn; hybrid yield evaluation

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Massachusetts has over 1,000 growers producing greenhouse crops in over 17 million square feet of protected growing space (2007 Census of Agriculture). This includes over 16,500,000 sq ft. in bedding plants, flowers and floral greens, foliage plants and potted flowering plants and over 1,200,000 sq ft in vegetable crops. Temperature needs of the crops vary, but often require a night temperature of at least 60 degrees F. Most of Massachusetts' greenhouses are heated with either fuel oil or liquid propane. A 20,000 sq. ft. greenhouse, heated all winter with a night temperature of 60 degrees F, uses an estimated 3200 gallons of fuel oil or the equivalent (Bartok, 2006). While there are no firm figures on the total fossil fuel used for greenhouse heat in the state, we know that we have the equivalent of at least 800 greenhouses that are 20,000 sq. ft. in size. If only one third of these greenhouses are heated all winter, and two thirds of these greenhouses begin heating in late winter (using one-third the heat energy), our total use of fossil fuels for greenhouse heat is equivalent to more than 1.5 million gallons of fuel oil.

This project focuses on shelled corn, a renewable heat source that can be grown and used in Massachusetts more cheaply than fossil fuels, using available and proven technology. We chose corn for this project because, unlike other potential biomass fuel sources, it is an annually renewable fuel source, burns cleanly, requires minimal processing, helps to preserve agricultural land and businesses, and can be produced in quantity locally. At current prices, corn compares very favorably with the standard fossil fuels that are used for greenhouse heat. Changing to energy sources that can be produced locally, travel a short distance from producer to user, and that have a high ratio of energy output to fossil fuel input is key to a viable future for farming in Massachusetts. To that end, we have partnered with a number of growers across the state that has begun using corn furnaces and boilers for heating their greenhouses. We collect information on their experiences with this technology and share their experiences with a wider circle of interested growers through field days, on-farm meetings, newsletter articles, and the umassvegetable.org website.

The emphasis of this project is on making the best possible use of our land for food and fuel production and not to detract from our ability to grow food crops. We're envisioning a system where fuel crops become a valuable rotational crop in vegetable farms and an alternative revenue stream for dairy farmers in a time of shrinking demand for silage; not a system in which the production of fuel shifts acreage away from food production.

Corn silage hybrids were evaluated for grain yield performance at the University of Massachusetts Crops Research and Education Center Farm, in South Deerfield, Massachusetts in 2010. Hybrids were placed in three groups based on relative maturity (RM) provided by the seed companies; Group I, shorter season maturity group (85-94 days), group II mid maturity group (95-100 days), and group III, full season group (101-115 days). Ears were handpicked on October 7, October 11, and October 14 for Group I, Group II, and Group III, respectively. In 2010 the corn crop experienced hot and dry condition especially in August which coincides with grain filling stage. The late dry condition had less negative impact on shorter-season hybrids compared to full-season hybrids. As a result, the shorter-season maturity hybrids in general performed better compared to full-season maturity groups. The result of grain yield, grain moisture at harvest, and cob/ear ratio of all hybrids tested in 2010 are presented in the following table.

Grain yield, grain moisture at harvest, and cob/ear ratio for three maturity group hybrids planted on May 6th, 2010 and harvested at about 20% grain moisture.

Brand	**Hybrid**	**Maturity group**	**grain Bu/ac***	**grain moisture%**	**cob/ear %**
TA Seeds	TA290-11 (CB/LL)	I	208	18	13
Dairyland	ST-9789 (RR)	I	208	19	9
Agrisure (NK)	N20R-GT	I	152	18	13
Mean			**189.3**	**18.3**	**11.7**
TA Seeds	TA501-161	II	183	21	11
Dairyland	ST-3195Q (RR)	II	172	20	10
DEKALB	DKC 46-07	II	206	20	9
DEKALB	DKC 46-6	II	193	21	10
DEKALB	DKC 49-94	II	181	21	12
DEKALB	DKC 45-52	II	181	19	11
DEKALB	DKC 48-37	II	183	20	11
Mean			**185.6**	**20.3**	**10.6**
TA Seeds	TA788-13 (YGVT3)	III	164	23	13
Dairyland	ST- 9703Q	III	182	20	11
DEKALB	DKC 52-59 (VT3)	III	162	18	13
DEKALB	DKC 54-16 (VT3)	III	192	19	10
DEKALB	DKC 57-50 (VT3)	III	174	24	13
DEKALB	DKC 59-64	III	185	21	11
DEKALB	DKC 61-69	III	199	21	11
DEKALB	DKC 63-42	III	187	23	11
DEKALB	DKC 63-84	III	183	21	11
DEKALB	DKC 50-35	III	195	17	10
Mean			**182.3**	**20.7**	**11.4**
Overall Mean			**185.7**	**19.8**	**11.2**
CV (%)			15.2	7.9	8.6

*grain yield was adjusted to 15.5% moisture