Abstract: #98
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

Paula Giacomini[1], Katelyn N. Gaffield*[1], Mike D. Tokach[1], Joel M. DeRouchey[1], Jordan T. Gebhardt[1], Robert D. Goodband[1], Jason C. Woodworth[1], Caleb Shull[2], Omarh Mendoza[2], Amy Petry[3], Margaret Putna[3], Aaron Gaines[4], and R. Dean Boyd[5]

[1]Kansas State University, Manhattan, KS; [2]The Maschhoffs, Carlyle, IL; [3]University of Missouri, Columbia, MO; [4]Ani-Tek, Shelbina, MO; [5]Animal Nutrition Research, Bowling Green, KY

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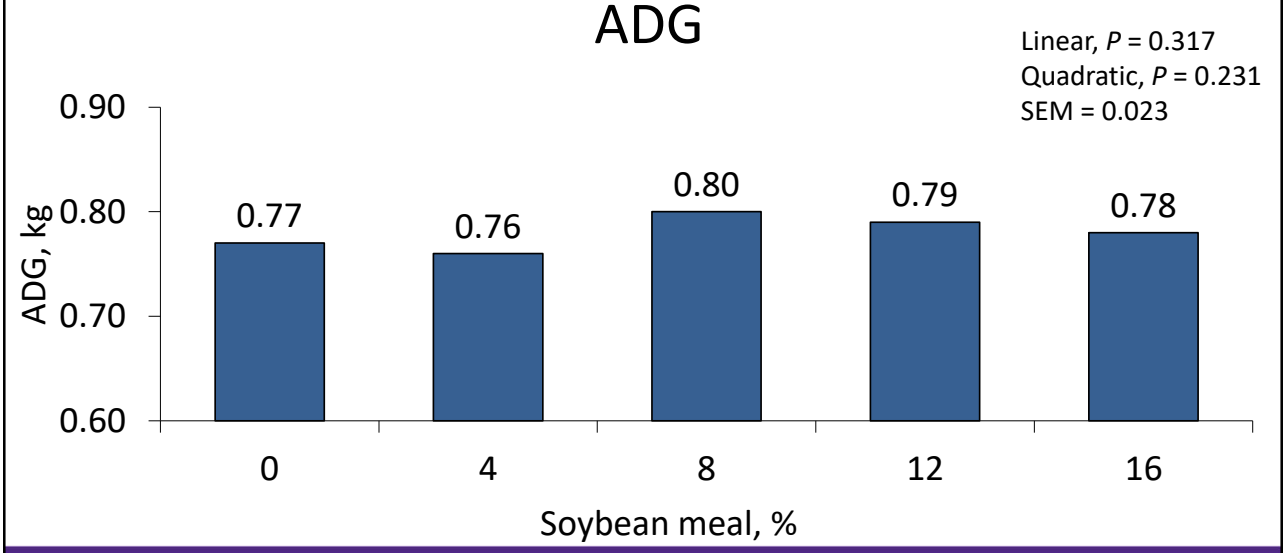
SBM level in late finishing – Corn/25% DDGS diets

ADG



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Objective

To determine the minimum soybean meal inclusion in diets with or without distillers dried grains with solubles to optimize growth performance and carcass characteristics in finishing pigs.

Materials and Methods

Early Finishing Experiment

- 4,080 pigs (PIC 800 × 1050, Hendersonville, TN)
  - Initial BW = 32.3 ± 1.47 kg
  - 34 pigs/pen
  - 15 replications/treatment
- All pigs were fed a common diet up to the start of the trial.
- Ad libitum feed and water access.
- Weights recorded throughout the study to calculate ADG, ADFI, and G:F.
- Pigs were fed a common diet with 7.5% DDGS following the conclusion of the experiment.

Materials and Methods

Late Finishing Experiment

- 3,984 pigs (PIC 800 × 1050, Hendersonville, TN)
  - Initial BW = 80.2 ± 1.94 kg
  - 30 to 34 pigs/pen
  - 15 replications/treatment
- Ad libitum feed and water access.
- Weights recorded throughout the study to calculate ADG, ADFI, and G:F.
- Pigs were marketed on a fixed weight basis across three marketing events for collection of carcass characteristics.

