

Quality of the United States Soybean Crop: 2009¹

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Summary

The American Soybean Association and the US Soybean Export Council have supported a survey of the quality of the US soybean crop since 1986. This survey is intended to provide new crop quality data to aid international customers with their purchasing decisions for the upcoming year.

2009 Acreage, Yields, and Total Production

According to the November 10, 2009 United States Department of Agriculture, National Agricultural Statistics Service (USDA-NASS) crop report, the total US soybean production area is expected to increase slightly (3%) from last year to 31.0 million hectares harvested (Table 1). With average soybean yields expected to be higher than in 2008, total US soybean production is expected to be 90.4 million MT. If realized this will be the largest soybean crop in history. However, due to late season harvest difficulties, a reduction in the estimated total production is expected.

Quality of the 2009 US Soybean Crop

By August 28, 2009 sample kits were mailed to approximately 7,000 producers. Producers were selected based on total land devoted to soybean production in each state, so that response distribution would closely match soybean production. Due to difficult harvest conditions throughout the US, only 1,602 samples were received by November 16, 2009. These were analyzed for protein and oil concentration by near-infrared spectroscopy (NIRS) using a Perten DA7200 diode array instrument (Huddinge, Sweden) equipped with calibration equations developed by Perten in cooperation with the University of Minnesota. Regional and national average protein values were determined by computing weighted averages using state and regional soybean production values, so that average values better represent the crop as a whole. Results can be found in Table 2.

Interpretation of Protein and Oil Results

Average protein and oil concentrations for the 2009 overall US soybean crop differed from the 2008 US soybean crop. Average US soybean protein concentration was 1.2% higher in 2009, at 35.3%, and average oil was 0.5% lower, at 18.6%, when compared with 2008 (Table 4). It should be noted however, that 2008 was a historic year for low protein. The 2009 crop has

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nearly identical quality characteristics to the long-term average (35.3% protein and 18.7% oil). As is noted in most years, Western Corn Belt states tended to have lower protein concentrations than the average US crop, while Midsouth and Southeast states tended to have higher than average oil concentrations.

Interpretation of Foreign Material Results

Foreign material (FM) found in samples was on average very low (Table 3). Foreign material among the 1,211 (as of 3 November) farmer collected samples evaluated for FM averaged 0.22%, with an overall range of 0 to 4.5%. Of 1,211 samples, 1,180 had FM below 1%, and 31 (2.6%) had FM greater than 1%. Only 14 (1.2%) had FM above 2%. While there was a tendency for samples harvested from Southern, Midsouth and Eastern states to have somewhat above average FM, individual samples with more than 2% FM could be found in all regions.

Interpretation of Seed Size Results

While seed size may not be important for most commodity soybean purchasers, seed size does provide some insight into the environmental conditions present during the production season. Seed size can also be correlated with changes in protein and oil concentration due to these same environmental conditions. In general, environmental stresses such as drought in the early seed-filling period (late July and early August) tend to reduce the number of seeds on individual plants; if conditions return to normal later, these remaining seeds can expand, resulting in larger than average seed size. Alternatively, stresses at the end of the seed-filling period (late August through September) reduce the energy available for each seed and seed size may be smaller than average.

In 2009, seed size was slightly larger than in 2008 with the average seed size increasing from 15.3 grams per 100 seeds in 2008 to 16.3 in 2009 (Table 3). Seed size tended to be largest in the Eastern Corn Belt states.

Climate Summary

Crop conditions through the summer reflect the influence of the weather. However, while a higher percentage of the 2009 crop was in good or excellent condition compared to the same June – October period in 2008, the below normal temperatures and above normal precipitation during the 2009 harvest season impacted the timeliness of harvesting and thus decreased the number of samples available for inclusion in the 2009 US Soybean Quality Survey. Additional samples are currently being analyzed and these will be included in an updated report available January 2, 2010.

