JUNE 2002

SOYBEAN MEAL
INFO source

PUBLISHED BY SOYBEAN GROWERS FOR THE FEED INDUSTRY SPECIAL BBI EDITION

# Soybean Meal Compositional Improvement and the United Soybean Board's Better Bean Initiative

*by Nick Bajjalieh, Ph.D.*

Soybean meal sets the value standard for supplemental protein/amino acid sources used in animal production nutrition. Yet, soybean meal is not perfect relative to its animal feed applications. Many view improving upon some of soybean meal's nutritional limitations as a business opportunity worthy of pursuit. Such activities represent potential value not only for those engaged in the feeding of livestock and poultry, but the entire soybean value chain as well.

Specific nutritional traits and associated levels of change targeted for improvement vary with the technical capabilities and business objectives of each group involved. Such information is often protected during the developmental stages of a project. However, certain compositional characteristics have been discussed within the public domain as potential candidates for improvement. An incomplete list of these meal traits is presented in the table below, along with an assessment of the major market applications associated with each trait.

Beneficial compositional changes improve the inherent value of the associated meal, which is then translated into economic value in the context of a given application and relevant market parameters. To be commercially sustainable, the economic value added by a trait or combination of traits must be great enough to not only cover additional costs, including those associated with research and development, loss of yield and added system costs such as those associated with identity preservation (IP), but also provide enough incentive for its use. Creating and maintaining the necessary balance between the actual value created and that necessary for commercial sustainability is a critical challenge for success.

Traits associated with higher economic values appear to have the greatest attraction, yet many of the higher value traits are sustainable only in the context of limited niche-type markets offering opportunity to limited segments of the soybean value chain. In addition, since supply and demand considerations impact the market value per unit of product, managing the amount produced in the context of market demand is critical to preventing an erosion of applied market value. Traits with broader market applications tend to have somewhat lower per-unit values. This is especially true for traits that must compete with other ingredient sources of the same nutrient. However, in the context of the volumes involved, such traits may offer a greater aggregate opportunity. The challenge, however, has been the development of market systems that support the consistent, low added cost commerce of such materials.

## Incomplete List of Nutritional Traits Considered for Improvement in Soybeans

| Trait | Primary Application(s) | | | |
|---|---|---|---|---|
| | Animal Feed | | Human Foods | Environmental |
| | Poultry | Swine | | |
| **Meal Traits** | | | | |
| Increased Lysine | X | X | | |
| Increased Methionine | X | | | |
| Increased Crude Protein | X | X | X | |
| Improved Amino Acid Profile | X | X | | X |
| Improved Carbohydrate Profile | X | X | X | X |
| Higher Isoflavone | ? | ? | X | |
| Reduced Lipoxygenase Levels | | ? | X | |
| Low-Phytate | X | X | | X |
| High Phytase | X | X | | X |

## The United Soybean Board's Approach: The Better Bean Initiative

The United Soybean Board (USB) recognizes that in today's global economy a product must constantly improve to remain competitive. As a result, USB is working to improve the inherent compositional value of U.S.-produced "commodity-type" soybeans. This multifaceted process is USB's Better Bean Initiative (BBI).

BBI is an ambitious program that seeks to grow demand for U.S. soybean oil and meal. Targeted BBI trait improvements include edible soybean oil enhanced for improved human food applications, and improving the inherent value of U.S.-produced soybean meal for animal feed applications. Typically, soybean meal is the major contributor to the combined product value (i.e., oil + meal + hulls) from soybeans.

Early in the process, representatives from the animal feed industry were asked for input on desired soybean meal improvements. Identified needs were further evaluated from the perspective of their impact on USB's goal of improving market demand for soybean meal. The BBI meal trait targets in the table below are the result of this interactive process.

BBI trait targets are split into two categories, *Primary* and *Secondary*. The primary traits are the major focus of BBI's initial efforts. While the secondary traits are of a lesser priority, USB will be opportunistic in its approach to them.

The note presented at the bottom of the table below is especially important. The 100 percent rule (i.e., that the sum of all proportions must add up to 100 percent) clearly applies when altering the compositional characteristics of soybeans where a change in the level of one component must be counterbalanced by a change someplace else. As a result, we must ensure that improvements in one area do not result in overriding losses in another. This is especially true when two divergent value streams are present in a single product, such as the oil and meal components of soybeans. All of this must be accomplished without a value offsetting decrease in yield per acre, and all of these considerations must be brought together in the context of a better bean.

## Translating Inherent Added Value Into an Estimate of Economic Value

The economic value of a given trait improvement is determined by the context in which it is used. It is commonly known that animal feed applications are subject to a variety of factors, many of which are constantly undergoing change. Therefore, establishing a single economic value for a given soybean meal trait improvement is not realistic. However, performing an objective evaluation of the commercial viability of value-adding compositional traits requires some vision of economic value.

