

Average Protein and Oil at 13 percent Moisture: Crop Year 2018*

Soybeans are used and valued on the basis of specific compositional characteristics. Since soybeans are relatively high in both protein and oil, they are typically processed to separate the oil and the protein so that each constituent can be effectively utilized in specific applications. The vast majority of soybeans are processed into three different types of commodity products; oil, meal and hulls.

Soybean value is directly related to the combined value of the products that result from a bushel of soybeans. Product value is a function of the amount of each product (i.e. oil, meal and hulls) produced, their respective compositional characteristics and the economic value assigned by the marketplace.

The historic descriptors of soybean compositional value are crude protein and oil levels. Soybeans with different protein and oil levels have different product values when processed.

Percent crude protein in soybeans is directly related to the level of crude protein in the meal that is produced but oil level is also a factor (see below). If commodity soybean meal does not contain a defined minimum level of protein, such as 48% for hi-pro meal, it is subject to discounts.

The percent oil in soybeans is directly related to the pounds of oil produced from a bushel of soybeans. Percent oil is also directly related to the pounds of meal produced per bushel since more pounds of oil per 60-pound bushel means fewer pounds of meal and vice versa. As such, oil level is related to the theoretical maximum protein level in the meal of a soybean with a given level of crude protein. As an example, if two soybeans have the same level of protein but different levels of oil, the soybean with the higher oil level will produce a higher protein meal. While both soybeans have the same pounds of protein per bushel, dividing these pounds into the fewer pounds of meal produced by the higher oil soybean results in a higher percent protein in the meal.

The extent to which soybean composition varies within the U.S. crop has implications for its most efficient use and associated economic value within the context of a given market structure.

A commodity market is based on the concept that product characteristics are uniform. In a commodity market, compositional variation is either ignored or addressed by establishing thresholds that trigger penalties when they are not met. When soybean composition varies, how the market chooses to describe soybean characteristics for purposes of establishing economic value becomes an issue. When the composition of soybeans at the time of delivery is unknown, the safest approach for a buyer is to assume the worst and price accordingly. Under this scenario, the attributed value of a crop is

established by the lower end of its quality range. This has important implications for the prices that farmers receive for their soybeans.

Variability of soybean composition determines the extent to which better management of compositional differences can result in an opportunity to capture greater value. While there are different approaches to addressing this opportunity, the first step is to recognize that it exists.

The following information is based on the NIR analysis of 966 soybean samples grown during 2018 and provided by USDA-National Agricultural Statistics Service (NASS) from their Objective Yield (OY) Survey to USB for further analysis. The soybeans from the USDA-NASS OY survey are obtained from farmer production fields, with the farmer having chosen the variety grown and other agronomic practices.

While crops are often described in terms of average values, the level of variation has significant implications. In fact, it could be argued that an understanding of the amount of variation is of greater importance than average values since the level of variation defines a type of risk that must be factored into market pricing and product usage when not otherwise managed. Conversely, variation may represent an opportunity depending on how it is managed.

One aspect of variation is the difference between the average values for different sets of samples. In this case, the different sets of samples represent different Federal Information Processing Standard (FIPS) districts. FIPS Districts are multi-county territories within each State.

Another consideration is the amount of variation that exists within a set of samples, in this case each FIPS district.

To help evaluate the extent of variation, two common statistical descriptors of variation are included in the table below, as well as in the Excel spreadsheet which can be accessed by clicking on the link below. The two descriptors of variation presented are the Standard Deviation (Std Dev) and the Range. The Range is the difference between the greatest and the lowest values.

The economic implications of observed oil and protein variation are further explored on the web page titled “Estimate of Processor Value (EPV): Crop Year 2018”.

Compositional variation and the economic value that can be associated with these differences represent a cost or an opportunity depending on how it is addressed and managed. The ability of growers to access this type of information and incorporate it into their production and marketing decisions will determine the extent to which they are able to contribute to and gain from this type of value opportunity.

Summary of Soybean Protein and Oil Results:

Summary of Values for 73 Individual FIPS* Districts						
	Soybean Crude Protein			Soybean Crude Oil		
	At 13% Moisture			At 13% Moisture		
	Average	Std Dev	Range (High - Low)	Average	Std Dev	Range (High - Low)
Average	34.5	1.5	4.8	19.6	0.9	2.8
High	36.8	3.1	9.8	20.8	1.4	5.3
Low	32.6	0.6	1.4	18.3	0.1	0.2

* F.I.P.S. is an acronym for "Federal Information Processing Standard". FIPS Districts are multi-county territories within each state.