Planting: *April* precipitation in the Midwest was generally above normal, with most of the region receiving precipitation exceeding normal by 50%. Drought conditions in the upper Midwest eased somewhat with abundant snow and rain. Flooding was a major concern from northern Missouri to southern Michigan and along the Red River in northwest Minnesota early in April. Mean monthly temperatures were near average or below to the north early in the month, but there was an area of much warmer than normal temperatures through the Ohio River Basin

during the last 10 days of April. *May* was very wet across the central Midwest (Missouri through Michigan as well as northwest Minnesota), with the exception of northwest Iowa, central and southern Minnesota, and northwest Wisconsin and upper Michigan where drought conditions persisted and expanded. The wet spring led to delayed soybean planting for the Midwest, except in Iowa, Minnesota, Wisconsin, and Ohio. Temperatures in May were cooler than normal mid-month, and then rose to record levels May 19-21.

Mid-season: *June* brought heavy rainfall to the southern half of the Midwest, while moderate to severe drought continued across eastern Minnesota, northern Wisconsin, and the Upper Peninsula of Michigan, and spread to western Minnesota. Cooler than average temperatures continued into early June, but the last two weeks of June brought above normal, even record high temperatures, and humidity to the entire Midwest region. The nine-state Midwest region experienced the coldest *July* on record, about 4.5° below average temperature. Moderate to severe drought continued in east central Minnesota, and upper Wisconsin and Michigan. Above normal rainfall (as much as 150% of normal) occurred in parts of Missouri, Illinois, Kentucky, and Iowa. Crop development was behind schedule, due to various combinations of late planting, dry conditions in some areas, and cool weather. Temperatures during *August* remained cooler than normal, with the exception of August 8-17, when temperatures rose to normal or above normal. Heavy rain (175 to nearly 300% of normal) repeatedly fell in an area across the central Midwest, from northwestern Missouri through Iowa into northern Illinois. In *September*, parts of Missouri, Illinois, Indiana, Ohio, and Kentucky received above normal precipitation. Drought conditions continued to persist and worsen in the upper Midwest and arose in northern Indiana and northwest Ohio. Average temperatures across the Midwest were near normal, with the exception of Minnesota, northern Wisconsin and upper Michigan, where temperatures ran above normal. Minnesota experienced its second warmest September ever.

Harvest: in *October* (1st to 25th), the average Midwest temperature departure from the mean ranged between -1° to -12°F. Additionally, total precipitation ranged from 100 to 300% of the mean across major soybean growing states. Soybean harvest has occurred at a near record slow pace with only 51% of the crop harvested as of November 1 (Figure 1 - NASS, 2009). Soybean harvest at the time of this report is about 3 weeks behind the three-year average. Many US soybean producers faced unprecedented challenges during the harvest season. In many areas, rains began just as the soybean crop reached maturity. Wet field conditions and cloudy and rainy days kept producers from harvesting their soybean crop in a timely manner.

US soybean farmers are normally assisted by dry conditions during the fall harvest season when the Midwest receives only about 25-35mm of rainfall during a typical October. However, this year precipitation for the month of October was above normal in all soybean production areas of the US. Some areas in Missouri and Illinois received 3-4 times the normal rainfall during the month of October. This equals more than 250mm of rainfall above normal.

Soybean farmers rely on natural drying of the soybean crop in the field, and typically harvest soybeans at less than 13% moisture. Soybean is difficult to harvest when the soybeans contain more than 13% moisture, and long term storage of wet soybeans can be difficult. Many farmers have been forced to harvest soybean with moisture contents of 15-20% due to the excessive rains throughout the normal harvest season. While it is possible to dry soybeans in large drying systems designed for corn, US producers are also faced with large quantities of high moisture corn this fall. At this time, it is too early to estimate the impact on the overall US crop of this

difficult harvest season. It is likely that quality losses will occur due to improper storage conditions, but it is difficult to predict the scale of this problem. Early November weather has allowed producers to get back into the fields and finish their soybean harvest.

Soybean Rust

Soybean rust (*Phakopsora pachyrhizi*) is a fungal pathogen of soybean that is known to cause very large yield losses in South America; it was first reported in the continental US in November of 2004. Soybean rust is spread by spores, but it requires a living host to remain viable over winter periods. In the US it is known to overwinter on a weedy plant, kudzu, in large areas of Florida and extreme southern Texas. Outbreaks of soybean rust on commercially produced soybean crops have been noted since 2005. Each year, soybean rust has spread further into the central soybean producing regions of the US.

