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Corn hybrids for corn ethanol

OMAFRA CORN SPECIALIST, GREG STEWART AND APPLIED RESEARCH COORDINATOR, IAN MCDONALD REVIEW THE RESEARCH

BACKGROUND

Seed companies have been extremely interested in assessing corn hybrids for their ability to produce more ethanol in the dry grind/fermentation process of an ethanol plant. Many hybrids have been labeled as having higher starch extraction or fermentation potential.

Some pilot projects have attempted to designate certain hybrids that would result in more efficient ethanol production, channel them to the end users and provide some sort of premium for the grain to the grower.

A project championed by the Brant County Soil and Crop Improvement Association wanted to examine hybrid difference as it related to grain yield and potential ethanol production. This project involved the collection of samples from multi-hybrid, field scale, strip trial plots throughout the Golden Horseshoe region in 2004 and 2005. Efforts were made to harmonize hybrids amongst sites in order to collect sufficient samples of the same hybrids from various production systems, climatic zones and geographies.

Samples were dried, sorted, packaged and shipped from the University of Guelph to the "Identity Preserved Grain Laboratory" of the Illinois Crop Improvement Association. This organization has an international reputation for grain analysis and has the ability to use Near-Infrared (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. This analysis was quite modest in price. A sub-set of the samples (35) were then selected to have the ethanol production analysis performed, this analysis was quite expensive ($120 per sample) hence the reason for sending only a fraction of all the samples gathered.

RESULTS

The plan was to use the less costly analysis to examine trends in starch content and then to follow that with actual ethanol fermentation tests to develop trends amongst hybrids.

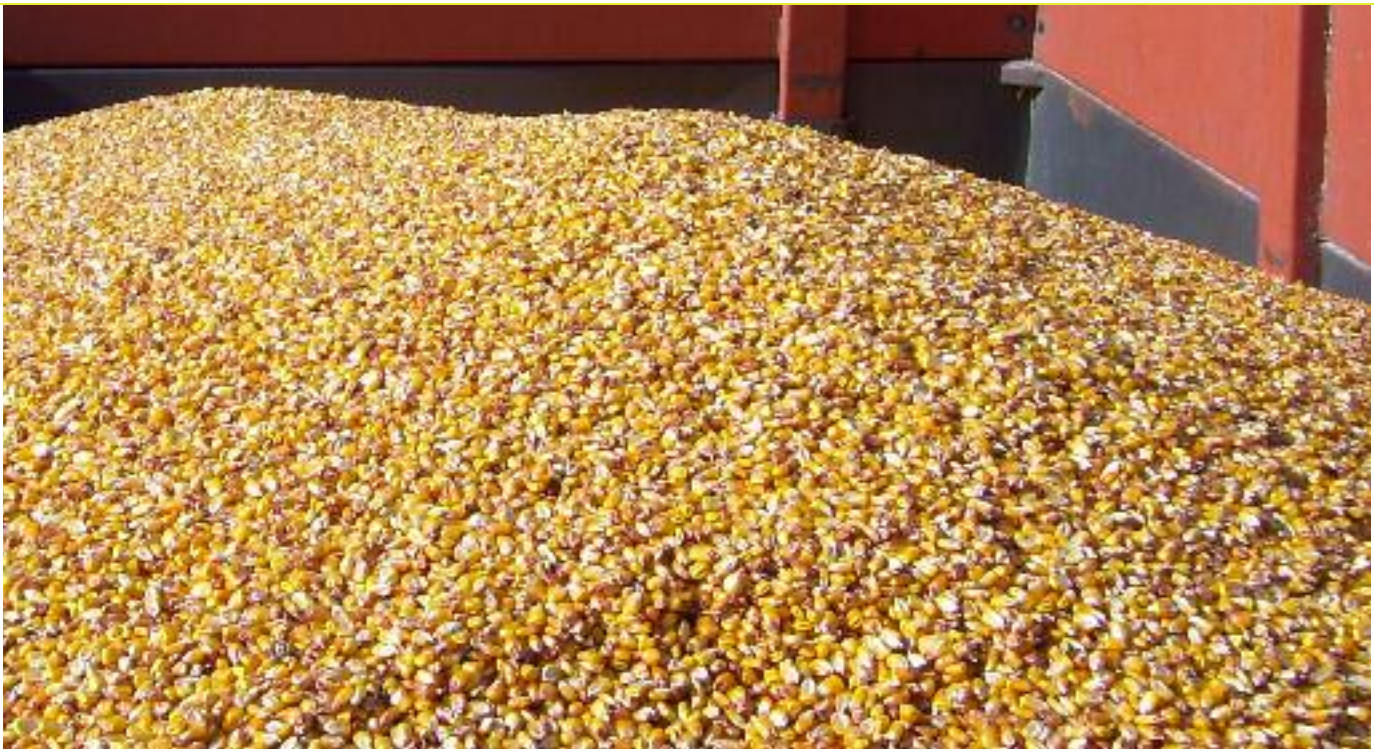
Results indicated that there were significant differences both in starch content and in protein content when samples were analyzed using the relatively inexpensive technique of Near-Infrared. These differences were associated both with hybrids and with environments. However, it was quite apparent that 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 (starch percentage was 71.7 to 74.4) was more than three times the range created by hybrids (72.8 to 73.6 per cent). These results indicated that recommending a particular hybrid as being high in starch might be subject to a great deal of environmental influence.

Samples processed for actual ethanol production revealed fairly small differences across hybrids with the range extending from a low of 2.73 US gallons per bushel (10.3 litres) to a high of 2.91 US gallons per bushel (11.0 litres). And, once again environmental impacts were large for ethanol production from the grain samples.

When we tested to see if there was a relationship between the NIR starch value and actual ethanol production we found none. Interestingly, there was a significant relationship between protein content and ethanol production. This relationship, although not very strong, is illustrated in Figure 1 (found on page 35) and points to the fact that as protein decreased in a grain sample ethanol production tended to increase.

So if you look at Figure 1 you might imagine a system where a "relatively" economical NIR type testing of a truck load of corn would have some predictive value as to how efficiently that grain would produce ethanol.



The results from this modest study indicated some real challenges with "labeling" hybrids as being more productive for ethanol without considering environmental factors.

Seed companies are undoubtedly differences are significant and can affect ethanol yields expected from corn hybrids. However, Syngenta also found significantly higher performing genetics when compared across environments, which this study did not confirm. In addition, Syngenta has not found any reliable relationship between simple starch or protein levels and eventual ethanol production and believes that the relationship found in this study between lower protein and higher ethanol production may be a result of the small number of samples.

Bauman did emphasize however that there is a real future in developing hybrids with higher ethanol production potential and in developing rapid tests that can assess the grain and predict ethanol yield from that grain.

As a final note we tried to find an ethanol plant in North America where a premium was actually being paid for certain hybrids or grain traits (i.e. high starch) and were unsuccessful; perhaps in the near future.

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Figure 1. Relationship between protein and ethanol production.