



## Task Force

### 1999 Indiana Corn Composition Data

*Dirk E. Maier & Jason Reising, Agricultural & Biological Engineering;  
Ralph W. Gann, Indiana Agricultural Statistics Service*

This fact sheet summarizes the composition data compiled for corn samples collected in Indiana during the 1999 harvest. District results are presented and composition data from the 1995, 1996, 1997, and 1998 crop years are compared.

#### 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. The Indiana Agricultural Statistics Service in West Lafayette conducted the sampling. Samples were analyzed for fungal damage, and mycotoxin levels were quantified. 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 using a stationary sheller. After shelling, the whole kernels were analyzed for moisture, protein, oil,

starch, and density using a near-infrared transmittance (NIRT) whole grain analyzer (Infratech 1229) at the Purdue University Grain Quality Laboratory in the Department of Agricultural and Biological Engineering. All results are reported on a 15% moisture content basis (wet).

A total of 299 samples were available for composition analysis from all nine crop-reporting districts. The number of samples from each crop-reporting district was roughly proportional to the corn acreage although the East Central and Southeast districts were slightly over-represented this year (Table 1). In comparison to the previous year, the acres per sample increased by approximately 850 acres per sample while production per sample decreased again this year by 18,000 bushels per sample from the 1998 all time low due to decreased production statewide in 1999.

**Table 1. Summary of the 1999 Indiana corn acres, yields, and production.**

District	Harvested Acres (1000's)	Acres per Sample	Yield (Bu/ac)	Production (1000 Bu)	Production (1000 Bu) per Sample
NW	910	22,195	136	123,767	3,019
NC	765	20,132	117	89,510	2,356
NE	565	29,737	116	65,544	3,450
WC	715	17,439	132	94,385	2,302
C	1,250	18,657	142	177,509	2,649
EC	450	14,516	138	62,103	2,003
SW	730	17,381	129	94,175	2,242
SC	185	23,125	109	20,166	2,521
SE	180	15,000	113	20,341	1,695
<b>State</b>	<b>5,750</b>	<b>19,231</b>	<b>130</b>	<b>747,500</b>	<b>2,500</b>
<b>1998</b>	<b>5,500</b>	<b>18,377</b>	<b>134</b>	<b>760,350</b>	<b>2,518</b>
<b>1997</b>	<b>5,850</b>	<b>36,792</b>	<b>123</b>	<b>719,550</b>	<b>4,525</b>
<b>1996</b>	<b>5,600</b>	<b>26,794</b>	<b>123</b>	<b>670,350</b>	<b>3,207</b>
<b>1995</b>	<b>5,400</b>	<b>35,762</b>	<b>113</b>	<b>598,900</b>	<b>3,966</b>

## Results

The overall state protein average increased 1.3 percentage points to 7.8% (Table 2, Figure 1) from the 1998 average. This value is very close to the state averages for the years 1995-1997. The spread between the minimum and maximum protein contents increased to 10.5 points, an increase of more than 1.5 times compared to the 1998 spread, which was 6.3 points. The 1999 spread is the largest to date, showing more variability in the samples received since 1997, which was 7.4 points and spreads of 5.4 and 4.0 for 1996 and 1995 respectively.

Generally, protein content is negatively correlated to starch content, however, the measured starch content provided in the following tables may not equal the extractable starch content available to processors. While the protein average increased in 1999, the starch content decreased 1.3 percentage points to 62.8% (Table 2, Figure 2). Starch ranges increased for the fourth straight year to 10.7 points, up from 10.0 points in 1998 and 9.6, 6.2, and 4.9 points for 1997, 1996, and 1995 respectively. Thus, the 1999 corn crop was more variable in its major constituents than in previous years.

This increased variability may reflect an increase in the types of corn grown for niche markets by Indiana farmers. The average oil content increased 0.1 percentage points to 3.3%. However, average oil contents have essentially remained unchanged for the past five years even though four high oil corn samples were included in the 1999 survey. Density is an indication of kernel hardness. There was an increase of 0.023