Treatments

	Early Finishing Experiment (34 to 68 kg)							
DDGS inclusion, %	No DDGS				30% DDGS			
Soybean meal, %	17.5	23.3	29.1	34.9	3.9	12.8	21.8	30.6

	Late Finishing Experiment (79 kg to market)							
DDGS inclusion, %	No DDGS				15% DDGS			
Soybean meal, %	6.5	11.5	16.4	21.3	0.0	6.4	12.8	19.2

*Pigs were fed a common diet with 7.5% DDGS between experiments.

	Early Finishing Experiment							
DDGS inclusion, %	No DDGS				30% DDGS			
Soybean meal, %	17.5	23.3	29.1	34.9	3.9	12.8	21.8	30.6
Corn	78.15	72.73	67.28	61.86	62.02	53.63	45.21	36.81
Soybean meal	17.49	23.29	29.11	34.91	3.94	12.84	21.75	30.65
DDGS	---	---	---	---	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	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

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	Early Finishing Experiment							
DDGS inclusion, %	No DDGS				30% DDGS			
Soybean meal, %	17.5	23.3	29.1	34.9	3.9	12.8	21.8	30.6
Corn	78.15	72.73	67.28	61.86	62.02	53.63	45.21	36.81
Soybean meal	17.49	23.29	29.11	34.91	3.94	12.84	21.75	30.65
DDGS	---	---	---	---	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	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

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	Early Finishing Experiment							
DDGS inclusion, %	No DDGS				30% DDGS			
Soybean meal, %	17.5	23.3	29.1	34.9	3.9	12.8	21.8	30.6
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/kg	2,623	2,639	2,652	2,668	2,504	2,524	2,542	2,562
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

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	Early Finishing Experiment							
DDGS inclusion, %	No DDGS				30% DDGS			
Soybean meal, %	17.5	23.3	29.1	34.9	3.9	12.8	21.8	30.6
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/kg	2,623	2,639	2,652	2,668	2,504	2,524	2,542	2,562
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

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	Late Finishing Experiment							
DDGS inclusion, %	No DDGS				15% DDGS			
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	6.55	11.45	16.38	21.28	---	6.40	12.82	19.22
DDGS	---	---	---	---	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	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

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	Late Finishing Experiment							
DDGS inclusion, %	No DDGS				15% DDGS			
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	6.55	11.45	16.38	21.28	---	6.40	12.82	19.22
DDGS	---	---	---	---	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	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

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	Late Finishing Experiment							
DDGS inclusion, %	No DDGS				15% DDGS			
Soybean meal, %	6.5	11.5	16.4	21.3	0.0	6.4	12.8	19.2
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/kg	2,641	2,652	2,663	2,676	2,582	2,595	2,608	2,623
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

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	Late Finishing Experiment							
DDGS inclusion, %	No DDGS				15% DDGS			
Soybean meal, %	6.5	11.5	16.4	21.3	0.0	6.4	12.8	19.2
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/kg	2,641	2,652	2,663	2,676	2,582	2,595	2,608	2,623
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

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Statistical Analysis

- Data were analyzed as a 2 × 4 factorial in a randomized complete block design using the *lmer* function from the *lme4* package in R (version 4.0.2).
  - Experimental unit: Pen
  - Fixed effects: Treatment
  - Random effect: Block and Room
- Contrasts were used to test for the main effects of the increasing soybean meal feeding levels within the two levels of DDGS.
- Results were considered significant with $P \leq 0.05$ and marginally significant with $P \leq 0.10$.

