This article is the Capstone to a **10-article** Feedstuffs series highlighting the unique value of soybean meal to swine nutrition and health.

Redefining the Value of Soybean Meal to Swine Nutrition and Health in Commercial Settings: A Feedstuffs Series Capstone

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Purpose and Scope

This series of ten papers (see Table of Contents) provides new information that solidifies the unique value of soybean meal (SBM) for swine nutrition and health. The Feedstuffs series is the result of a three-year study by a United Soybean Board (USB) committee of industry scientists. This capstone paper distills the most consequential findings that emerged from their study of private sector research that was made available to them by The Hanor Company. These studies had few, if any, comparable counterparts in the public domain.

The Feedstuffs series redefines soybean meal (SBM) value for swine nutrition and health for today's genetics and commercial housing environment. Integrated swine companies, such as Hanor, have some of the most accomplished scientists in applied biology. Their research facilities are extensive and situated in the 'field' on sites with a high pig population. The field setting has an environment that presents a broad spectrum of performance challenges (e.g., temperature, air quality – gases, pathogens, endotoxins; Von Essen and Romberger, 2003). These environments include high pig density, seasonal heat stress, aerial irritants, and endemic pathogens — conditions that elicit responses rarely captured in academic settings.

Knowledge Advanced Includes a Unifying Hypothesis

Advancements by this series of papers fit into four distinct categories:

1. Energetic value of SBM in principle and practice
2. SBM is vital for maximum growth expression
3. SBM mitigation of growth suppression by swine respiratory disease (SRD)
4. SBM role in mitigation of summer carcass weight dip

A unifying hypothesis emerged from these studies: SBM provides an abundance of functional compounds that confer value beyond amino acids and energy. These may serve a complementary function to enable efficient nutrient use for growth in commercial settings (papers 2, 3, 4, 10).

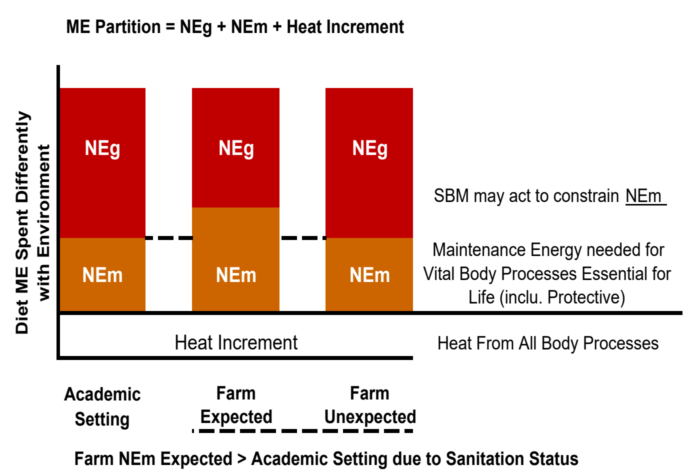
Advancement 1: Energetic Value of SBM in Principle and Practice

Two advances were made to our understanding of SBM energy value: (1) Classic net energy (NE) value for SBM was corrected (papers 1, 2). (2) 'Expressed' NE value of SBM in the commercial environment exceeds classic NE (constituent energetics) estimates by about 30% (paper 2). Both advances were proven by the Snyder FCE growth assay (paper 2).

Classic NE estimates for SBM were corrected upward to 0.82–0.83 x corn NE (NRC, 2012) on a dry-matter (DM) basis, based on private-sector research – Hanor Company and Cargill animal nutrition (CAN). CAN is expert in dynamic NE estimation for ingredients. These estimates agree with a subsequent calorimetry estimate (Lee et al., 2022). In the commercial environment, 'expressed' energetic value exceeded classic NE by roughly 30%. This was described as productive energy (PE), which encompasses classic NE as the major component. We specified that the terms (NE, PE) are not synonymous and should not be used interchangeably in scientific discussions. We expect that ingredients exhibiting a PE effect to be in a very small class.