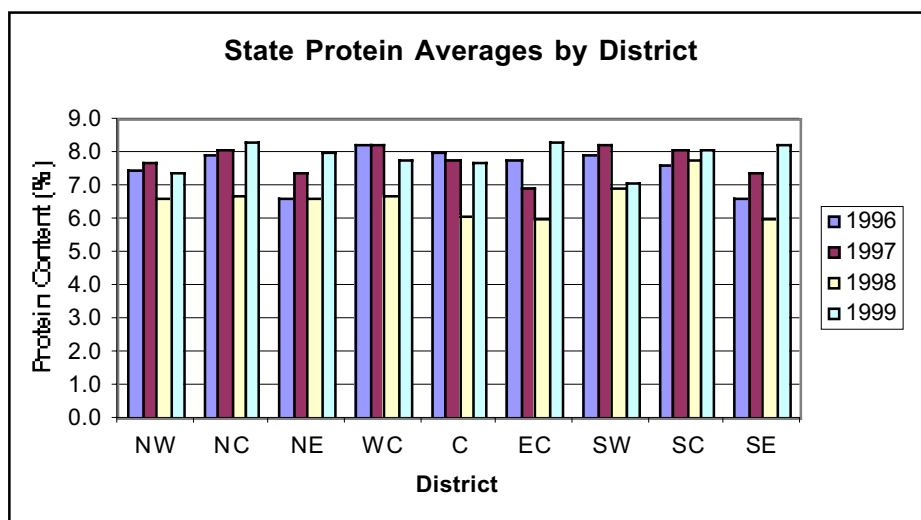


Figure 1. Protein Averages by District

Table 2. Summary of the 1999 Indiana corn composition survey (15% moisture basis).

District	Samples	Protein (%)		Oil (%)		Starch (%)		Density (g/ml)	
		Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range
NW	41	7.4	5.5-9.5	3.6	2.6-7.1	62.6	57.2-65.7	1.308	1.247-1.382
NC	38	8.3	5.5-12.0	3.4	2.7-4.4	62.2	57.2-65.1	1.336	1.269-1.385
NE	19	8.0	6.5-10.5	3.3	2.9-3.8	62.7	60.3-64.1	1.317	1.294-1.343
WC	41	7.8	5.2-10.7	3.3	2.4-4.4	62.9	59.6-65.2	1.327	1.283-1.379
C	67	7.7	4.9-10.3	3.3	2.4-4.3	62.9	59.8-65.2	1.327	1.278-1.391
EC	31	8.3	5.3-15.1	3.3	2.4-4.0	62.3	55.4-65.4	1.320	1.277-1.358
SW	42	7.1	4.6-9.3	3.1	2.4-3.9	63.7	58.2-66.1	1.318	1.252-1.367
SC	8	8.1	5.8-10.5	3.3	2.7-4.0	62.6	59.4-65.5	1.309	1.300-1.319
SE	12	8.2	5.9-11.1	3.3	2.8-3.9	62.3	58.4-64.8	1.316	1.265-1.382
<b>State</b>	<b>299</b>	<b>7.8</b>	<b>4.6-15.1</b>	<b>3.3</b>	<b>2.4-7.1</b>	<b>62.8</b>	<b>55.4-66.1</b>	<b>1.322</b>	<b>1.247-1.391</b>
<b>1998</b>	<b>302</b>	<b>6.5</b>	<b>3.3-9.6</b>	<b>3.2</b>	<b>2.1-6.9</b>	<b>64.1</b>	<b>58.0-68.0</b>	<b>1.299</b>	<b>1.219-1.355</b>
<b>1997</b>	<b>159</b>	<b>7.9</b>	<b>4.5-11.9</b>	<b>3.3</b>	<b>2.5-7.2</b>	<b>61.9</b>	<b>55.3-64.9</b>	<b>1.302</b>	<b>1.200-1.339</b>
<b>1996</b>	<b>209</b>	<b>7.8</b>	<b>5.4-10.8</b>	<b>3.3</b>	<b>2.5-4.6</b>	<b>61.2</b>	<b>57.3-63.5</b>	<b>1.270</b>	<b>1.170-1.330</b>
<b>1995</b>	<b>151</b>	<b>7.7</b>	<b>5.7-9.7</b>	<b>3.3</b>	<b>2.6-4.9</b>	<b>61.7</b>	<b>59.9-64.8</b>	<b>1.260</b>	<b>1.200-1.310</b>

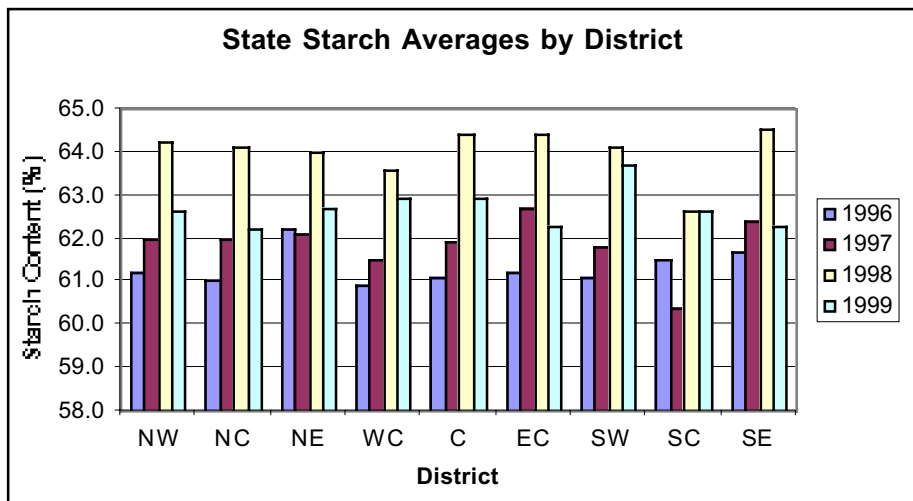


Figure 2. Starch Averages by District

Table 3. Statistical Analysis Across Years.

