# Effects of Increasing Soybean Meal in Diets with or without Distillers Dried Grains with Solubles on Growth Performance and Carcass Characteristics of Pigs in Early and Late Finishing Phases[1]

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## Summary
This study aimed to determine the minimum soybean meal (SBM) inclusion in diets with or without distillers dried grains with solubles (DDGS) to optimize growth performance and carcass characteristics in finishing pigs. For the early finishing period (Exp. 1), a total of 4,080 pigs were used in a 28-day trial. Dietary treatments were arranged in a 2 × 4 factorial with main effects of DDGS (none or 30%) and increasing SBM (low, low-medium, medium-high, and high). There were 34 pigs per pen and 15 pens per treatment. Diets without DDGS contained 17.5, 23.3, 29.1, or 34.9% SBM, while diets with DDGS contained 3.9, 12.8, 21.8, or 30.6% SBM. For the late finishing period (Exp. 2), a total of 3,984 pigs were used in a 28-day trial. Diets were also arranged in a 2 × 4 arrangement with main effects of DDGS (none or 15%) and SBM (low, low-medium, medium-high and high). There were 30 to 34 pigs per pen and 15 pens per treatment. Diets without DDGS contained 6.5, 11.5, 16.4, or 21.3% SBM while diets with DDGS contained none, 6.4, 12.8, or 19.2% SBM. The NE of corn was assumed to be 1,228 Kcal/lb and soybean meal was assumed to be 1,267 Kcal/lb (103% of corn NE). Following the 28-day growth study, pigs were marketed on a fixed weight basis across three marketing events, and carcass characteristics were collected. Between experiments, from 140 to 175 lb, pigs were fed a common diet with 7.5% DDGS. In Exp. 1, a tendency ($P = 0.088$) for a linear interaction between DDGS and SBM level was observed for ADG, where increasing SBM decreased ADG in diets with 30% DDGS but did not affect diets without DDGS. Pigs fed 30% DDGS had decreased ($P \leq 0.01$)

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ADFI and poorer F/G than pigs fed the corn-SBM-based diet without DDGS. Increasing SBM, regardless of DDGS inclusion, decreased ADFI (linear, $P = 0.001$) and improved F/G (linear, $P = 0.043$). In Exp. 2, from d 0 to d 28, an interaction (linear, $P \leq 0.05$) between DDGS and SBM level was observed for ADG and ADFI, where increasing SBM reduced ADG and ADFI only in diets containing 15% DDGS. Pigs fed diets without DDGS had a tendency ($P = 0.094$) for improved F/G compared to pigs fed 15% DDGS. Increasing SBM improved F/G (linear, $P < 0.001$) but did not affect final BW. Marginal interactions between DDGS and SBM for percentage lean and loin depth ($P \leq 0.10$) were observed with increasing SBM improving these traits to a greater extent in diets with 15% DDGS. Pigs fed diets without DDGS had increased ($P < 0.05$) HCW, carcass yield, and backfat depth. Increasing SBM decreased carcass yield (linear, $P < 0.001$) and backfat depth (quadratic, $P = 0.033$), regardless of DDGS inclusion. In conclusion, 30% and 15% DDGS negatively affected ADG and F/G in the early and late finishing periods, respectively. Feeding 29.1% SBM without DDGS and 21.8% SBM with 30% DDGS in the early period improved F/G without compromising ADG, while feeding 16.4% SBM without DDGS and 19.2% SBM with 15% DDGS in the late period improved F/G and carcass characteristics. Caloric efficiency was not changed with increasing SBM, suggesting that our initial estimate for SBM of 103% of the NE value for corn was appropriate.

## Introduction

Soybean meal (SBM) is a commonly used protein source in swine diets due to its high digestibility and excellent amino acid profile that complements corn. In addition, SBM contains biologically active compounds like isoflavones, saponins, peptides, and omega-3 fatty acids that may enhance the immune response and growth performance of pigs facing health challenges.