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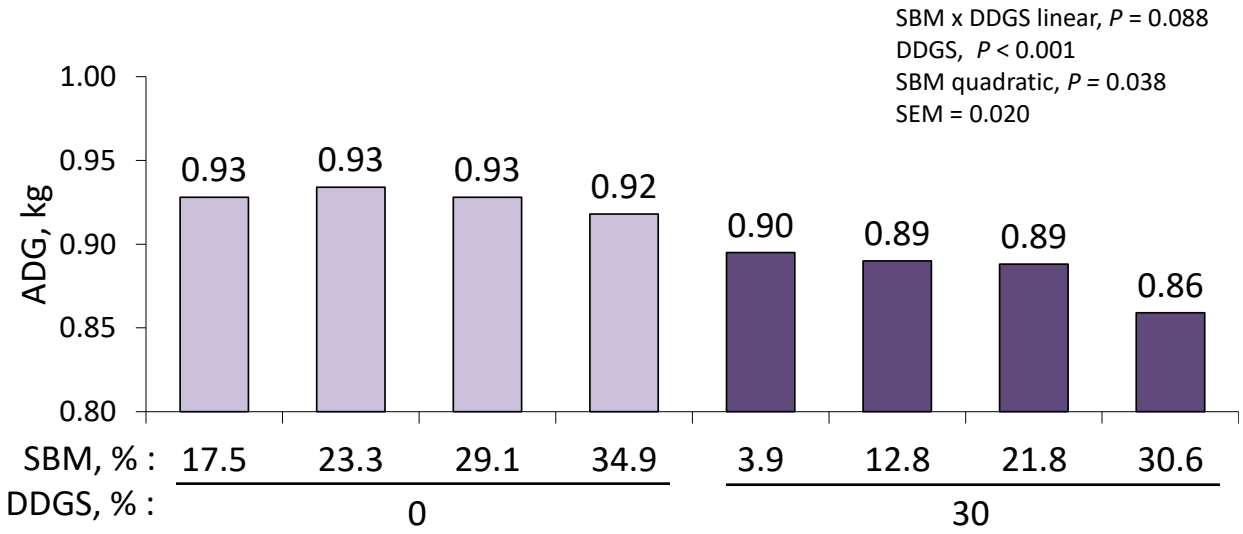
Effects of SBM and DDGS on ADG (34 to 68 kg)



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*Simple effect of SBM in diet without DDGS (linear, $P = 0.243$)
*Simple effect of SBM in diet with 30% DDGS (linear, $P < 0.001$)

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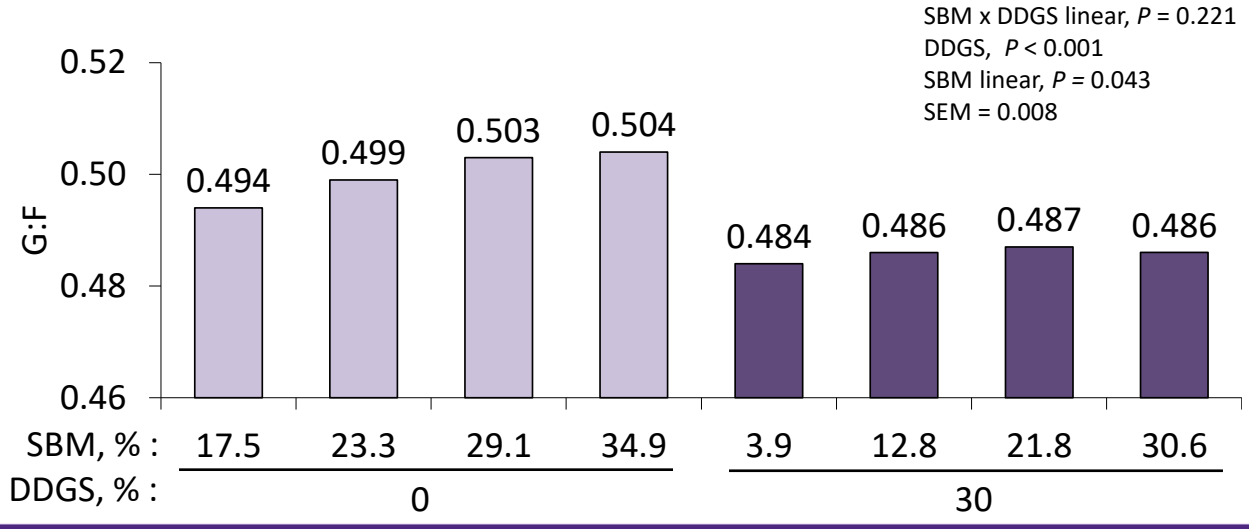
Effects of SBM and DDGS on G:F (34 to 68 kg)