	Protein	Oil	Starch	Density
1996	A	A	D	C
1997	A	A	C	B
1998	B	B	A	B
1999	A	A	B	A

g/ml to 1.322 g/ml in average density when compared to the 1998 data.

The results in Table 2 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 such as protein, oil, starch, and density. Producers need to have their own samples analyzed to get more precise values.

### Analysis

A statistical analysis was performed on the data collected from the last four years using Statistical Analysis Software (SAS) to uncover differences between years and between districts within a year. All tests used an alpha of 0.05. District summary values for 1996, 1997, and 1998 can be found in Grain Quality Fact Sheets 32, 37, and 40, respectively. The results of the analysis can be found in Tables 3 and 4. In Table 3, for each compositional component the years with the same letter are statistically similar, while in Table 4, the districts with the same letter are similar within the year.

Yearly trends are apparent in the analysis of the data, showing that 1998 was the only year in which the statewide protein content average was statistically different than the other years (Table 3). In 1996, the NE and SE districts were similarly low in protein compared to all other districts (Table 4). In 1997 and 1999, all districts were statistically similar in protein, while in 1998 the SC

district was higher in protein compared to all other districts. The SW and WC districts had consistently higher protein averages. In the past three out of four years, they have been in the top three districts. The SW district had the third highest average in 1996 (7.9%), the highest in 1997 (8.2%), and the second highest in 1998 (6.9%). However, in 1999, it had the lowest protein average of the state at 7.1%. The WC district had the highest average in 1996 (8.2%), the second highest in 1997 (8.2%), and the third highest in 1998 (6.7%). In 1999, the WC district slipped to sixth place. The NE district had the lowest average at 6.6% in 1996, while the EC district had the lowest averages for 1997 and 1998 with 6.9 and 6.0%, respectively. The SE district had the second lowest averages in all three years with 6.6, 7.4, and 6.0% protein respectively. However, in 1999 the SE district had a 8.2% protein average, second highest in the state.

Oil contents were fairly consistent across the last four years with only 1998 being significantly different (Table 3). In 1996 and 1998, all districts were similar in oil, while in 1997 the SC district was statistically higher in oil compared to all other districts (Table 4). In 1999, the NW district was significantly higher while the SW district was lower compared to all of the other districts. The SE district had the highest oil content average at 3.4% in 1996, but had the lowest average in 1997 (3.1%) and was tied for the lowest in 1999 with a 3.3 average. The SC district had the highest averages in both 1997 and 1998, 4.3% and 3.4%

Table 4. Statistical Analysis Across Districts Within a Year.

District	Protein	Average	Oil	Average	Starch	Average	Density	Average
<b>1996</b>								
NW	A	7.5	A	3.4	A, B	61.2	A	1.267
NC	A	7.9	A	3.4	B	61.0	A	1.272
NE	B	6.6	A	3.1	A	62.2	A	1.257
WC	A	8.2	A	3.3	B	60.9	A	1.281
C	A	8.0	A	3.3	A, B	61.1	A	1.273
EC	A	7.8	A	3.3	A, B	61.2	A	1.276
SW	A	7.9	A	3.3	A, B	61.1	A	1.276
SC	A	7.6	A	3.4	A, B	61.5	A	1.281
SE	B	6.6	A	3.4	A	61.7	A	1.253
<b>1997</b>								
NW	A	7.8	A	3.4	A	61.9	A	1.309
NC	A	8.0	A	3.1	A	62.0	A	1.306
NE	A	7.3	A	3.4	A	62.1	A	1.285
WC	A	8.2	A	3.5	A	61.5	A	1.294
C	A	7.8	A	3.3	A	61.9	A	1.306
EC	A	6.9	A	3.3	A	62.7	A	1.301
SW	A	8.2	A	3.2	A	61.8	A	1.308
SC	A	8.1	B	4.3	A	60.4	A	1.289
SE	A	7.4	A	3.1	A	62.4	A	1.286
<b>1998</b>								
NW	A	6.6	A	3.1	A	64.2	A, B	1.302
NC	A	6.7	A	3.1	A	64.1	A, B	1.305
NE	A	6.6	A	3.1	A	64.0	A, B	1.304
WC	A	6.7	A	3.4	A	63.6	B	1.290
C	A	6.1	A	3.2	A	64.4	A, B	1.296
EC	A	6.0	A	3.1	A	64.4	B	1.293
SW	A	6.9	A	3.0	A	64.1	A	1.315
SC	B	7.8	A	3.4	B	62.6	A, B	1.296
SE	A	6.0	A	3.1	A	64.5	B	1.289
<b>1999</b>								
NW	A	7.4	A	3.6	A	62.6	B	1.307
NC	A	8.3	A, B	3.4	A	62.2	A	1.336
NE	A	8.0	A, B	3.3	A	62.7	A, B	1.317
WC	A	7.8	A, B	3.3	A	62.9	A, B	1.327
C	A	7.7	A, B	3.3	A	62.9	A, B	1.327
EC	A	8.3	A, B	3.3	A	62.3	A, B	1.320
SW	A	7.1	B	3.1	A	63.7	A, B	1.318
SC	A	8.1	A, B	3.3	A	62.6	B	1.309
SE	A	8.2	A, B	3.3	A	62.3	A, B	1.316

