Evaluation of Hybrid Differences for Corn Grain Ethanol Yield

Purpose:

To determine if there is verifiable ethanol yield differences between current hybrids available in Ontario. This is in response to seed company marketing of “ethanol or starch” select hybrids without much data being available that describes the hybrid advantages.

Methods:

This project involved the collection of samples from ICAT plots throughout the Golden Horseshoe region. Utilizing ICAT plots is important in allowing the collection of sufficient samples of the same hybrids from various production systems, climatic zones and geographies. This puts the same series of hybrids under various “stresses” which when analyzed for ethanol yield, should allow any hybrid to hybrid differences in ethanol yield potential to be identified and quantified.
Strip trials plots had usually a standardized protocol and hybrid selection in addition to internal checks (3 occurrences of a check variety across the plot) to ensure that a statistical analysis of the extraction data has sufficient replication to provide scientific confidence in the data.

Samples collected from all plots were dried in the sample driers at the Elora Research Station of the University of Guelph. Samples were sorted, packaged and shipped from the University.

Samples were shipped to the “Identity Preserved Grain Laboratory” of the Illinois Crop Improvement Association. This organization has an international reputation for grain analysis and have the ability to use NIR technology to analyze for starch, oil and protein and have developed a fermentation technique for measuring actual ethanol production per bushel from a grain corn sample.
All 240 samples were sent to the IP lab for starch, oil and protein analysis, A sub-set of the samples (35) were then selected to have the ethanol production analysis performed.

Results

Results indicated that there were significant differences both in starch content and in protein content when samples were analyzed using the relatively inexpensive technique of NIR. These differences were associated both with hybrids and with environments. In examining Table 1 it is apparent that environmental differences (due to site or year) in fact produced a greater range in the measured components than did the selection of hybrid. In the case of starch content the range in environments was more than three time the range created by hybrids. These results indicated that recommending a particular hybrid as being high in starch might be subject to a great deal of environmental influence.

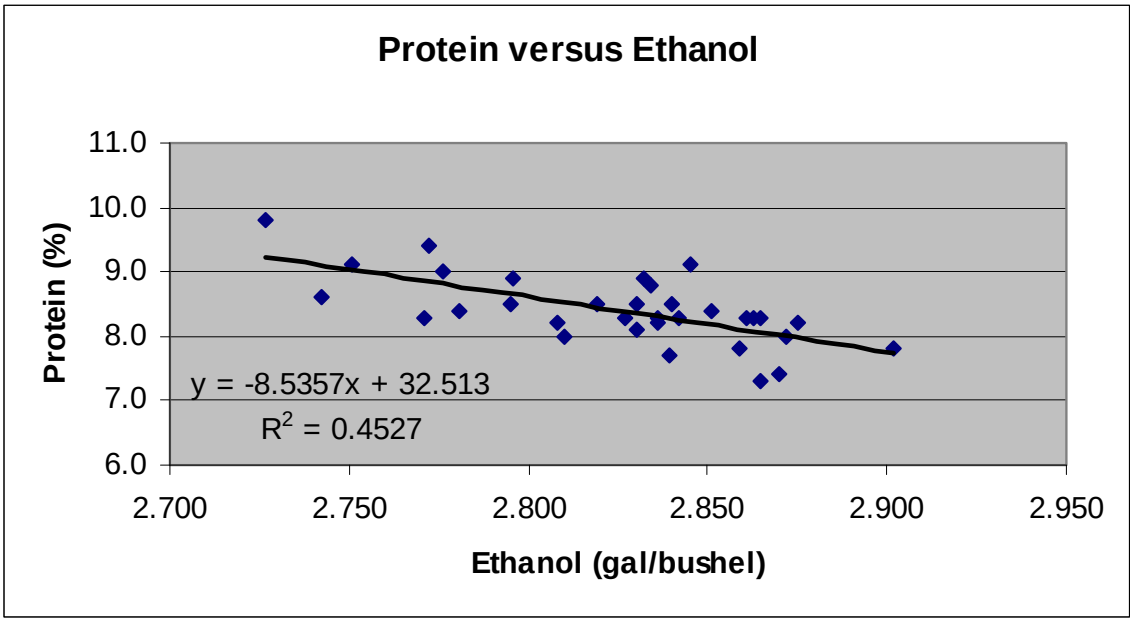
Table 1. The effect of hybrid and environment on grain starch levels.

By Hybrids	Starch (%)	Protein (%)	By Environments	Starch (%)	Protein (%)
5675 BT	72.8	8.9	Kitchholm-2005	71.7	10.2
Laxxot Bt	72.8	8.5	Davis-2005	72.6	8.6
38B85	73.0	8.8	Sickle-2004	72.7	8.7
37F16	73.0	8.9	Cruickshank-2004	72.8	8.8
NK43C4	73.1	9.1	Pate-2005	72.9	8.3
HLB282	73.2	8.1	Agresearch-2005	72.9	8.1
4956 BT	73.2	8.1	McLellen-2005	72.9	8.1
MZ 3888 BT	73.2	8.0	Van Sickle-2005	73.0	8.5
D69 BT	73.3	8.0	Shepherd-2005	73.0	8.8
2R426 BT	73.5	7.8	Cruickshank-2005	73.0	7.7
DKC 50-18	73.6	8.0	Martin-2005	73.0	8.1
NK 3030BT	73.6	8.3	Burt-2005	73.1	7.8
			Smith-2004	73.3	8.4
			Pate-2004	73.5	8.8
			Sickle-2005	73.5	7.4
			McIntyre-2004	73.6	8.3
			Shepherd-2004	73.7	8.4
			McLellen-2004	73.8	8.5
			Maple Leaf-2004	74.0	8.6
			Davis-2004	74.4	8.3
Range	**0.8**	**1.3**	**Range**	**2.7**	**2.8**

Table 2. The effect of hybrid on ethanol production.

Hybrid	Average of Ethanol (USgal/bu)	
	Year	
	2004	2005
Dekalb DKC 50-18	2.865	2.867
Hyland HLB282	2.835	-
Hyland Laxxot Bt	2.789	2.826
Mycogen 2R426 BT	2.839	2.848
Pickseed 5675 BT	2.830	2.768
Pioneer 37F16	2.761	-
Pioneer 37R70	-	2.742

Figure 1. Relationship between protein and ethanol production.



Samples processed for actual ethanol revealed fairly small differences across hybrids (see Table 2) and no relationship between starch content and ethanol production. Interestingly there was a significant relationship between protein content and ethanol production. This relationship is illustrated in Figure 1 and point to the fact that as protein decreased in a grain sample ethanol production tended to increase.

Summary:

This project found little evidence to support the idea that specific hybrids would consistently result in grain that yields more ethanol per bushel. Environmental influences make it unlikely that hybrid X would consistently have higher ethanol production that hybrid Y. A low cost test for grain protein (based on NIR) did seem to be correlated with ethanol production but again it appears that this sort of test would need be done on a truck load basis as hybrid trends were generally insignificant.

Next Steps:

In the future producers and ethanol producers will need to continue to explore techniques for improving ethanol efficiencies on two fronts:
1) define techniques for improving ethanol production based on grain characteristics,
2) develop ways to allow producers to capture the value of increased ethanol production through management, hybrid selection, or testing.

Acknowledgements:

This project was funded by a OSCIA/OMAFRA Partner Grant to the Brant County Soil and Crop Improvement Association. Appreciation is also extended to the all of the farm

co-operators, John Sheppard and the University of Guelph for assistance with sample co-ordination.

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