U.S. Soy Center for Animal Nutrition and Health

Emerging questions on the benefits of soybean meal for swine nutrition and health

FACT SHEET 1

US SOY

Can Dietary Soybean Meal Level be Too Low or Too High for Maximum Swine Growth?

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A minimum amount of dietary soybean meal (SBM) is needed for maximum growth, feed efficiency (FCE) and lean deposition, but relative balance is important for SBM, as for other ingredients. The question of whether too much SBM can be used in swine diets is important.

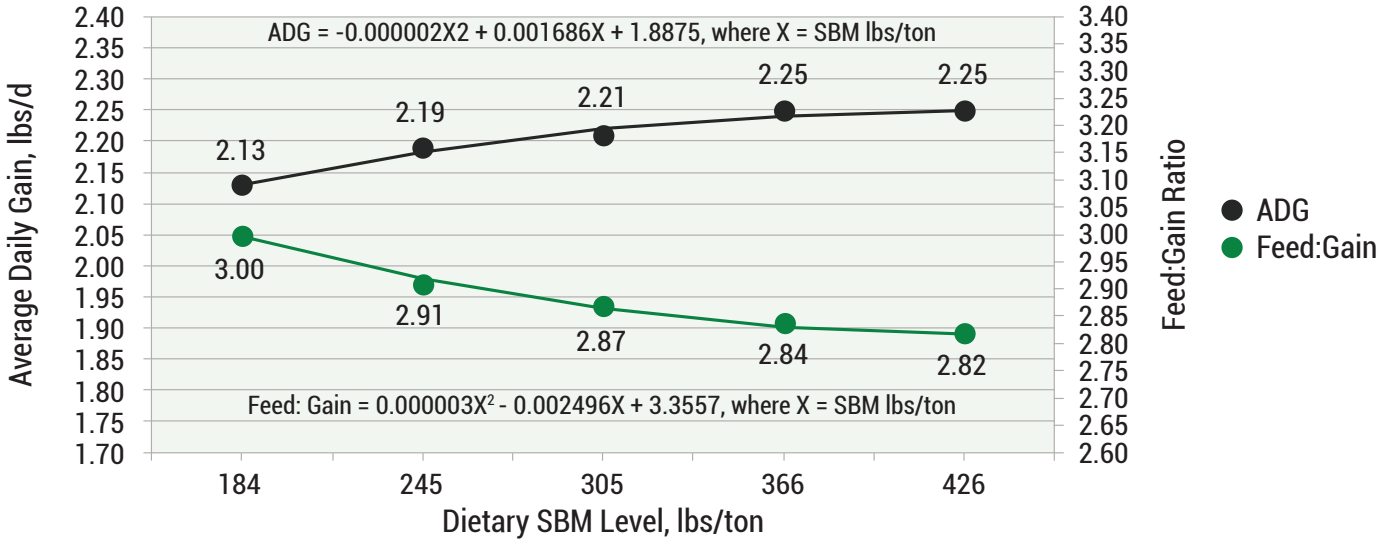
The proper balance of SBM that is needed to maximize growth and not impair growth has 3 parts:

1. Can dietary SBM level be too low for maximum growth in the commercial environment?
2. Can SBM level be too high for maximum growth?
3. Can SBM level be high enough to reduce carcass yield?

Can dietary SBM level be too low for maximum growth?

Yes. Extreme SBM replacement by the combination of corn protein sources (e.g. DDGS) and amino acids in diets for growing pigs impairs growth rate, FCE and carcass lean content even though amino acid and energy levels are met. This is a new concept and suggests that SBM contributes value beyond amino acid supply. This concept is illustrated in **Figure 1**, where the response to increasing dietary SBM content, in nutrient equivalent diets, is shown for growth rate and FCE. The SBM level needed for maximum growth and FCE was determined in this manner for each growth phase with healthy pigs in a commercial environment. The result was published as a curve over the 25 to 295 lbs growth span.[1]

Figure 1. Daily gain and FCE response to increasing dietary SBM level[1]



Key takeaways

- *Extensive SBM removal compromises growth rate, FCE and carcass lean content.*
- *A certain level of dietary SBM is needed for maximum growth, FCE and lean deposition.*

Can SBM level be too high for maximum growth?