Distillers dried grains with solubles (DDGS) are a co-product of the ethanol industry. They are commonly used in swine diets as a partial substitute for SBM. There are limited data available comparing increasing levels of SBM in diets with or without DDGS. Therefore, the objective of this study was to determine the minimum amount of SBM required in diets with and without DDGS for growing and finishing pigs to achieve optimal growth performance, caloric efficiency, and carcass characteristics.

## Materials and Methods

The Kansas State University Institutional Animal Care and Use Committee approved the protocol for this experiment. This study was conducted at a commercial research-finishing site in southern Illinois across four different rooms. The barns were totally enclosed, environmentally regulated, and naturally ventilated. Each pen was equipped with a four-hole, wet-dry feeder and a bowl waterer for *ad libitum* access to feed and water.

### *Animals and diets*

For the early finishing period (Exp. 1), a total of 4,080 pigs were used in a 28-d trial. Pens of pigs were randomly assigned to one of eight dietary treatments in a randomized complete block design with 34 pigs per pen and 15 pens per treatment. Treatments were arranged in a 2 × 4 factorial with main effects of DDGS (none or 30%) and increasing SBM (low, low-medium, medium-high, and high). Diets without added DDGS contained 17.5, 23.3, 29.1, or 34.9% SBM, while diets with DDGS (30%; Big River Resources, Burlington, IA) contained 3.9, 12.8, 21.8, or 30.6% SBM. For the late phase period (Exp. 2), a total of 3,984 pigs were used in a 28-d trial. Pens of pigs were randomly assigned to one of eight dietary treatments in a randomized complete block design with 30 to 34 pigs per pen and 15 pens per treatment. Dietary treatments were set up similarly to Exp. 1, as a 2 × 4 factorial with main effects of DDGS (none or 15%) and increasing SBM (low, low-medium, medium-high, and high). Diets without DDGS contained 6.5, 11.5, 16.4, or 21.3% SBM, while diets with DDGS (15%) contained none, 6.4, 12.8, or 19.2% SBM.

All diets were formulated to be isocaloric, with SBM NE considered to be 103% of corn NE. The NE value for SBM was calculated based on the results of a previous study conducted within this facility. The corn was ground to approximately 225 microns and all diets were pelleted. Dietary additions of feed grade AA were adjusted to meet or exceed AA requirement estimate in relation to Lys for Ile, Met and Cys, Thr, Trp, and Val (Tables 1 and 2). Daily feed additions to each pen were accomplished using a robotic feeding system (FeedPro; Feedlogic Corp., Wilmar, MN). All diets were fed in pellet form. The early phase period was fed for 28 days from approximately 75 to 140 lb. Then all pigs were fed a common diet with 7.5% DDGS until the start of Exp. 2. For the late finishing period, pigs were fed from 175 to 295 lb of body weight. Pigs were weighed approximately every two weeks and at each marketing event to determine ADG, ADFI, and F/G.

Following the 28-day growth study in Exp. 2, pigs were marketed on a fixed-weight basis across three marketing events. Hot carcass weight, loin depth, and backfat measurements were collected. A proprietary equation from the packing plant was used to calculate the percentage lean. Caloric efficiency (CE) was calculated using NE values derived from the formulation and according to NRC (2012) for all ingredients except SBM and DDGS.

### *Statistical analysis*

Data were analyzed as a completely randomized block design for a two-way ANOVA using the lmer function from the lme4 package in R (version 4.1.1 (2021-08-10), R Foundation for Statistical Computing, Vienna, Austria), with pen considered the experimental unit. The block was formed by creating eight pens of 34 pigs with similar gender, weaning age, and initial weight. For the late period, within the blocks formed at the start of the early feeding period, the treatments were randomly assigned to the eight pens following the common feeding period. Soybean meal level, DDGS, and their interactions were included as fixed effects. Room and block were included in the model as random effects. Within the main effect of SBM, linear and quadratic contrasts were tested. As the levels of SBM were not evenly spaced and had different inclusion rates depending on the use of DDGS, contrast coefficients were developed for each set of diets, and the average between them was used for the overall linear, quadratic, and interaction of each for SBM level. If there was a significant interaction, contrast statements were conducted within diets utilizing coefficients specific to that diet's SBM level. Results are considered significant at $P \leq 0.05$ and marginally significant at $0.05 \leq P \leq 0.10$.