The PE value likely reflects reduced diet energy diversion toward immune and inflammatory processes, although, the basis is not yet known. We proposed that NE required for maintenance (NEm) may become larger in a commercial environment because energy is expended to counter immune stress (e.g., inflammation from dust and endotoxins, viral infection) would exceed that of a university setting. The concept of NEm variance is known to arise from stressors that incite protective energy use (Huntley et al., 2018; van der Meer et al., 2020). We propose that SBM effects dietary ME conservation for growth (NEg) by constraining processes that increase NEm. This hypothesis is illustrated in **Figure 1**.

Figure 1. Illustration of dynamic energy need for environments differing in degree of immune stress (e.g., sanitation) with possible benefit of SBM.
It is hypothesized that SBM mediates a lower than expected NEm need with more NE available for growth (NEg) in commercial settings (Boyd and Gaines, 2024).



Key Takeaways 1, 2

- *Classic SBM NE value is 2502 kcal/kg DM (0.82 x corn NE/kg DM; NRC, 2012).*
- *SBM PE in the commercial setting is approximately 3026 kcal/kg DM (1.00 x corn NE/kg DM).*

Integrating concepts into practice: Knowing when to formulate diets using SBM NE and PE

Which term (NE, PE) is used for research in an 'academic' vs commercial environment?

Use of SBM NE is recommended for university and similar environments of low pen and pig density and absence of clinical signs of respiratory disease. The Stein lab SBM NE value of 2502 kcal NE/kg DM (overall average, paper 2) is recommended. SBM PE is recommended for commercial settings (research and in practice).

How is the SBM PE value integrated into ingredient energy specifications that use NE?

The SBM PE value is inserted as the 'NE' value in the ingredient composition library.

Assume that SBM PE is set = 100% of corn NE value (97 to 105%, within field estimates). NE values (DM basis) are then translated to NE specifications on an as-fed moisture basis, consistent with feed mill source. Since SBM DM is often greater in practice than for corn, the SBM 'NE' value will be >100% corn NE. Insert these values into the ingredient specification library.

Integrating concepts into practice: Temporary Solution when formulating with SBM PE

If SBM PE is used for formulation, the lysine to 'NE' ratio of SBM would decline.

Since we do not know if SBM also improves diet amino acid efficiency as for NE, formulating to a digestible lysine:NE ratio involves a reduced SBM value. A similar issue arises if one is formulating to a phosphorus to NE ratio. How should we handle these until the question is resolved?

a) If formulation is based on digestible lysine %, then no problem exists.

b) If formulation is based on digestible lysine:NE ratio, then Genus PIC published a requirement tool that calculates their digestible lysine:NE curve, based on the SBM PE to corn NE ratio that you have chosen (range 78–100%). This avoids a SBM penalty for less lysine:NE.

https://www.pic.com/impact-of-soybean-meal-energy-on-lysine-and-phosphorus-for-pic-growing-pigs/ (accessed 16 January 2026).

Research Priority: Determine if SBM can minimize NEm expansion during pathogen challenge

The basis for SBM having a relatively higher 'NE' or PE in the commercial setting than for the university environment suggests that although substrate-based NE is accurate, something in SBM (e.g., functional compounds) may prevent diversion of total diet energy from growth. Classic SBM NE has not increased. This could be tested using calorimetry and viral or endotoxin challenge. The calorimetry procedure used by Huntley et al. (2018) serves as a template to probe for NEm variance in pigs under viral infection (e.g., PRRSv, influenza) and fed two SBM levels (low, +100% SBM). An alternative could be to use Isoflavones, saponins as employed by Smith et al., 2020.

Advancement 2: SBM Is Vital for Maximum Growth Expression

This pillar of new knowledge embodies two important advances: Extreme SBM depletion impairs growth rate, FCE and carcass lean, even when amino acid requirements are met (papers 5, 7). Next, SBM dose-response work identified phase-specific minimum SBM levels required for maximum growth in the commercial environment, which suggests that SBM contributes value beyond amino acid supply (papers 6, 10).