Yes. There is limited research on which to base this response since extensive use of amino acids has become the norm for commercial diets. Our response is based on a study by Elsbernd and co-workers,[2] who determined the growth response to 3 dietary SBM levels (Low, Med, High), by healthy pigs in a commercial environment (2283 PIC terminal pigs). Four feeding phases were used over the 98 to 295 lbs weight range.

Dietary SBM level for each phase covered the range from below the amount expected for maximum growth (Low) to slightly above the level expected for maximum growth (High), based on a preliminary study. The response to 3 dietary SBM levels for each phase of growth is shown in **Table 1**.

Table 1. Impact of diet SBM level on growth, feed efficiency and body lean content[a,b,c]

Phase, lbs	SBM Level Tested, %			Growth Rate, lbs/d			Feed Efficiency Feed:Gain Ratio			Auto FOM Carcass Lean, %			SBM Level[1] Min, %
98-130	19.0	24.5	30.0	2.01	2.03	2.05	2.24	2.29	2.21				25.4
130-190	14.0	18.0	22.0	2.02	2.05	2.00	2.77	2.76	2.62				20.4
190-230	9.5	13.0	16.5	2.07	2.06	1.99	2.96	2.93	2.80				16.0
230-295	7.5	10.5	13.5	1.63	1.59	1.61	3.85	4.01	3.71	53.9	54.0	54.3	12.4

[a]Data with statistical analysis posted on Research Gate[2]
[b]Carcass Yield (%) was 73.25, 73.44, 73.62 respectively (Not Different, SEM 0.266)
[c]Primal Yield % (Saleable meat/Carcass lbs.) increase coincided with Lean %

The estimated minimum SBM level for maximum growth and FCE is also shown in **Table 1** (right column). This allowed us to compare SBM treatments in **Table 1** for their relative deficit and excess.

Dietary SBM content slightly above our standard tended to reduce growth rate (**Table 1**). Although this was not the case for phases 1 and 4, there was a tendency for High SBM to reduce growth in phases 2 and 3. The end result for High SBM-fed pigs was to gain slightly less total weight (-2.5 lbs./pig). It is conceivable that significantly higher than practical SBM levels may have resulted in a more consistent decline in growth.

The High SBM diet had a numerical advantage in FCE for all 4 phases, despite diets having equivalent net energy. We attribute this to dietary productive energy (PE) differences; diet PE increased in direct relationship to increasing SBM content.[3] A linear improvement in carcass lean (%) also coincided with increasing dietary SBM level (Low, Med, High), and this translated to an increase in saleable meat per carcass (primal %). Increase in primal lbs is expected with greater lean (%).

Key takeaway

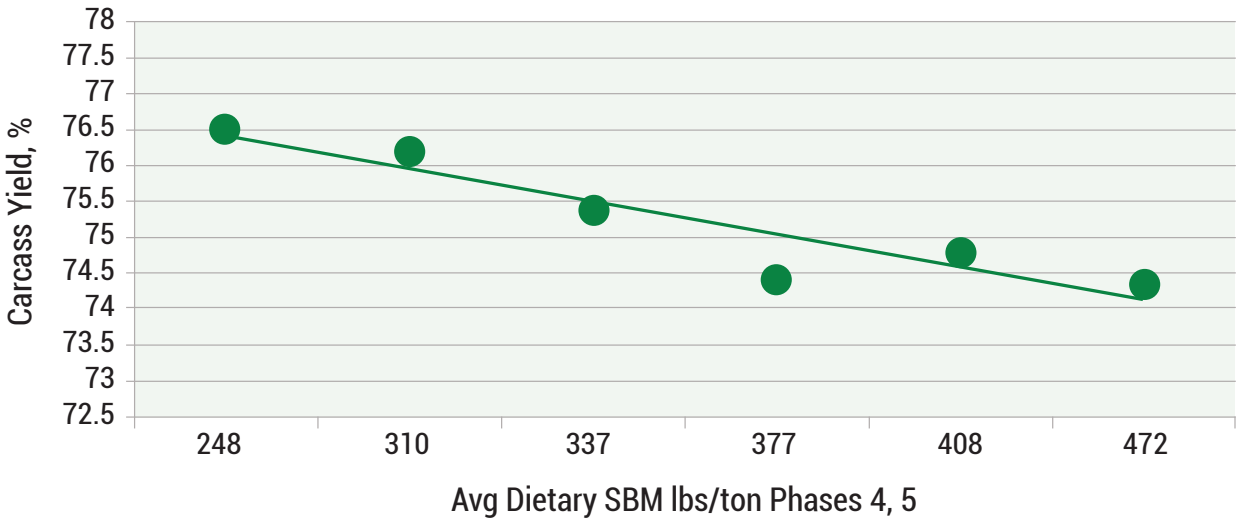
- *Dietary SBM content above the recommended level may slightly reduce growth rate, but FCE and body lean content improves.*