## Results and Discussion

In the early finishing phase (Exp. 1), a tendency ($P = 0.088$) for a linear interaction between DDGS and SBM was observed for ADG. Increasing SBM decreased the ADG when 30% DDGS was present in the diet but did not affect growth in diets without

DDGS (Table 3). Pigs fed diets with 30% DDGS had decreased ($P \leq 0.01$) final BW, ADFI, and poorer F/G and CE compared to pigs fed diets without DDGS. As SBM increased, final BW increased then decreased (quadratic, $P = 0.007$) at the highest SBM level in both sets of diets. Furthermore, increasing SBM in the diet decreased (linear, $P = 0.001$) ADFI but improved (linear, $P = 0.043$) F/G in pigs fed diets with and without DDGS. The calculated caloric efficiency did not change with increasing SBM and therefore, it appears that our initial estimate for SBM of 103% of the NE value for corn was accurate.

For the late finishing period (Exp. 2), during the 28-d growth period, a significant interaction (linear, $P \leq 0.05$) between DDGS and SBM level was observed for ADG and ADFI, where increasing SBM reduced the growth and feed intake to a greater extent in diets containing 15% DDGS (Table 4). Regardless of SBM level, pigs fed no DDGS were heavier at the end of the study ($P = 0.031$) and tended ($P = 0.094$) to have improved F/G compared to pigs fed 15% DDGS. Increasing the SBM level in diets with or without 15% DDGS, did not affect d 28 BW. However, an improvement (linear, $P < 0.001$) in F/G was observed with increasing SBM. For the 28-d period, CE tended (linear, $P < 0.10$) to decrease, suggesting that for this phase, our initial estimate of NE of SBM was slightly underestimated. Caloric efficiency was also improved ($P < 0.01$) for pigs fed DDGS suggesting our initial NE estimate (1,046 Kcal NE) was also underestimated.

For the entire finishing period up to marketing, a tendency for the SBM × DDGS interaction was observed for ADFI, where increasing SBM tended to decrease the ADFI in diets containing 15% DDGS but did not affect ADFI in diets without DDGS. Pigs fed diets without DDGS tended to have increased ($P = 0.066$) ADG compared to pigs fed diets with 15% DDGS. Regardless of added DDGS, F/G was improved (linear, $P = 0.016$) with increasing SBM. Caloric efficiency was unaffected by increasing SBM level.

For carcass characteristics, a tendency for the SBM × DDGS interaction was observed (linear, $P \leq 0.10$) for percentage lean and loin depth, where increasing SBM increased the percentage lean and loin depth only in diets containing 15% DDGS. Pigs fed diets without DDGS had increased HCW, carcass yield, backfat depth, and poorer CE compared to diets with 15% DDGS. Regardless of added DDGS, increasing SBM decreased carcass yield (linear, $P < 0.001$) and backfat depth (quadratic, $P = 0.033$) and worsened HCW-based CE, regardless of DDGS inclusion.

In conclusion, feeding pigs with 30 and 15% DDGS during the early and late finishing periods, respectively, negatively affected most growth performance criteria. For the early finishing period, feeding greater than up to 29.1% SBM without DDGS and 21.8% SBM with DDGS decreased the ADG. However, in the late finishing period, ADG was not affected by SBM level. Moreover, in both periods, increasing SBM levels decreased ADFI resulting in an improvement in F/G regardless of added DDGS. Caloric efficiency was not changed with increasing SBM, suggesting that our initial estimate for SBM of 103% of the NE for corn was appropriate.