Extreme depletion of dietary SBM content impaired growth (rate, FCE, lean composition) in a SBM dose-dependent manner, which is not the result of a deficit of essential (EAA), non-essential (NEAA) or conditionally essential amino acids (CEAA). Complete restoration of all amino acids did not restore growth but led to increased feed intake and body fatness (paper 5). Therefore, at some point in SBM displacement, something other than amino acids becomes first limiting to normal growth (e.g., SBM, intact protein). We eliminated intact protein from consideration because restoring dietary intact protein to the original level with non-SBM protein did not restore the growth observed previously (Elsbernd et al., 2022). Removal of SBM includes reducing total diet content of functional compounds and these have health improving activity (paper 4; Smith et al., 2020).

SBM, as with other legumes, is a rich source of functional compounds that favor improved health (antiviral, anti-inflammation, gut barrier function) and metabolic status (anti-oxidation) to permit improved growth (papers 3, 4). In this manner, functional compounds may complement amino acids and energy substrates by facilitating their efficient use in commercial settings.

Key Takeaways 3, 4

- *A minimum SBM level is needed to better express genetic growth potential.*
- *Severe SBM removal leads to impaired growth (rate, composition) and FCE erosion.*

Integrating concepts into practice: Ideal amino acid pattern works well, until it doesn't

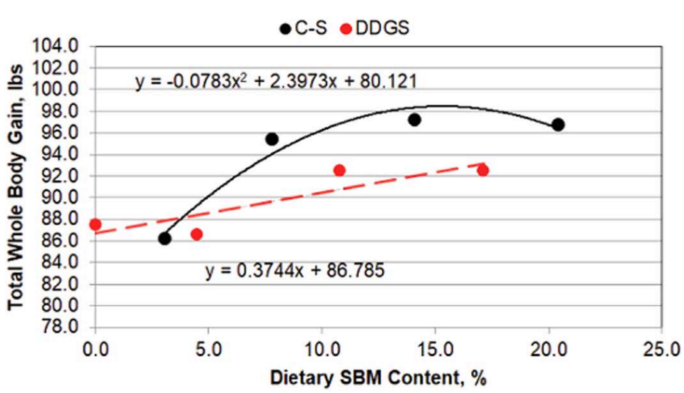
Private sector nutritionists must know the extent to which SBM can be replaced for each feeding phase using dose-response studies with synthetic lysine (paper 7). Displacement of SBM with amino acids can be extensive from weaning to about 150 lbs. body weight. After this approximate weight, there is a 'barrier' to extensive amino acid use. We have not been able to resolve this complication for more than 20 years (paper 7). The term 'barrier' is used by seasoned private-sector nutritionists because the level of synthetic lysine that can be used without harming growth declines sharply (e.g., 30%). This has been a persistent problem, despite formulating diets to equivalent NE and meeting or exceeding the ideal amino acid pattern for all 10 EAA (NRC, 2012). Addition of NEAA nitrogen has not provided a resolution to this problem.

Maximum Growth is Routinely Undermined:

Integrating concepts into Practice: Maximum growth diets are undermined by typical DDGS levels

In principle, feeding two diet programs to pigs that have equal NE and nutrient content can result in different growth results (gain, FCE, lean content). A diet program that meets the minimum SBM level specified for maximum growth (paper 10, Figure 8) would be superior to a program that had decidedly less SBM (e.g., 40–50% below minimum). And growth rate for both programs would be constrained if diets contain DDGS at typical levels (e.g., 15–25%). The concept of dietary SBM level being positively associated with growth rate and the secondary effect of DDGS to undermine maximum growth is shown in **Figure 2** (adapted from paper 6). If growth rate is at a premium, then dietary DDGS cannot be used above levels that may support gut health (e.g., 5% to 8%).