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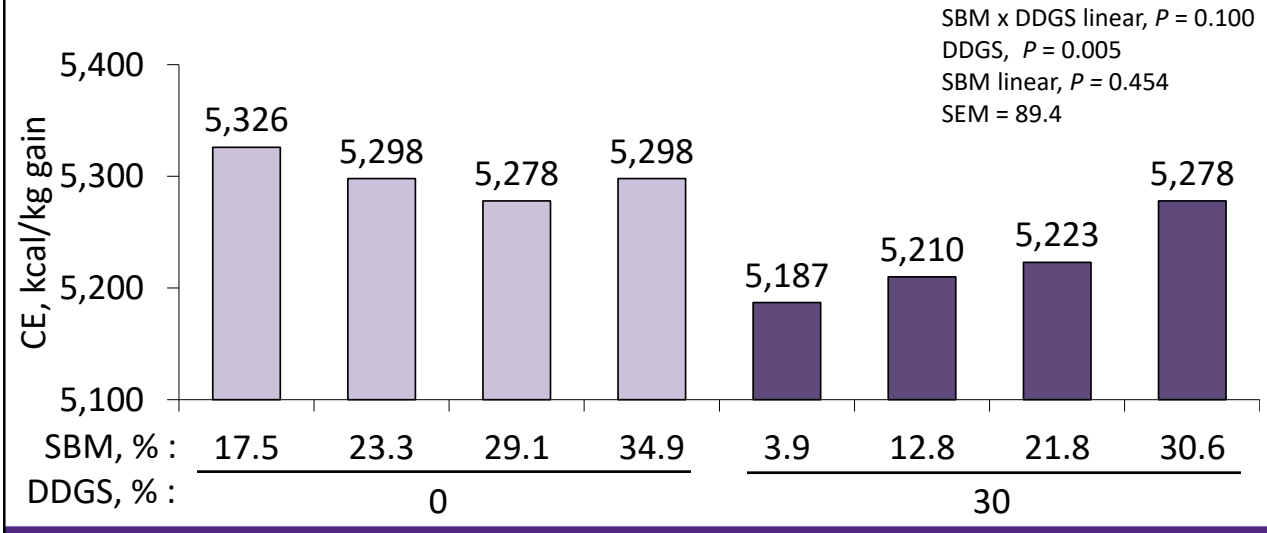
Effects of SBM and DDGS on Caloric Efficiency (34 to 68 kg)



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*Simple effect of SBM in diet without DDGS (linear, $P = 0.523$)
*Simple effect of SBM in diet with 30% DDGS (linear, $P = 0.091$)