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**Table 1. Diet composition (as-fed basis, early finishing period)[1,2]**

| | No DDGS | | | | 30% DDGS[3] | | | |
|---|---|---|---|---|---|---|---|---|
| **Soybean meal, %:** | **17.5** | **23.3** | **29.1** | **34.9** | **3.9** | **12.8** | **21.8** | **30.6** |
| Ingredients, % | | | | | | | | |
| Corn | 78.15 | 72.73 | 67.28 | 61.86 | 62.02 | 53.63 | 45.21 | 36.81 |
| Soybean meal (46% CP) | 17.49 | 23.29 | 29.11 | 34.91 | 3.94 | 12.84 | 21.75 | 30.65 |
| Distillers dried grains with solubles | --- | --- | --- | --- | 30.00 | 30.00 | 30.00 | 30.00 |
| Beef tallow | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Limestone | 1.06 | 1.09 | 1.12 | 1.14 | 1.41 | 1.45 | 1.50 | 1.54 |
| Monocalcium P (21% P) | 0.99 | 0.96 | 0.93 | 0.90 | 0.14 | 0.10 | 0.05 | --- |
| Copper chloride | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Salt | 0.51 | 0.51 | 0.51 | 0.51 | 0.35 | 0.35 | 0.35 | 0.35 |
| L-Lys-HCl | 0.52 | 0.35 | 0.17 | --- | 0.79 | 0.53 | 0.26 | --- |
| DL-Met | 0.18 | 0.13 | 0.08 | 0.03 | 0.12 | 0.08 | 0.04 | --- |
| L-Trp | 0.05 | 0.03 | 0.02 | --- | 0.08 | 0.06 | 0.03 | --- |
| L-Thr | 0.19 | 0.13 | 0.06 | --- | 0.22 | 0.14 | 0.07 | --- |
| L-Val | 0.15 | 0.10 | 0.05 | --- | 0.14 | 0.10 | 0.05 | --- |
| L-Ile | 0.07 | 0.04 | 0.02 | --- | 0.12 | 0.08 | 0.04 | --- |
| Phytase[4] | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Vitamin premix | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Trace mineral premix | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| Titanium dioxide | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| | | | | | | | | |
| Calculated analysis | | | | | | | | |
| SID AA, % | | | | | | | | |
| Lys | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Ile:Lys | 55 | 63 | 71 | 79 | 55 | 67 | 78 | 90 |
| Leu:Lys | 111 | 125 | 140 | 154 | 142 | 163 | 185 | 207 |
| Met and Cys:Lys | 57 | 57 | 57 | 57 | 57 | 60 | 64 | 67 |
| His:Lys | 32 | 37 | 43 | 48 | 32 | 40 | 48 | 56 |
| Trp:Lys | 19 | 21 | 22 | 24 | 19 | 21 | 23 | 25 |
| Thr:Lys | 63 | 65 | 67 | 69 | 63 | 69 | 74 | 80 |
| Val:Lys | 68 | 72 | 76 | 81 | 68 | 77 | 87 | 96 |
| NE, kcal/lb[5] | 1,190 | 1,197 | 1,203 | 1,210 | 1,136 | 1,145 | 1,153 | 1,162 |
| SID Lys:NE, g/Mcal | 3.74 | 3.71 | 3.70 | 3.67 | 3.91 | 3.88 | 3.86 | 3.83 |
| Ca, % | 0.65 | 0.67 | 0.69 | 0.72 | 0.60 | 0.63 | 0.67 | 0.70 |
| P, % | 0.50 | 0.52 | 0.53 | 0.55 | 0.46 | 0.49 | 0.52 | 0.54 |
| CP, % | 14.70 | 16.69 | 18.68 | 20.67 | 16.29 | 19.38 | 22.48 | 25.58 |
| NDF, % | 5.73 | 5.82 | 5.91 | 6.00 | 12.98 | 13.11 | 13.25 | 13.38 |

[1]Calculated analysis is based on analyzed values for DDGS and soybean meal, while other ingredients were based on nutrient profiles from NRC (2012).
[2]Treatment diets were fed from 75 to 130 lb.
[3]Big River Resources, Burlington, IA
[4]HiPhos 2500 (DSM Nutritional Products, Parsippany, NJ) provided 500 FTU/lb for an estimated release of 0.10% STTD P.
[5]Assumed NE values of 1,228, 1,267, and 1,046 kcal/lb for corn, SBM and DDGS, respectively.