Figure 2. Total gain response to increasing dietary SBM level for corn-soybean (C-S) diets and diets containing a typical level of DDGS (20%)
Figure was taken from paper 10, which was adapted from the original finding of van Heugten (paper 6). Pigs were fed diets from 183 to 275 lbs. (37 d).



Advancement 3: SBM Mitigation of Growth Suppression by Swine Respiratory Disease

This pillar represents a remarkable discovery in food animal science (health, growth). Higher dietary SBM inclusion for pigs with SRD mitigated growth and FCE losses associated with the disease. Tactical use of higher-SBM diets during anticipated infection periods represents a practical precision-nutrition strategy, which has been successfully implemented by a coordinated team of veterinarians, nutritionists, and feed desk coordinators (described below).

Key Takeaway 5

SBM has profound mitigating effect on SRD suppression of growth and FCE.

Integrating Concepts into Practice: Employing tactical SBM diets to mitigate SRD effect on growth

Dr. Eva Jablonsky (MS nutrition, DVM), formerly of Hanor, led the application of this precision feeding technology for the Hanor Company (Iowa system), soon after we realized the financial benefit of SBM as a tactical 'tool' for SRD-affected pigs. Each flow of weaned pigs was derived from a single sow farm to minimize disease. And pigs tend to perform (gain, FCE, viability, medication) in relation to the health of their sow farm origin (pers. communication, Dr. Steve Pollmann). As sow farms encountered PRRSv infection, it was inevitable that weaned pigs became infected with the virus and other opportunistic pathogens (viral, bacterial). Dr. Jablonski and production personnel identified problem pig flows and period of anticipated infection. Diets with higher SBM content were applied to the time frame of expected infection. The diet library was composed of standard diets and their tactical SBM counterpart. The feed desk coordinator implemented the 'prescribed' diet order from the library by inserting them into the computer program that controls diet order and its budget. The budget was altered for lack of knowledge. An example of the diet library is shown in **Figure 3**.

A lateral infection of placed pigs is more difficult because they are less predictable.

The ingredient framework for SRD diets is shown in **Table 1**. The format is used to mitigate weight decline in summer harvested pigs, but it is applied as the starting point for mitigation of SRD growth suppression. It is possible that the SBM level shown may not be quite high enough for pigs that encounter SRD, because SBM levels were developed to maximize growth in healthy pigs (paper 10). This assumes that functional compounds are important for both classes (healthy, unhealthy), but the level of immune stress imposed by SRD may benefit from a larger dose of functional compounds in SBM.

Figure 3. Precision use of the diet library to mitigate SRD effects on growth. The top frame shows the standard diet library from final nursery diet to harvest. Tactical alternatives to standard diets are equal in nutrient levels but contain higher levels of SBM (**Table 1**). Veterinary and production teams determine the health status of placed pigs, based on sow farm health and history of prior weaned pigs from the source farm. Two unhealthy pig flows are shown as an example of using tactical diets to bracket the time frame of expected infection (seroconversion).

FEED DESK DIET LIBRARY

Standard Diet Library					
Nurse 3	Finish 1	Finish 2	Finish 3	Finish 4	Finish 5
Tactical SRD SBM Diets					
Nurse 13	Finish 11	Finish 12	Finish 13	Finish 14	Finish 15