In 2009, soybean rust developed in early spring along the Gulf Coast states, and was detected in Louisiana relatively early in the season. Disease spread was low throughout most of the summer, then rapidly increased in the south in September and early October. The most northerly detection was in west central Illinois in late September/early October, but was of no significance. In Mississippi, this may be the first year that soybean rust caused yield loss – Mississippi may be the only state where soybean rust was more severe in 2009 than in 2008 (D. Malvick, personal communication).

As of October 26, 2009, soybean rust has been reported in 16 states (Alabama, Arkansas, Georgia, Florida, Illinois, Louisiana, Kansas, Kentucky, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia). Rust was also reported in 3 states and 6 municipalities (counties) in Mexico. Soybean rust is expected to spread northward until frost.

References

Federal Grain Inspection Service. 2004. Test Weight. *In* Grain Inspection Handbook II (Chapter 10). Washington DC: USDA-GIPSA-FGIS.

National Agricultural Statistics Service. 2009. Available at (verified 10, November, 2009) <<http://usda.mannlib.cornell.edu/usda/nass/CropProg//2000s/2009/CropProg-10-05-2009.pdf>>. USDA-NASS, Washington, DC.

Midwestern Regional Climate Center (MRCC) <<http://mcc.sws.uiuc.edu/cliwatch/watch.htm>>. Champaign, IL.

Soybean rust information <<http://sbr.ipmpipe.org/cgi-bin/sbr/public.cgi>>

Table 1. Soybean production data for the United States, 2009 crop

Region	State	Yield (MT ha ⁻¹)	Area Harvested (1000 ha)	Production (M MT)
Western Corn Belt (WCB)	Iowa	3.43	3,860	13.2
	Kansas	2.89	1,478	4.3
	Minnesota	2.82	2,876	8.1
	Missouri	2.96	2,147	6.4
	Nebraska	3.49	1,924	6.7
	North Dakota	2.02	1,559	3.1
	South Dakota	2.75	1,701	4.7
	Western Corn Belt	2.9	15,544	47 51.5%
Eastern Corn Belt (ECB)	Illinois	3.02	3,787	11.5
	Indiana	3.09	2,199	6.8
	Michigan	2.62	806	2.1
	Ohio	3.23	1,855	6.0
	Wisconsin	2.75	660	1.8
	Eastern Corn Belt	2.9	9,307	28 31.2%
Midsouth (MDS)	Arkansas	2.55	1,365	3.5
	Kentucky	3.09	571	1.8
	Louisiana	2.49	393	1.0
	Mississippi	2.42	867	2.1
	Oklahoma	1.88	150	0.3
	Tennessee	2.75	620	1.7
	Texas	1.55	79	0.1
	Midsouth	2.4	4,044	10 11.6%
Southeast (SE)	Alabama	2.49	174	0.4
	Florida	*	*	*
	Georgia	2.22	182	0.4
	North Carolina	2.28	713	1.6
	South Carolina	1.81	227	0.4
	Southeast	2.2	1,296	3 3.2%
East Coast (EC)	Delaware	2.62	74	0.2
	Maryland	2.89	192	0.6
	New Jersey	2.69	35	0.1
	New York	2.89	102	0.3
	Pennsylvania	3.16	180	0.6
	Virginia	2.49	235	0.6
	East Coast	2.8	819	2 2.5%
	*Other States (FL and WV)	2.56	21	0.05 0.06%
USA 2009		2.91	31,031	90.4
USA 2008		2.64	30,121	79.6

Source: United States Department of Agriculture, NASS 2009 Crop Production Report (November 10, 2009)

Table 2. United Soybean Board/American Soybean Association 2009 Soybean Quality Survey Data