Results by FIPS District:

Note: For a table with individual district values used to calculate the above table and the data map presented below, [click here](#).

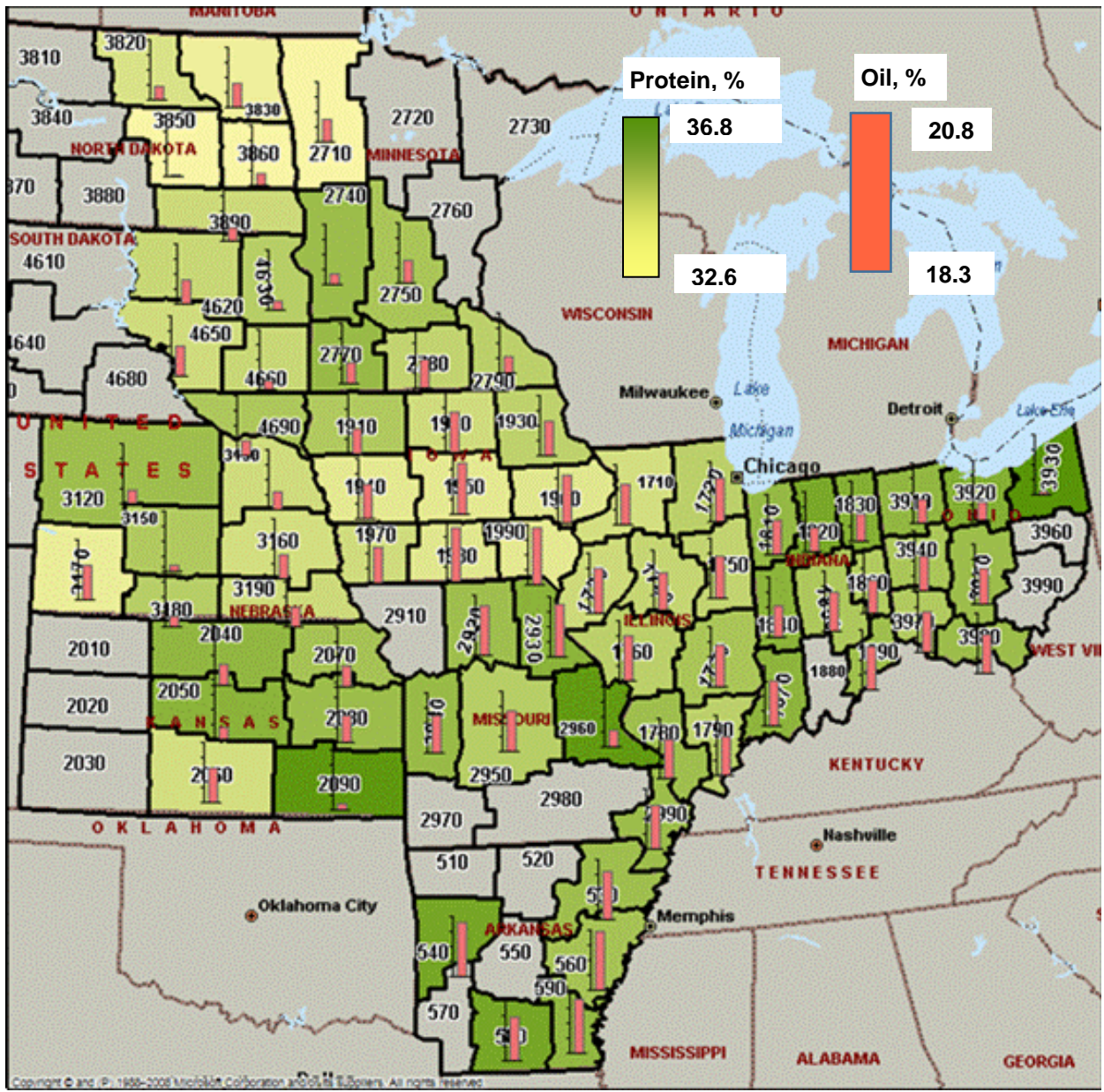
Data-Map Presentation of FIPS District Average Values for Protein and Oil at 13% Moisture:

Average protein and oil values for 73 multi-county districts are presented in the following data map. Each district is identified by a numeric code which is a combination of the respective state and district codes. As an example, district 1710 is District 10 in Illinois which has a state code of 17. The same code is used in the table of individual district values which can be accessed via the "Click Here" link above.

Each district's average protein level is represented by its background color using the identified color gradient.