Economic value estimates of soybean meal trait improvements must always be evaluated within the context of the set of assumptions employed in their development. Since no single economic value applies, such evaluations are most meaningful when trait economic projections are bracketed through the use of multiple application scenarios.

Presented on page 3 are estimates for both a broiler and a swine application. Least-cost formulations in the context of corn-soy based diets and "composite" nutrient specifications were utilized. Pertinent ingredient costs utilized were: corn at $2/bu, all soybean meals at $170/ton, L-lysine at $0.85/lb, DL methionine at $1/lb, animal fat at $0.10/lb and monocalcium phosphate at $250/ton. In the context of a given species application, each improved soybean meal trait was compared to values associated with those for "typical" soybean meal. Gross Savings and Gross Added Values (GAV) do not include any added costs associated with production, handling and use of the respective meals.

Comparing results between the broiler and swine applications illustrates that trait value is application driven. As an example, the improved methionine + cystine trait brings value to the broiler application, but none to that for swine. Also, the increased tryptophan trait, by itself, brings no value to either application.

### Better Bean Initiative Primary Meal Trait Targets

| | Changes in High Protein Meal | | | Maximum Displacement of Selected Ingredient |
|---|---|---|---|---|
| **Primary Traits** | **From** | **To** | **Coefficient of Change** | **for Each 100 lbs of Meal Used** |
| Increased Methionine + Cystine | 1.4% | 2.1% | 1.5X | 0.7 lb DL Methionine |
| Reduced Phytate-Bound Phosphorus | 0.4% | 0.2% | 0.5X | 0.95 lb Monocal Phos. |
| Increased Metabolizable Energy (ME) | ^ 150 kcal ME/lb | | Swine: Approx 1.1X | 4.2 lbs Added Fat |
| (From Improved Carbohydrate Characteristics) | | | Broilers: Approx 1.13X | |
| **Secondary Traits** | | | | |
| Improved Utilization of Protein/Amino Acids | ^ by a min. of 5% | | 1.05X | 5 lbs Soybean Meal |
| Increased Levels of: | | | | |
| Lysine | 3.0% | 3.7% | 1.23X | 0.88 lb L-Lysine HCl |
| Threonine | 1.9% | 2.3% | 1.21X | 0.4 lb L-Threonine |
| Tryptophan | 0.65% | 0.80% | 1.23X | 0.15 lb L-Tryptophan |

***NOTE: Must insure that improvements in one area do not result in overriding losses in others.***

Different value chain participants will focus on different value-defining formats. A major point of interest from the animal nutritionist's perspective is feed ingredient cost savings per ton of feed. Since more soybean meal is utilized in a ton of broiler ration, the savings per ton of feed tends to be greater in the broiler diets than in the swine diets. For those traits utilized to a similar degree, this difference often narrows when expressed on a per ton of meal or per bushel basis. The processor and other intermediate value chain participants will focus on GAV per ton of meal. Value chain participants toward the grower end of the value chain will focus on GAV per bushel of soybeans.

It is typically assumed that the end user is the driver of demand for such value-added traits. However, if the earlier value chain participants are not sufficiently economically motivated to participate, the system fails.

## The Impact of the Marketing System Utilized on Commercial Viability

The above scenarios are gross added values. Ultimately, net added value drives business decisions. Therefore, costs associated with bringing the above materials through the value chain become a critical consideration. The lowest cost system is that associated with today's commodity market. Each deviation and/or added step relative to that practiced as a part of the commodity system is a potential source of added cost.

While the majority of the above traits possess enough gross added value to drive end-user interest, the extent to which net added value is eroded by added system costs becomes an important determinant of commercial viability. When traits with significant added value are rendered unviable due to overriding

## Broiler Illustration

| | Feed Ingredient Cost | | Meal in Feed | GAV* Based on Gross Savings and Meal Usage | |
|---|---|---|---|---|---|
| **Primary Traits** | **Cost/Ton** | **Gross Savings*** | **Lbs/Ton of Feed** | **$/Ton Meal** | **$ /Bu. Soybeans** |
| "Typical" Soybean Meal | $113.92 | | 551 | | |
| Increased Methionine + Cystine | $111.20 | $2.72 | 550 | $9.90 | $0.218 |
| Reduced Phytate-Bound Phosphorus** | $113.19 | $0.73 | 550 | $2.66 | $0.058 |
| Increased Metabolizable Energy (ME) | $110.84 | $3.08 | 543 | $11.36 | $0.250 |
| Primary Traits Combined** | $107.47 | $6.45 | 542 | $23.82 | $0.524 |
| **Secondary Traits** | | | | | |
| Improved Protein Utilization | $111.97 | $1.95 | 519 | $7.52 | $0.165 |
| Increased Lysine Level | $112.75 | $1.17 | 550 | $4.26 | $0.094 |
| Increased Threonine Level | $112.32 | $1.60 | 487 | $6.58 | $0.145 |
| Increased Tryptophan Level | $113.92 | $0.00 | 551 | $0.00 | $0.000 |