respectively. The NC district had the second highest average in 1996 with 3.4%, while the WC district was second for both 1997 and 1998 and ranked fourth in 1999 with averages of 3.5, 3.4, and 3.3% respectively. The NW district had

the highest average in 1999, averaging 3.6%. The NE district had the lowest average in 1996 with 3.1% while the SW district had the lowest in 1998 and 1999 with 2.9% and 3.1% average respectively.

Starch content has been statistically different in each of the last four years, with 1998 having the highest average followed by 1999, 1997, and 1996 respectively (Table 3). In 1996, the NC and WC districts were statistically lower in starch than all other districts, while the NE and SE districts were statistically higher than all other districts (Table 4). In 1997 and 1999, there was no significant difference among districts in starch content, while in 1998, the SC district was significantly lower compared to all other districts. The SE district was in the top three districts in overall starch content average three out of four years. In 1996, the NE district had the highest average with 62.2%, followed by the SE and SC districts (61.6%, and 61.4% respectively). EC district had the highest average in 1997, with SE district second (62.4%) and the NE district third with a 62.1% average. The SE district had the highest average of 64.5% in 1998, while the EC and C districts were second and third respectively (64.4% and 64.3%). The SW district had the highest average at 63.7% in 1999, while the WC and C districts were second highest with a 62.9% average. The WC district had one of the two lowest averages in three out of four years of the survey. The WC district had the lowest average in 1996 (60.9%), and second lowest in 1997 and 1998 with a 61.5% and 63.6% average, respectively. The C district had the third lowest average in 1996 and 1997 with 61.1% and 61.9%, respectively. The NC district had the lowest average at 62.2% in 1999, followed by the EC and SE districts, which averaged 62.3%.

Two of the years, 1997 and 1998, were statistically similar with regards to density, while 1999 had the highest average and 1996 had the lowest (Table 3). In 1996 and 1997, all districts were similar in density values, while in 1998 the SW district was significantly higher and the WC, EC, and SE districts were lower compared to all other districts (Table 4). The NC district was significantly higher in density while the NW and SC districts had significantly lower values in 1999. The SW district was in the top three districts in three out of four years, being third in 1996 (1.276 g/ml), second in 1997 (1.308 g/ml) and had the highest average in 1998 (1.315 g/ml). The NC district had the third highest average in

1997, the second highest average in 1998 and the highest average in 1999 (1.306, 1.305, and 1.336 g/ml respectively). The SE district was in the bottom three each of the four years. It had the lowest average in 1996 and 1998 with averages of 1.253 and 1.289 g/ml respectively. In 1997, the SE district had the second lowest average with 1.286 g/ml and in 1999 had the third lowest average (1.316 g/ml).

Purdue University's Grain Quality Laboratory continues to offer composition analysis for whole corn, soybeans, and soybean meal. This service is offered at *no charge* to Indiana producers, elevators, and processors thanks to Value-Added Grants from the Office of the Indiana Commissioner of Agriculture and a grant from the Mary S. Rice Farm Estate. 450 g (about 1 lb.) may be sent to:

Grain Quality Laboratory  
1146 ABE  
Purdue University  
West Lafayette, IN 47907-1146

For further information, call (765) 494-2285, or send e-mail to [grainlab@ecn.purdue.edu](mailto:grainlab@ecn.purdue.edu), or visit us on the World Wide Web at <http://www.GrainQuality.org>, where data from a number of county test plots are summarized.

Grain Quality Fact Sheets can be accessed on-line through the World Wide Web at: <http://www.agcom.purdue.edu/AgCom/Pubs/grain.htm>

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