**Table 2. Diet composition (as-fed basis, late finishing period)[1,2]**

| | No DDGS | | | | DDGS, 15 %[3] | | | |
|---|---|---|---|---|---|---|---|---|
| **Soybean meal, %:** | **6.5** | **11.5** | **16.4** | **21.3** | **0.0** | **6.4** | **12.8** | **19.2** |
| Ingredients, % | | | | | | | | |
| Corn | 90.05 | 85.45 | 80.83 | 76.23 | 81.74 | 75.70 | 69.65 | 63.62 |
| Soybean meal (46% CP) | 6.55 | 11.45 | 16.38 | 21.28 | --- | 6.40 | 12.82 | 19.22 |
| Distillers dried grains with solubles | --- | --- | --- | --- | 15.00 | 15.00 | 15.00 | 15.00 |
| Beef tallow | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Limestone | 0.89 | 0.92 | 0.94 | 0.97 | 1.08 | 1.11 | 1.14 | 1.16 |
| Monocalcium P (21% P) | 0.53 | 0.50 | 0.47 | 0.45 | 0.12 | 0.08 | 0.04 | --- |
| Copper chloride | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Salt | 0.46 | 0.46 | 0.46 | 0.46 | 0.38 | 0.38 | 0.38 | 0.38 |
| L-Lys-HCl | 0.44 | 0.29 | 0.15 | --- | 0.57 | 0.38 | 0.19 | --- |
| DL-Met | 0.09 | 0.06 | 0.03 | --- | 0.06 | 0.04 | 0.02 | --- |
| L-Trp | 0.05 | 0.03 | 0.02 | --- | 0.06 | 0.04 | 0.02 | --- |
| L-Thr | 0.16 | 0.11 | 0.05 | --- | 0.17 | 0.11 | 0.06 | --- |
| L-Val | 0.10 | 0.07 | 0.03 | --- | 0.09 | 0.06 | 0.03 | --- |
| L-Ile | 0.07 | 0.05 | 0.02 | --- | 0.10 | 0.07 | 0.03 | --- |
| Phytase[4] | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Vitamin premix | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Trace mineral premix | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| Titanium dioxide | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| | | | | | | | | |
| Calculated analysis | | | | | | | | |
| SID AA, % | | | | | | | | |
| Lys | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 |
| Ile:Lys | 55 | 64 | 73 | 83 | 55 | 67 | 79 | 91 |
| Leu:Lys | 127 | 145 | 162 | 180 | 150 | 173 | 196 | 219 |
| Met and Cys:Lys | 59 | 60 | 62 | 64 | 59 | 64 | 69 | 73 |
| His:Lys | 33 | 40 | 46 | 53 | 33 | 42 | 50 | 59 |
| Trp:Lys | 19 | 21 | 22 | 24 | 19 | 21 | 23 | 25 |
| Thr:Lys | 66 | 69 | 71 | 74 | 66 | 71 | 76 | 81 |
| Val:Lys | 68 | 75 | 81 | 88 | 68 | 78 | 89 | 99 |
| NE, kcal/lb[5] | 1,198 | 1,203 | 1,208 | 1,214 | 1,171 | 1,177 | 1,183 | 1,190 |
| SID Lys:NE, g/Mcal | 2.50 | 2.49 | 2.48 | 2.47 | 2.56 | 2.54 | 2.53 | 2.52 |
| Ca, % | 0.47 | 0.49 | 0.51 | 0.53 | 0.45 | 0.47 | 0.50 | 0.52 |
| P, % | 0.36 | 0.37 | 0.39 | 0.40 | 0.35 | 0.36 | 0.38 | 0.40 |
| CP, % | 10.33 | 12.01 | 13.71 | 15.40 | 11.20 | 13.42 | 15.66 | 17.89 |
| NDF, % | 5.65 | 5.73 | 5.80 | 5.88 | 9.28 | 9.38 | 9.47 | 9.57 |