Region	State	Number of Samples	Protein (%)*		Oil (%)*	
			Percent Average	Std. dev.	Percent Average	Std. dev.
Western Corn Belt (WCB)	Iowa	266	34.7	1.2	18.6	0.7
	Kansas	47	35.0	1.1	18.6	0.7
	Minnesota	246	34.6	1.3	18.8	0.8
	Missouri	70	35.4	1.0	18.6	0.9
	Nebraska	147	34.7	1.2	18.5	0.8
	North Dakota	39	34.9	1.3	18.4	0.9
	South Dakota	76	34.6	1.2	18.3	0.8
Averages† Ranges	Western Corn Belt Western Corn Belt	891	34.8 (28.3-38.6)	1.2	18.6 (15.8-21.0)	0.8
Eastern Corn Belt (ECB)	Illinois	217	35.8	1.2	18.1	0.9
	Indiana	95	36.0	1.1	18.3	0.9
	Michigan	55	35.9	1.3	18.1	0.8
	Ohio	128	35.8	1.2	18.5	0.9
	Wisconsin	38	34.4	1.1	18.3	0.6
Averages† Ranges	Eastern Corn Belt Eastern Corn Belt	533	35.8 (31.8-39.6)	1.2	18.2 (15.7-20.8)	0.9
Midsouth (MDS)	Arkansas	46	36.1	1.6	19.9	1.2
	Kentucky	17	34.9	1.1	19.2	0.8
	Louisiana	7	36.3	2.0	20.2	0.9
	Mississippi	16	36.7	1.5	20.3	1.5
	Oklahoma	2	37.6	0.9	20.1	0.6
	Tennessee	18	35.9	1.3	20.0	1.0
	Texas	2	36.6	1.7	19.0	0.0
Averages† Ranges	Midsouth Midsouth	108	36.1 (31.8-40.0)	1.5	19.9 (17.3-23.7)	1.1
Southeast (SE)	Alabama	2	34.1	0.6	19.8	0.2
	Florida	1	36.5		18.2	
	Georgia	2	35.5	0.9	19.9	0.7
	North Carolina	20	35.9	1.5	19.4	1.1
	South Carolina	0				
Averages† Ranges	Southeast Southeast	25	35.5 (33.0-38.4)	1.0	19.5 (17.8-22.0)	0.7
East Coast (EC)	Delaware	3	36.1	1.7	19.3	1.3
	Maryland	7	35.1	0.8	18.8	0.9
	New Jersey	3	36.1	0.7	18.6	1.1
	New York	5	35.6	1.3	18.1	1.1
	Pennsylvania	19	35.7	1.4	18.1	1.2
	Virginia	8	35.7	0.7	19.2	0.6
Averages† Ranges	East Coast East Coast	45	35.6 (33.4-39.3)	1.1	18.7 (15.2-20.8)	1.0
USA	Averages	1602	35.2	1.4	18.6	1.0
	Ranges		(28.3-40.0)		(15.2-23.7)	
	Average of 2009 Crop†		35.3	1.2	18.6	0.9
	US 1986-2009 avg.		35.3	1.5	18.7	0.9

* 13% moisture basis

† Regional and US average values weighted based on estimated production by state as estimated by USDA, NASS Crop Production Report (November 10, 2009).

**Table 3. United Soybean Board/American Soybean Association 2009
Soybean Quality Survey Data**

Region	State	Number of Samples	FM		Seed Wt.	
			Percent Average	Std. dev.	g/100 seeds	Std. dev.
Western	Iowa	207	0.20	0.28	16.2	1.6
Corn Belt (WCB)	Kansas	35	0.19	0.33	15.6	1.4
	Minnesota	191	0.20	0.42	16.4	1.8
	Missouri	55	0.24	0.30	16.2	1.3
	Nebraska	124	0.23	0.51	16.3	1.6
	North Dakota	26	0.18	0.24	15.0	1.4
	South Dakota	42	0.29	0.68	16.1	2.0
	Averages† Ranges	Western Corn Belt Western Corn Belt	680	0.22 (0 -4.5)	0.38	16.1 (11.8-22.4)
Eastern	Illinois	155	0.28	0.44	16.7	1.6
Corn Belt (ECB)	Indiana	81	0.21	0.29	16.4	1.6
	Michigan	39	0.11	0.14	16.2	1.6
	Ohio	114	0.15	0.26	16.9	1.4
	Wisconsin	27	0.24	0.39	16.6	3.2
Averages† Ranges	Eastern Corn Belt Eastern Corn Belt	416	0.22 (0 -3.7)	0.34	16.6 (11.7-23.0)	1.7
Midsouth (MDS)	Arkansas	33	0.51	0.66	14.9	1.5
	Kentucky	10	0.19	0.24	15.2	1.2
	Louisiana	7	0.38	0.46	15.9	2.0
	Mississippi	11	0.39	0.46	16.1	1.1
	Oklahoma	2	0.20	0.16	16.7	0.2
	Tennessee	10	0.32	0.38	15.7	1.7
	Texas	2	0.37	0.53	17.1	1.7
Averages† Ranges	Midsouth Midsouth	75	0.38 (0 - 3.0)	0.47	15.5 (12.1-20.0)	1.4
Southeast (SE)	Alabama	1	0.00		16.4	
	Florida	1	0.00		12.8	
	Georgia					
	North Carolina	13	0.41	0.44	14.9	1.4
	South Carolina					
Averages† Ranges	Southeast Southeast	15	0.32 (0 - 1.6)	0.44	15.2 (12.8-18.3)	1.4
East	Delaware	1	0.00		13.1	
Coast (EC)	Maryland	3	0.07	0.06	15.5	0.1
	New Jersey	2	1.36	1.35	15.1	0.0
	New York	3	0.03	0.05	16.0	1.7
	Pennsylvania	13	0.21	0.22	16.2	1.6
	Virginia	3	0.12	0.11	17.2	0.9
Averages† Ranges	East Coast East Coast	25	0.30 (0 - 2.3)	0.36	15.5 (13.1-19.2)	0.8
USA	Averages	1211	0.22	0.40	16.3	1.7
	Ranges		(0 - 4.5)		(11.7 - 23.0)	
	Average of 2009 Crop†		0.24	0.37	16.2	1.6