FEED PLAN FOR HEALTHY and SRD AFFECTED PIGS

A. Healthy Wean to Finish Pigs

Nurse 3	Finish 1	Finish 2	Finish 3	Finish 4	Finish 5

B. Weaned Pigs from PRRSv Infected Sow Farm

1	Nurse 3	Finish 11	Finish 12	Finish 13	Finish 4	Finish 5
2	Nurse 13	Finish 11	Finish 2	Finish 3	Finish 4	Finish 5

Emergence of other Commercial proof of concept and mechanism studies

The discovery that SBM mitigates SRD growth suppression was followed by other field tests and mechanistic studies with PRRSv-infected pigs. Increased dietary SBM mitigated the PRRSv effect on growth and FCE in nursery pigs (Rochell et al., 2015). Commercial studies with weaned pigs that were naturally infected with PRRSv (paper 4, Figure 1) and pigs from PRRSv stable sow farms (paper 3, Figure 4) showed that higher dietary SBM improved the ability to thrive, in both studies. The Dilger lab group (University of Illinois) made significant contributions to our understanding of how isoflavones (and saponins) improve health and viability of PRRSv-infected pigs from weaning to harvest (paper 4, Figure 2; Smith et al., 2020). Their reviews on the role of SBM functional compounds in pigs and poultry brought greater relevance of them to the food animal realm (Smith and Dilger, 2018; White and Dilger, 2024a; White et al., 2024b).

Advancement 4: SBM Mitigates Summer Carcass Weight Dip

This pillar represents the discovery of a solution to one of the most costly issues in swine production – summer carcass weight dip. The problem is primarily one of reduced feed intake during heat stress, which is made worse by excessive diet DDGS. The intake suppression is exacerbated further by SBM-depleted diets (papers 8, 10). Maintaining sufficient SBM to maximize growth rate, while limiting DDGS to a level (e.g., <10%) that does not interfere with intake is key to mitigating summer carcass dip. The framework for key ingredient constraints for summer harvest pig diets is shown in **Table 1**.

Key Takeaway 6

- *Managing SBM level to maximize growth and limiting DDGS (<10%) to not reduce intake is key to mitigating summer harvest pig weight dip.*
- *Diets for summer harvest pigs begin in February, not the start of spring.*

Integrating concepts into practice: Timing of high growth rate diets for summer harvest pigs

Elimination of summer carcass weight dip is achievable with a diet strategy that maximizes growth rate. The second component is timing – introduce summer harvest pig diets early enough to maximize gain prior to summer heat stress (paper 8). Diets for summer harvest pigs begin to be fed in the late nursery phase (25 lbs.) and start February 1-15. An example scheme (**Table 2**) shows the approximate time to initiate high-growth diets, which is based on the month of weaned pig placement (months February, March, April, May). Diets should begin with the final nursery diet. The intent is to maximize carcass weights for pigs harvested in June, July, August and September. Pigs weaned about June 1 and after would normally not receive summer harvest diets because they will be marketed beginning in early fall.

USB Milestone: Soybean Growers Define Nutritional Value of SBM – A First

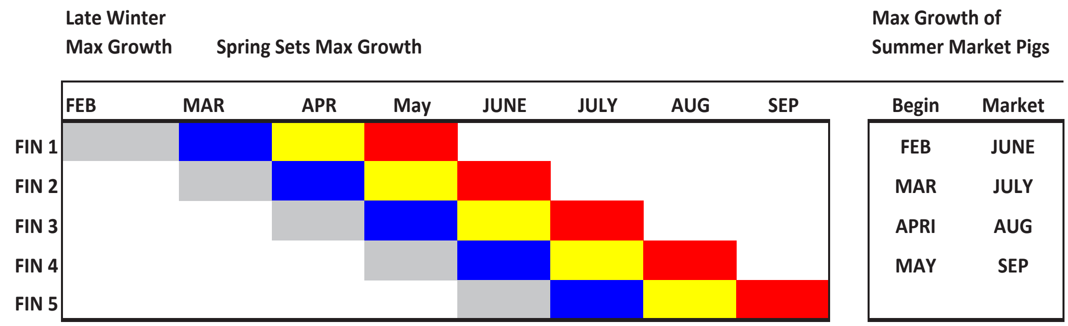
Three members of the USB animal nutrition working group defined the amino acid and energy specifications of SBM over a range of CP classes (44–48%; paper 1) that are normally provided in international ingredient composition tables. This

Table 1. Key ingredient constraints for summer dip mitigation[1,2,3]