[1]Calculated analysis is based on analyzed values for DDGS and soybean meal, while other ingredients were based on nutrient profiles from NRC (2012).
[2]Treatment diets were fed from 175 lb to market.
[3]Big River Resources, Burlington, IA.
[4]HiPhos 2500 (DSM Nutritional Products, Parsippany, NJ) provided 500 FTU/lb for an estimated release of 0.10% STTD P.
[5]Assumed NE values of 1,228, 1,267, and 1,046 Kcal/lb for corn, SBM and DDGS, respectively.

**Table 3. Effect of increasing soybean meal (SBM) in the early finishing period in pelleted diets with or without dried distillers grains with solubles (DDGS) on growth performance[1]**

| | No DDGS | | | | 30% DDGS | | | | | P = | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | SBM × DDGS | | | SBM level | |
| SBM, %: | 17.5 | 23.3 | 29.1 | 34.9 | 3.9 | 12.8 | 21.8 | 30.6 | SEM | Linear | Quadratic | DDGS | Linear | Quadratic |
| BW, lb | | | | | | | | | | | | | | |
| Initial | 71.3 | 71.3 | 71.5 | 71.6 | 71.3 | 71.7 | 71.6 | 71.4 | 3.24 | 0.431 | 0.185 | 0.513 | 0.254 | 0.475 |
| Final | 129.1 | 129.4 | 129.4 | 128.5 | 126.7 | 127.1 | 127.1 | 124.8 | 4.16 | 0.181 | 0.273 | < 0.001 | 0.012 | 0.007 |
| Early period | | | | | | | | | | | | | | |
| ADG, lb[2] | 2.05 | 2.06 | 2.05 | 2.02 | 1.97 | 1.96 | 1.96 | 1.89 | 0.045 | 0.088 | 0.674 | < 0.001 | 0.001 | 0.038 |
| ADFI, lb | 4.14 | 4.13 | 4.06 | 4.01 | 4.08 | 4.04 | 4.02 | 3.89 | 0.062 | 0.577 | 0.619 | 0.001 | < 0.001 | 0.258 |
| F/G | 2.02 | 2.00 | 1.98 | 1.99 | 2.07 | 2.06 | 2.05 | 2.06 | --- | --- | --- | --- | --- | --- |
| G:F | 0.494 | 0.499 | 0.503 | 0.504 | 0.484 | 0.486 | 0.487 | 0.486 | 0.008 | 0.221 | 0.925 | < 0.001 | 0.043 | 0.452 |
| CE, kcal/lb gain[3] | 2,416 | 2,403 | 2,394 | 2,403 | 2,353 | 2,363 | 2,369 | 2,394 | 39.2 | 0.100 | 0.856 | 0.005 | 0.454 | 0.448 |

[1]A total of 4,080 pigs were used with 34 pigs per pen and 15 pens per treatment. Dietary treatments were arranged in a 2 × 4 factorial with main effects of increasing SBM and DDGS.
[2]Simple effect of SBM in diets without DDGS (linear, $P = 0.243$); simple effect of SBM in diet with 30% DDGS (linear, $P < 0.001$).
[3]Caloric efficiency = F/G × dietary NE (kcal/lb). Initial NE values were 1,228, 1,267, and 1,046 Kcal/lb for corn, SBM and DDGS, respectively.

