GRAIN QUALITY Task Force

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Purdue University

1995 Indiana Corn Quality Survey - Composition Data

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Value added grains and oilseeds (or, Specialty Grains, Identity Preserved Grains, High Value Crops, Super Commodities) have specific traits that have been genetically developed for specific end use purposes, such as for corn dry and wet milling, snack food manufacturing, and peroxidase recovery from soybean hulls. Examples include food grade white and yellow corn, waxy corn, high oil corn, and high peroxidase soybeans. High value end use products include starch, sweeteners, oil, snack foods, seed, gluten feed, tofu, and high protein animal feeds.

Grain quality properties can be defined in terms of physical, sanitary and intrinsic quality characteristics (see Grain Quality Fact Sheet GQ-23). Maximizing intrinsic quality factors, such as protein, oil and starch content, can increase product value by 10 - 40 cents per bushel, or more. The markets for grains and oilseeds are beginning to recognize the potential of these factors with respect to product differentiation and new marketing opportunities. Intrinsic quality factors are becoming more important than the standard grade factors for marketing.

This fact sheet summarizes the first year of composition data compiled for corn samples collected in Indiana during the 1995 harvest.

Composition Analysis

Intrinsic characteristics (or, Chemical Properties, Traits, Composition Factors), such as starch, protein and oil, can be quantified in whole kernels of corn and soybeans using state-of-the-art Near Infrared Transmittance (NIT) scanners. Producers, handlers, processors and plant breeders need access to this rapid-analysis tool to quantify these intrinsic factors precisely in order to develop and expand value-added marketing opportunities. Unfortunately, only a few of these machines are currently available and are being utilized. Additionally, only Iowa has had a long-term effort in place for developing a public database of composition values for both corn and soybeans grown in that state.

Testing for composition of corn and soybeans should be of interest and importance to:

(1) Crop producers interested in taking advantage of premiums for quality grain.

(2) Livestock feeders aiming at optimizing ration formulation, and utlizing higher protein and oil grains for feeds.

(3) Elevators merchandising grain based on desired quality parameters.

(4) Processors in need of grain qualities that optimize milling and end product yield.

(5) Exporters competing in foreign markets.

(6) Plant breeders striving to develop specialty corn and soybean varieties.

Methodology

Whole ear corn samples were taken directly from the field as part of a multi-year survey conducted by the Purdue University Botany and Plant Pathology Department. Sampling was conducted by the Indiana Agricultural Statistics Service in West Lafayette. Samples were analyzed for fungal damage, and myxotoxin level was quantified (see GQ-25). Each ear corn sample consisted of 5-10 ears, which were placed in cotton bags. After the disease analysis, each bag of ears was dried with forced air and subsequently shelled with a stationary sheller. After shelling, about 400 grams of whole kernels were removed from each bag sample. These subsamples were shipped to the Iowa State University Grain Quality Laboratory in Ames, Iowa for analysis of moisture, protein, oil, starch and density.

A total of 151 samples were available for composition analysis. The number of samples from each crop reporting district was roughly proportional to the corn acreage and production in each district with two exceptions (Table 1). The North Central district was slighlty over-represented, and the South West district was slighlty under-represented.

Results

Average protein values across the State were fairly evenly distributed with the exception of the South Central district (Table 2). There, protein levels were significantly lower (7%) than the state average of 7.7%. Feed samples from the Indiana State Chemist Office taken from feed mills around the state average about 7.5% protein, which confirm the values in this survey. However, these values are significantly lower than the average nutrient content of 8.5% crude protein generally ascribed to corn (see the Pork Industry Handbook PIH-23 Swine Diets). The impact on formulating a diet is significant. For example, to mix a one-ton 15% protein swine ration by combining a 36% protein supplement and 8.5% protein corn would require 473 lb of supplement and 1,527 lb of corn. Corn with only 7.7% protein requires 516 lb of supplement and 1,484 lb of corn, a shift of 43 lb. This problem is further heightened by the fact that protein levels in corn were as low as 5.7% or as high as 9.7%. Thus, 5.7% protein corn would require an additional 141 lb of corn, while 9.7% protein corn would require 70 lb less supplement. In order for livestock feeders to be able to formulate their rations consistently, they should take advantage of this new, rapid and inexpenisve method of composition analysis.