	Start	End	Max	Min. SBM	Min.	Max.
Name	Wt., lbs.	Wt., lbs.	Lys. HCl	lbs./ton	DDGS, lbs./ton	
Nurse 3	25	60	12.5	536	100	100
Finish 1	60	90	12.0	607	100	125
Finish 2	90	130	10.0	518	125	150
Finish 3	130	180	8.0	418	125	200
Finish 4	180	230	7.0	327	125	300
Finish 5	230	295	6.0	249	125	300

[1]Three components are important to maximum gain: crystalline lysine level (paper 7), diet SBM level and severely reduced DDGS content (paper 10).
[2]The minimum DDGS level may be important for gut function (e.g., believed by some field to have been important to reduced 'twisted gut.'
[3]Minimum SBM level was computed from the equation in paper 10. Different number and (or) weight phases can be set by using the SBM equation.

Table 2. Framework for initiating maximum growth summer harvest pig diets.
This framework uses color coding to show about when groups of nursery pigs begin the mitigation diet protocol, when they are expected to be marketed and when to stop using the mitigation diets (groups placed in June do not receive these diets).



departure from producing a product that others defined was especially important for NE content.

Nutritionists must competently predict the EAA content in order to formulate, but reliable prediction equations are not available to every nutritionist. Clients of an amino acid company that is expert in predicting EAA content have an advantage over those who are not. The regression equations (paper 1) are meant to level the landscape for all nutritionists. Prediction equations were developed from truckload samples arriving at the feed plant from Midwestern soybean processors.

Members of the USB animal nutrition group found that the major international references underestimate SBM NE (swine: 7–8%; papers 1, 2), which undermines the ability of SBM to compete with other ingredients for formula space. Classic NE estimates (academic setting) were obtained from two private-sector companies because they were validated by FCE growth assay in pigs. Cargill animal nutrition, who is expert in deriving dynamic NE estimates for ingredients, was especially helpful in deriving NE estimates over the SBM CP range needed (pers. comm., Dr. Chad Pilcher, CAN). SBM NE estimates showed a positive association with SBM CP level, which agrees, in principle, with standardized estimates (DM, oil, fiber) published by Rostagno et al. (2022).

Key Takeaways 7, 8

- *Amino acid prediction equations were developed so all nutritionists have the ability to predict EAA content over the continuum of SBM CP encountered.*
- *Classic NE values (paper 1) align with FCE growth assay and are minimum SBM NE values.*

Research priority: Does SBM CP and NE increase together as shown in paper 1?

The apparent positive association between SBM CP and SBM NE needs to be verified by indirect calorimetry. Whether or not this association is verified, a NE equation needs to be developed that is a reliable predictor of SBM NE for today's high protein deposition pig. This is important

Research priority: Does SBM CP and NE increase together as shown in paper 1? (cont.)

for academic research, and practicing nutritionists, who may not accept the concept of PE for the commercial environment.

And, if classic NE differs with SBM CP class, then how is the PE value affected if at all?

Value of High SBM CP: What is the value to poultry, swine end-users and to soybean grower?

Animal nutritionists, who are the major clients for SBM, want higher CP sources. High soybean cultivars exist (50–53% CP), some of which have good yield and field characteristics. Soybean growers contracted a study to determine whether increased SBM CP would increase or decrease total SBM tons sold into poultry and swine markets. The study involved extensive diet formulation runs to evaluate SBM competitiveness for diet space, as SBM CP increased from 44% to 48%; determined by diet cost for equivalent nutrient content (paper 9). Specifications for SBM CP classes (amino acids for SBM CP; ME, poultry; NE, pig) were derived from paper 1.

As SBM CP increased, economic and environmental benefits occurred for poultry and pig diets. SBM market value increased as SBM CP increased because diet cost declined. Slightly less SBM was used in diets for both species, but the end-user was incentivized to pay more for higher CP SBM in order to capture the value of declining diet cost. The decline in SBM amount coincided with increased corn grain demand. The net outcome for soybean growers was projected to be slightly less total SBM tons needed, but total SBM revenue could be greater. How could the SBM processor become a collaborator with soybean growers to provide animal nutritionists with what they want, while sharing additional revenue with soybean growers? Would SBM processors change the payment basis on which they value pay soybean growers?