**Table 4. Effect of increasing soybean meal (SBM) in the late finishing period (175 lb to harvest) in grow-finish pig pelleted diets with or without the inclusion of dried distillers grains with solubles (DDGS) on growth performance[1]**

| | No DDGS | | | | 15% DDGS | | | | | P = | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | SBM × DDGS | | | SBM level | |
| SBM, %: | 6.5 | 11.5 | 16.4 | 21.3 | 0.0 | 6.4 | 12.8 | 19.2 | SEM | Linear | Quadratic | DDGS | Linear | Quadratic |
| Average days to market[2]: | 51 | 50 | 51 | 49 | 50 | 50 | 51 | 50 | --- | --- | --- | --- | --- | --- |
| BW, lb | | | | | | | | | | | | | | |
| Initial | 176.7 | 176.7 | 176.7 | 176.7 | 176.6 | 176.7 | 176.7 | 176.6 | 4.28 | 0.963 | 0.879 | 0.513 | 0.254 | 0.475 |
| d 28 | 247.1 | 246.9 | 249.0 | 247.9 | 246.7 | 247.0 | 244.7 | 245.8 | 4.62 | 0.160 | 0.592 | 0.031 | 0.927 | 0.921 |
| Average marketing weight | 295.0 | 294.0 | 298.2 | 294.3 | 293.3 | 294.4 | 294.0 | 295.3 | 2.30 | 0.747 | 0.459 | 0.274 | 0.407 | 0.521 |
| d 0 to 28 | | | | | | | | | | | | | | |
| ADG, lb[3] | 2.50 | 2.49 | 2.55 | 2.53 | 2.50 | 2.47 | 2.42 | 2.46 | 0.055 | 0.031 | 0.292 | 0.002 | 0.919 | 0.317 |
| ADFI, lb[4] | 6.51 | 6.52 | 6.51 | 6.49 | 6.62 | 6.44 | 6.37 | 6.28 | 0.193 | 0.009 | 0.512 | 0.054 | 0.003 | 0.707 |
| F/G | 2.60 | 2.62 | 2.55 | 2.57 | 2.65 | 2.61 | 2.63 | 2.55 | --- | --- | --- | --- | --- | --- |
| G:F | 0.385 | 0.383 | 0.392 | 0.392 | 0.378 | 0.386 | 0.380 | 0.394 | 0.005 | 0.623 | 0.506 | 0.094 | < 0.001 | 0.345 |
| CE, kcal/lb gain | 3,119 | 3,149 | 3,083 | 3,107 | 3,097 | 3,055 | 3,121 | 3,027 | 43.9 | 0.788 | 0.497 | 0.019 | 0.095 | 0.379 |

*continued*

**Table 4. Effect of increasing soybean meal (SBM) in the late finishing period (175 lb to harvest) in grow-finish pig pelleted diets with or without the inclusion of dried distillers grains with solubles (DDGS) on growth performance[1]**