* 13% moisture basis

† Regional and US average values weighted based on estimated production by state as estimated by USDA, NASS Crop Production Report (October 10, 2009).

Table 4. Historical Summary of Yield and Quality Data for US Soybeans

Year	Yield (kg ha ⁻¹)	Protein* (%)	Oil* (%)	Sum† (%)	Harvested (M ha)	Production (M MT)	Protein Std. Dev.	Oil Std. Dev.
1986	2237	35.8	18.5	54.3	23.6	52.9	1.39	0.70
1987	2278	35.5	19.1	54.6	23.2	52.8	1.59	0.71
1988	1814	35.1	19.3	54.4	23.2	42.2	1.50	0.83
1989	2170	35.2	18.7	53.9	24.1	52.4	1.51	0.82
1990	2291	35.4	19.2	54.6	22.9	52.5	1.22	0.66
1991	2298	35.5	18.7	54.1	23.5	54.0	1.38	0.86
1992	2526	35.6	17.3	52.8	23.6	59.6	1.38	0.97
1993	2190	35.7	18.0	53.8	23.2	50.9	1.24	0.87
1994	2782	35.4	18.2	53.6	24.6	68.6	1.36	0.93
1995	2372	35.5	18.2	53.6	24.9	59.2	1.39	0.86
1996	2526	35.6	17.9	53.5	25.7	64.9	1.25	0.87
1997	2614	34.6	18.5	53.0	28.0	73.2	1.51	0.96
1998	2614	36.1	19.1	55.3	28.5	74.6	1.50	0.81
1999	2452	34.6	18.6	53.2	29.4	72.1	1.88	1.05
2000	2553	36.2	18.7	54.9	29.6	75.6	1.68	0.94
2001	2647	35.0	19.0	54.0	30.0	79.6	1.95	1.07
2002	2486	35.4	19.4	54.8	29.1	72.2	1.58	0.93
2003	2284	35.7	18.7	54.3	29.4	67.2	1.71	1.19
2004	2822	35.1	18.6	53.7	30.0	84.6	1.47	0.90
2005	2889	34.9	19.4	54.3	29.2	83.4	1.46	0.87
2006‡	2869	34.5	19.2	53.7	30.2	86.8	1.64	1.01
2007‡	2802	35.2	18.6	53.8	26.0	72.9	1.23	0.76
2008‡	2641	34.1	19.1	53.2	30.1	79.6	1.40	0.82
2009‡	2909	35.3	18.6	53.9	31.0	90.4	1.21	0.87
Averages (1986-2009)	2503	35.3	18.7	54.0	26.8	67.6	1.48	0.89

Sources: United States Department of Agriculture
Iowa State University
University of Minnesota

*Protein and oil concentrations expressed on a 13% basis moisture

†Sum represents sum of protein and oil concentrations

‡2006 - 2009 quality estimates are weighted by yearly production estimates by state.

Figure 1. US Soybean Planting and Harvest Progress