Principle Alert: What is the value of increasing SBM CP if SBM NE does not also increase?

> The results above are based on SBM increasing in CP and energy simultaneously (paper 1). Formula runs with only SBM CP increasing had substantially less value in diet cost savings for poultry and pig diets. The alignment of protein and energy advances is important to SBM value, and this result sends an important message to USB leaders and soybean geneticists.

Capstone – 'Real World' Test of Knowledge Advanced on SBM Value for the Commercial Environment

Purpose

The original intent of this study was to determine whether diets with higher than typical SBM content (H-SBM) provided economic value during winter and early spring months when SRD can be a problem. A second objective was to verify the extent to which H-SBM diets would mitigate summer harvest pig weight reduction (heat stress); neither circumstance materialized. Pigs were derived from PRRSv stable or naïve sow farms, which made SRD infection unlikely, and summer months were unusually temperate in the upper half of Iowa. Therefore, the test evolved to be an evaluation of dietary SBM value for high-health pigs in the commercial environment.

Collaborator and Method

This study involved collaboration between USB and the Audubon Manning Veterinary Clinic (AMVC) in Iowa. Dr. Trey Kellner and his nutrition team conducted a study that compared performance of pigs fed 'typical' commercial diets (control, AMVC) to those receiving diets with greater SBM content (USB H-SBM). The study involved more than 95,000 pigs and 41 barns (USB Project report, 2025). Three sow farms provided weaned pigs to barns (barn=EU) with dietary treatment alternating as each barn filled (AMVC control or USB H-SBM). Pig placement covered a 6.5-month span with data collected during winter, spring and summer months. Common nursery diets were fed from placement to 25 lbs., when the test initiated; completing at 295 lbs.

Diets

Diets were fed using AMVC feed phases and diet budgeting. Test diets were formulated to equivalent nutrient content with 1 exception. AMVC diets had SBM NE valued at 80% of corn NE and USB valued SBM at 100% of corn. USB diets suggest a slight increase in NE, containing 35% less DDGS and 76% more SBM than control diets (**Table 3**: ingredient intake). USB diets were intended to contain 10% or less DDGS. Experimental SBM levels were, on average, 13% higher than presented in paper 10 (18.9 vs 16.7%), because the minimum diet SBM curve was still being refined. In addition, the minimum SBM level for this study was set based on average pig weight at the start of a feeding phase, rather than the mid-point as with paper 10.

Health Status of Weaned Pigs

Classification of pigs as high health was based on low medical treatment, low mortality rate, high percentage of full value pigs marketed and rapid growth rate (**Table 4**). Advantages were anticipated (USB program) for some measures based on paper 10 (growth rate, FCE, lean content), but pig viability was not expected to improve because mortality was too low to do so. Carcass yield was an important measure because 'excessive' SBM content has been associated with reduced carcass to whole-body weight (see Appendix).

Results and SBM Value

Pigs failed to maximize growth rate, FCE and lean content if fed reduced SBM control diets (**Table 3**). USB H-SBM diets showed an advantage for growth rate and carcass lean content. Numerical 'differences for FCE, harvest live and carcass weight did not reach statistical significance but were in line with improvements observed in prior studies (papers 6, 7). Number of full-value pigs and carcass yield percent were similar for diet programs. The correlation (R) value for live weight (0.40, P=0.01), carcass weight (0.29, P=0.07) and carcass lean (0.40, P=0.01) suggest a benefit to greater SBM intake for key financial indicators. The slight negative association (-0.34, P=0.03) between SBM level and carcass yield suggests that higher SBM intake could become problematic.