| | | | | | | | | | | *P* = | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No DDGS | | | | 15% DDGS | | | | | SBM × DDGS | | | SBM level | |
| **SBM, %:** | **6.5** | **11.5** | **16.4** | **21.3** | **0.0** | **6.4** | **12.8** | **19.2** | **SEM** | **Linear** | **Quadratic** | **DDGS** | **Linear** | **Quadratic** |
| **Average days to market[2]:** | **51** | **50** | **51** | **49** | **50** | **50** | **51** | **50** | --- | --- | --- | --- | --- | --- |
| d 0 – end of marketing | | | | | | | | | | | | | | |
| ADG, lb | 2.37 | 2.38 | 2.42 | 2.42 | 2.38 | 2.39 | 2.33 | 2.38 | 0.050 | 0.101 | 0.432 | 0.066 | 0.283 | 0.643 |
| ADFI, lb[5] | 6.54 | 6.55 | 6.62 | 6.59 | 6.63 | 6.54 | 6.48 | 6.50 | 0.186 | 0.065 | 0.393 | 0.351 | 0.545 | 0.684 |
| F/G | 2.76 | 2.75 | 2.74 | 2.69 | 2.79 | 2.74 | 2.76 | 2.73 | --- | --- | --- | --- | --- | --- |
| G:F | 0.363 | 0.365 | 0.365 | 0.368 | 0.359 | 0.365 | 0.360 | 0.367 | 0.004 | 0.818 | 0.987 | 0.123 | 0.016 | 0.790 |
| CE, kcal/lb gain | 3,305 | 3,304 | 3,308 | 3,305 | 3,263 | 3,225 | 3,289 | 3,246 | 36.81 | 0.926 | 0.975 | < 0.001 | 0.895 | 0.924 |
| Carcass characteristics | | | | | | | | | | | | | | |
| Overall marketing event | | | | | | | | | | | | | | |
| Market weight, lb | 292.5 | 292.8 | 297.1 | 295.5 | 289.7 | 291.4 | 289.6 | 293.8 | 2.86 | 0.828 | 0.475 | 0.028 | 0.081 | 0.900 |
| HCW, lb | 218.3 | 216.1 | 219.8 | 215.1 | 215.1 | 215.9 | 214.7 | 214.7 | 2.03 | 0.649 | 0.625 | 0.009 | 0.242 | 0.321 |
| Carcass yield, % | 74.0 | 73.5 | 73.7 | 73.1 | 73.4 | 73.3 | 73.1 | 72.7 | 0.20 | 0.668 | 0.585 | <0.001 | <0.001 | 0.278 |
| Lean, %[6] | 53.8 | 53.9 | 54.2 | 54.1 | 53.7 | 54.0 | 54.2 | 54.2 | 0.16 | 0.064 | 0.615 | 0.532 | <0.001 | 0.061 |
| Backfat depth, in | 0.76 | 0.75 | 0.73 | 0.73 | 0.75 | 0.73 | 0.71 | 0.71 | 0.016 | 0.452 | 0.521 | <0.001 | <0.001 | 0.033 |
| Loin depth, in[7] | 2.67 | 2.66 | 2.67 | 2.66 | 2.61 | 2.64 | 2.64 | 2.66 | 0.020 | 0.078 | 0.758 | 0.009 | 0.074 | 0.573 |
| HCW CE, kcal/lb gain[8] | 4,467 | 4,495 | 4,490 | 4,524 | 4,450 | 4,399 | 4,503 | 4,468 | 44.1 | 0.959 | 0.880 | 0.031 | 0.045 | 0.774 |

[1]A total of 3,984 pigs were used with 30 to 34 pigs per pen and 15 pens per treatment. Dietary treatments were arranged in a 2 × 4 factorial with main effects of SBM and DDGS.

[2]The average days to market were calculated by considering the entire 28-d trial period, in addition to all three marketing events.

[3]Simple effect of SBM in diets without DDGS (linear, $P = 0.109$); simple effect of SBM in diets with 15% DDGS (linear, $P = 0.145$).

[4]Simple effect of SBM in diets without DDGS (linear, $P = 0.781$); simple effect of SBM in diets with 15% DDGS (linear, $P < 0.001$).

[5]Simple effect of SBM in diets without DDGS (linear, $P = 0.375$); simple effect of SBM in diets with 15% DDGS (linear, $P = 0.084$).

[6]Simple effect of SBM in diets without DDGS (linear, $P = 0.006$); simple effect of SBM in diets with 15% DDGS (linear, $P = 0.013$).

[7]Simple effect of SBM in diets without DDGS (linear, $P = 0.982$); simple effect of SBM in diets with 15% DDGS (linear, $P = 0.013$).

[8]Caloric efficiency = ADFI (d 0 to end marketing) / Carcass ADG (ADG d 0 to end marketing) × (Weighted yield/100) × NE (kcal/lb). Initial NE values were 1,228, 1,267, and 1,046 Kcal/lb for corn, SBM and DDGS, respectively.