Each districts average oil level is represented by the relative height of a column which represents the identified range in oil level.

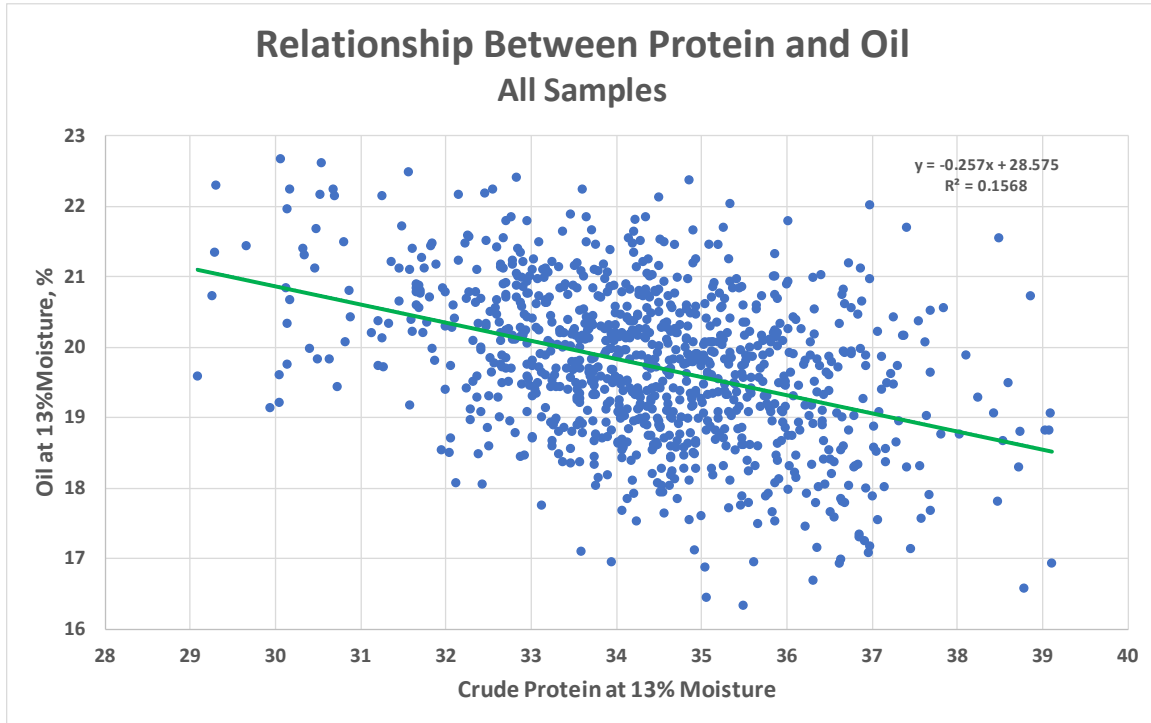
Soybeans at 13% Moisture



Relationship between % Protein and % Oil

The above data map presents average values for protein and oil by FIPS district. A quick visual survey indicates that the districts with the higher protein levels (darker green background) often, but not always, had a lower oil level (shorter column height).

An inverse relationship is one in which an increase in one characteristic is associated with a decrease in another. Such a relationship is typically cited as existing between protein and oil levels in soybeans. This relationship is obviously an important consideration since both protein and oil represent value and therefore being able to increase both would be desirable. To explore this relationship further, the following chart presents protein and oil levels for the individual samples.



While a negative trend between protein level and oil level is observed, the relationship is inconsistent as evidenced by a visual evaluation of the cloud of values. A stronger relationship would be associated with individual points falling closer to the computer generated trend line drawn in green.

A statistical measure of the extent to which two sets of values are related is R^2 . The closer the value for R^2 is to the number 1, the stronger the relationship. As R^2 moves from 1 toward 0 (Zero), the relationship becomes progressively weaker. The above R^2 of 0.157 indicates that the relationship between oil and protein for the above set of values is not very strong.

Differences in soybean composition represent potential opportunities for not only progressive value-chain segments, but the entire soy industry. An improved understanding of the causes of compositional differences, the extent to which they can be controlled, and how beneficial changes can be achieved, will allow the soy industry to work together to affect beneficial change. For that portion of compositional variation that is beyond direct control, its better management also represents an opportunity.

Soybean producers have a critical role to play in this effort in that their production, handling and marketing decisions will ultimately enable the realization of the Composition-Opportunity. By affording soybean growers greater access to soybean composition information, they will be able to both contribute to the creation of value through their crop production decisions and better share in the value that they help to create.

***Disclaimer:**

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