Can SBM level be high enough to reduce carcass yield?

Yes. Relatively high dietary SBM content is known to reduce carcass yield (carcass lbs./whole-body lbs.), even though whole-body weight may not be affected.[4] The relationship between SBM level in diets fed during the last 50–60 d prior to harvest and carcass yield (%) is shown in **Figure 1**. Based on this relationship, feeding diets that contain more than 310 lbs SBM/ton in the final two diets may cause a decline in carcass yield (Linear, 0.081).

It is not clear why this phenomenon exists; however, it is reasonable to assume that either carcass shrink increased during transport to harvest or that organ and viscera mass increased.

Figure 2. Relationship between average SBM level in diets fed 50-60 d prior to harvest and carcass percent of whole-body weight (SEM, 0.82).



Excess dietary SBM content did not compromise carcass yield in pigs infected with PRRSv.[5] In 2025, 25% to 50% of pigs in the field were infected with PRRSv (Swine Disease Reporting System); an infection that derives from their infected mothers or from site-to-site transfer of infection in the field. In the study,[5] PRRSv-infected pigs were fed diets with 50% more SBM than control pigs, which led to a profound mitigation of growth and FCE suppression, with no impact on carcass yield.

Key takeaways

- *Carcass percent of whole-body weight may decline if diets fed 50–60 days prior to harvest exceed our recommendation for maximum growth by 15% or more.*
- *This conclusion applies to healthy pigs that are reared in a commercial environment during the summer or non-summer months.*

Bottom line for strategic SBM use

The dietary SBM level for maximum growth and FCE was published for healthy pigs in a commercial environment.[1] Feeding to this standard will improve carcass lean content but will not compromise carcass yield. Feeding less SBM may compromise growth rate, FCE and carcass lean content slightly. Feeding diets with higher SBM content (e.g., 10%–15%) may slightly reduce growth rate, but FCE and body lean content tends to improve. The financial consequence of a slight decrease in gain may be offset by a concomitant improvement in FCE.

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Reference Information

[1]Boyd, R.D., C. Rush, N. Augspurger. 2025. New finding in animal growth: Dietary soybean meal content is important for maximum growth expression by pigs. https://doi.org/10.13140/RG.2.2.12950.20809

[2]Elsbernd, A., D. Rosero, R.D. Boyd. 2022. Increasing dietary soybean meal level improves growth and feed conversion in healthy pigs and reduces GHG emissions. https://doi.org/10.1093/jas/skac247.233

[3]Boyd, R.D., A.M. Gaines. 2023. Soybean meal NE value for growing pigs is greater in commercial environments. https://dx.doi.org/10.13140/RG.2.2.23294.09287

[4]Johnston, M.E., B. Fields et al., 2004. Whole-body growth, carcass growth and primal mass as indices of lysine adequacy in high lean growth pigs. http://doi.org/10.13140/RG.2.2.11665.29286

[5]Boyd, R.D., M.E. Johnston et al., 2023. Soybean meal mitigates respiratory disease-impaired growth in pigs. http://dx.doi.org/10.13140/RG.2.2.23608.66564