This data set is invaluable for developing an economic sensitivity table of diet cost x pig harvest price. This allows one to identify the point where higher SBM diets would be profitable for healthy pig flows without disease or temperature stress. In this case, feed cost increased for pigs fed H-SBM diets ($1.49/pig), but this investment resulted in 1.9 lbs. more carcass weight, which equated to $1.67/pig ($0.88/carcass lbs.). This is based on 2024 ingredient prices for AMVC and average carcass value for the study. The H-SBM program yielded a small return over investment ($0.18/pig). This showed that applying H-SBM diets

Table 3. Weighted ingredient intake computed from diet composition[1,2]

Item		AMVC Control	USB Hi-SBM	SEM	Prob. =
No. Pigs		56,325	38,888	-	-
No. Barns (Exp. Unit)		23	18	-	-
Weighted ingredient Intake:					
SBM, 46 CP	%	10.6	18.9	-	<0.001
DDGS	%	16.4	10.7	-	<0.001
Corn	%	69.2	67.3	-	0.33

[1]An equal number of groups were placed and completed for each treatment as planned. However, 3 groups on the H-SBM treatment were removed by the principal investigator because mortality exceeded 2 SD from a previously established average mortality of pigs from the source farm. One other group was eliminated because days on feed was too low (141 d) and an outlier compared to all treatment groups.

[2]Ingredient intake is percent of each diet consumed x its ingredient composition.

Table 4. Comparison of SBM programs for growth and carcass response[1,2,3]

Item		AMVC Control	USB Hi-SBM	SEM	Prob. =	R Coeff	Prob. =
Days on Feed	days	158	158	-	-	-	-
Daily gain	lbs/d	1.74	1.77	0.01	0.07	0.150	0.36
Feed:Gain	ratio	2.66	2.62	0.03	0.37	-0.004	0.98
Daily feed intake	lbs/d	4.63	4.64	0.06	0.87	0.084	0.60
Total Feed Intake	lbs/pig	731.8	728.6	12.3	0.85	-	-
Market WT	lbs	289.3	292.4	1.7	0.18	0.400	0.01
Death loss	%	5.4	5.3	0.5	0.97	0.022	0.89
Substandard Culls	%	1.4	1.2	0.2	0.43	0.008	0.96
Full-value Pigs	%	92.8	92.6	0.6	0.81	-0.110	0.50
Carcass WT	SD	16.2	16.6	0.4	0.52	-	-
Carcass WT	lbs/pig	218.3	220.2	1.4	0.33	0.290	0.07
Carcass Yield	%	75.3	75.1	0.15	0.42	-0.340	0.03
Carcass Lean	%	56.9	57.1	0.07	0.07	0.40	0.01

Simple financial outcome

Value Creation vs Feed Invested				Difference
Feed Cost/Pig	$	91.88	93.37	1.49
Carcass WT	lbs.	218.3	220.2	1.90
Carcass Revenue	$/pig	191.75	193.42	1.67
Revenue over Feed	$/pig	99.87	100.05	0.179

[1]Growth response means are from weaning to harvest, but diets were imposed at 25 lbs.
[2]R^2 values are shown for criteria where P< 0.10.
[3]USB research report 23-125-D-A-1-A submitted by Dr. Trey Kelner.

for SRD and (or) heat stress, that did not materialize, was not financially fatal even though carcass price was relatively low and SBM price was higher than normal.

The 4-point FCE 'advantage' for the H-SBM program is consistent with information in paper 10. We believe that this is due to the *Productive Energy* benefit of SBM (paper 2), which we hypothesize to reflect improved total dietary energy use for growth, and which is manifested as improved FCE. The net effect of FCE improvement was that less total feed (vs control) was required to create more carcass weight.

Key Takeaways 9–11

- *Higher SBM levels improved growth, FCE, lean content without altering carcass yield.*
- *High SBM Improved FCE which reduced total feed required (SBM PE effect).*
- *SBM value was extended beyond SRD and heat stress to include improved gain, FCE in healthy pigs, at any time of the year.*

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