***Gross Savings and Gross Added Value (GAV) do not include any added costs associated with procurement and use of the respective meals***

****Does not include "Environmental Value"***

## Swine Illustration

| | Feed Ingredient Cost | | Meal in Feed | GAV* Based on Gross Savings and Meal Usage | |
|---|---|---|---|---|---|
| **Primary Traits** | **Cost/Ton** | **Gross Savings*** | **Lbs/Ton of Feed** | **$/Ton Meal** | **$ /Bu. Soybeans** |
| "Typical" Soybean Meal | $98.09 | | 368 | | |
| Increased Methionine + Cystine | $98.09 | $0.00 | 368 | $0.00 | $0.000 |
| Reduced Phytate-Bound Phosphorus | $97.62 | $0.47 | 367 | $2.56 | $0.056 |
| Increased Metabolizable Energy (ME) | $96.15 | $1.94 | 363 | $10.70 | $0.235 |
| Primary Traits Combined** | $95.69 | $2.40 | 362 | $13.27 | $0.292 |
| **Secondary Traits** | | | | | |
| Improved Protein Utilization | $97.11 | $0.98 | 347 | $5.65 | $0.124 |
| Increased Lysine Level | $96.52 | $1.57 | 368 | $8.54 | $0.188 |
| Increased Threonine Level | $97.26 | $0.83 | 312 | $5.33 | $0.117 |
| Increased Tryptophan Level | $98.09 | $0.00 | 368 | $0.00 | $0.000 |

***Gross Savings and Gross Added Value (GAV) do not include any added costs associated with procurement and use of the respective meals***

****Does not include "Environmental Value"***

system costs, this represents a potential lost opportunity for the entire value chain. Utilizing the most efficient and cost-effective system is in the best interest of the value chain as a whole; thus, BBI's commodity approach to the commercialization of targeted traits.

## Better Bean Initiative: Moving Beyond the Vision

Critical to BBI's success is the development of soybeans that provide the targeted BBI meal traits. Recognizing that progress can most rapidly be made by building upon that which already exists, a large part of BBI's current meal-related activities is focused on identifying existing sources of germplasm that provide targeted BBI meal traits, and then gaining access to their use. One tactic involves developing relationships with companies that are or have been improving the compositional characteristics of soybeans; another focuses on "public" research programs. In both instances, the BBI commodity approach may allow for the commercialization of materials that would otherwise not represent enough value in the context of an IP system.

The extent to which genetic and associated compositional diversity exists determines the boundaries in which we must work, though the opportunity may be much broader than once thought. Gizlice, Carter and Burton have determined that only six ancestors account for more than half of the genetic base for North American soybeans. Eighty-four percent of the total genetic base is drawn from only 17 ancestors. The possibility for expanding beyond this narrow genetic base should be evaluated in light of more than 15,000 samples within the USDA Soybean Germplasm Collection. USB's Meal Trait Identification Project has begun to access this, as well as other existing potential opportunities.

## Commercializing a Better Bean

A commodity-type bean requires that germplasm providing desired BBI traits be accessible throughout the seed industry. At the same time, intellectual property rights of the owners of the germplasm must be respected and rewarded. All of this must be done without adding excessive cost to the system. While the focus is on creating a better commodity-type soybean, the early stages of commercialization will probably require some initial degree of IP.

Once an enhanced soybean is developed, it must still survive the commercialization gauntlet. Realizing that any new product must be nurtured through the early stages of commercial development if it is to survive and succeed, BBI also has a market development and support component, including trait measurement and standards tools. This involves the identification and validation of procedures that will provide for the rapid and low-cost verification of BBI traits. This ability will be critical to differentiating U.S.-grown BBI soybean products from non-BBI materials grown by others. Appropriate animal feeding evaluations will also be an important component of the commercialization process.

BBI, like most development processes, is constantly evolving while at the same time building on past efforts. Outputs from BBI will add considerable value to the U.S. soybean value chain. While the marketplace will ultimately determine the extent and distribution of the value created, the net effect will be a more competitive, and thus viable, domestic soybean franchise. Since all of the participants in the soybean value chain are mutually dependent, BBI represents an important opportunity for all.

*Gizlice, Z, Carter, TE and Burton, JW, Genetic Base for North American Public Soybean Cultivars Released between 1947 and 1988, Crop Science, Vol 34:1143-1151 (1994).*

**The Soybean Meal INFOsource program is funded by the:**

IOWA SOYBEAN PROMOTION BOARD

Soybeans Nebraska Soybean Board

USB UNITED SOYBEAN BOARD *Making Your Checkoff Pay Off.*

SOYBEAN MEAL INFO source

4554 114th St.
Urbandale, IA 50322-5410
www.soymeal.org

PRESORTED
STANDARD
U.S. POSTAGE PAID
DES MOINES IA
PERMIT NO. 1332