Lower protein values generally result in higher starch values. Thus, as expected, corn in the South Central district was higher in starch compared to other districts (Table 2). Higher starch values are especially desirable to wet millers, whose highest value end products are starch and sweeteners. The range within the samples tested from across the state is about 5 percentage points. Oil content is fairly evenly distributed across the state with the exception of the South Central district, which has an average oil value of about 0.4 percentage points higher than the

Table 1. Summary of the 1995 Indiana Corn Acres, Yields and Production (January 1, 1996 Estimates) (see Table 2 for number of samples).

District	Harvested Acres	Acres per Sample (1,000s)	Yield (bu/ac)	Production (1,000 bu) per Sample	Production (in 1000's)
1 NW	925	38,542	111	102,000	4,250
2 NC	720	24,828	114	80,600	2,779
3 NE	470	39,167	114	51,978	4,332
4 WC	700	38,889	110	76,446	4,247
5 C	1,160	32,222	114	131,089	3,641
6 EC	400	36,364	113	44,486	4,044
7 SW	690	57,500	113	76,942	6,412
8 SC	165	32,400	108	17,137	3,427
9 SE	170	42,500	112	18,222	4,556
State	5,400	35,762	113	598,900	3,966

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state average of 3.3%. Density is another important quality indicator. Generally, the denser the kernel, the harder and more desirable for dry millers and snack food manufacturers. The average across the state is 1.26 g/cm^3, with values as low as 1.20 g/cm^3 and as high as 1.31 g/cm^3.

Finally, these results only give an indication of the composition values of corn across Indiana. Conditions during the growing season, hybrid selection, and soil fertility significantly affect intrinsic values. Producers need to have their own samples analyzed to get more precise values. Beginning with the 1996 harvest season, producers, elevators, processors and breeders in Indiana will be able to submit corn and soybean samples for composition analysis to Purdue University's Grain Quality Laboratory (Call 1-800-872-1920 for more information). Thus, this database will be further expanded to include additional samples from variety trials across the state. Both corn and soybeans will be analyzed. At the time of writing this fact sheet, procedures for submitting samples and charges for conducting analysis are still being formulated.

Grain Quality Fact Sheets can be accessed on-line through:

World Wide Web (Mosaic or Netscape) URL address: http//:hermes.ecn.purdue.edu:8001/server/purdue/acspub.html

(select) Grain Quality

or

Almanac:

send e-mail to: almanac@ecn.purdue.edu

message: send grain guide
or send grain catalog
or send grain factsheet#12 (for example)
or send acsonline GQ-12

Table 2. Summary of the 1995 Indiana Corn Composition Survey (15% Moisture Basis)

District	Number of Samples	Protein (%) Avg.	Protein (%) Range	Oil (%) Avg.	Oil (%) Range	Starch (%) Avg.	Starch (%) Range	Density (g/cm^3) Avg.	Density (g/cm^3) Range
1 NW	24	7.9	6.5-8.9	3.3	2.8-4.9	62.0	60.0-63.5	1.27	1.21-1.31
2 NC	29	7.7	6.3-9.7	3.4	2.9-4.0	61.7	60.1-63.0	1.26	1.21-1.29
3 NE	12	7.7	5.7-9.3	3.4	3.0-3.8	62.0	59.9-64.4	1.26	1.20-1.28
4 WC	18	7.7	6.4-9.4	3.3	2.9-3.8	61.9	60.5-63.6	1.26	1.22-1.30
5 C	36	7.6	6.0-9.2	3.3	2.8-3.8	62.4	60.0-64.8	1.27	1.23-1.30
6 EC	11	7.7	6.6-9.3	3.3	2.9-3.9	61.7	60.2-63.1	1.27	1.24-1.29
7 SW	12	7.9	6.9-8.5	3.2	2.6-3.7	62.4	61.2-63.5	1.28	1.24-1.31
8 SC	5	7.0	5.9-8.5	3.7	3.4-4.3	63.0	61.5-64.0	1.27	1.26-1.29
9 SE	4	7.6	7.1-8.5	3.4	3.1-3.6	62.2	61.8-62.7	1.28	1.27-1.28
All	151	7.7	5.7-9.7	3.3	2.6-4.9	61.7	59.9-64.8	1.26	1.20-1.31