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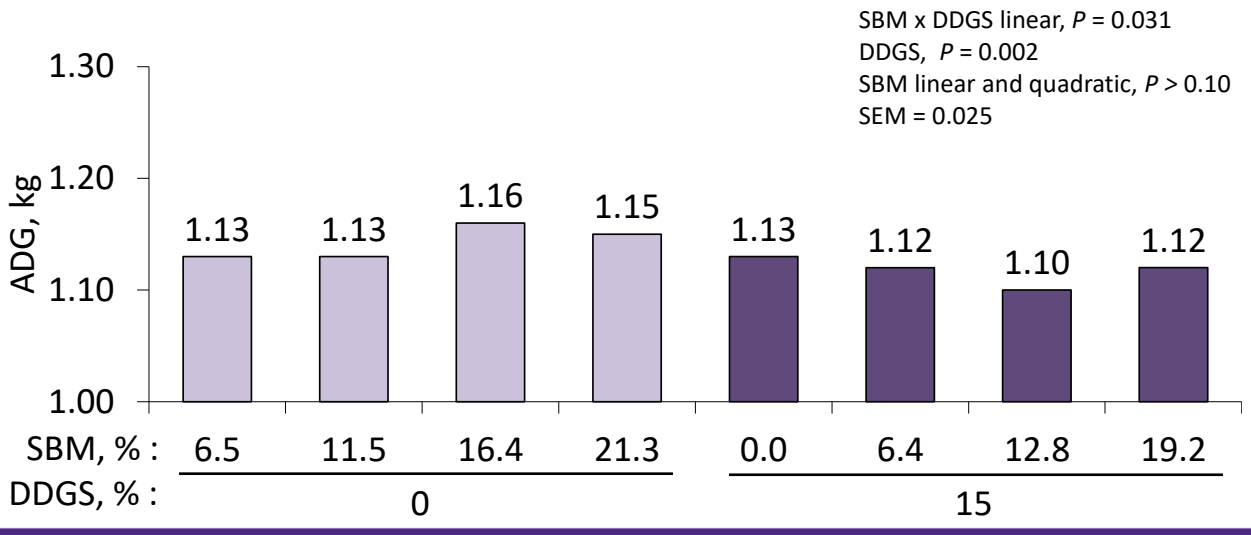
Effects of SBM and DDGS on ADG (79 kg to harvest)



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*Simple effect of SBM in diet without DDGS (linear, $P = 0.109$)
*Simple effect of SBM in diet with 15% DDGS (linear, $P = 0.144$)

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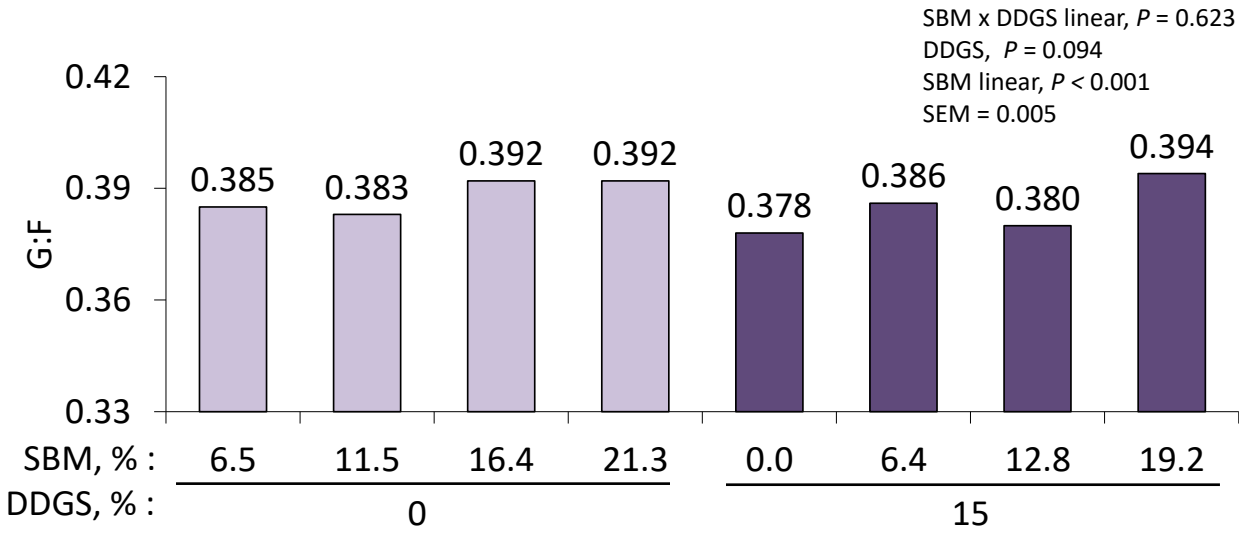
Effects of SBM and DDGS on G:F (79 kg to harvest)



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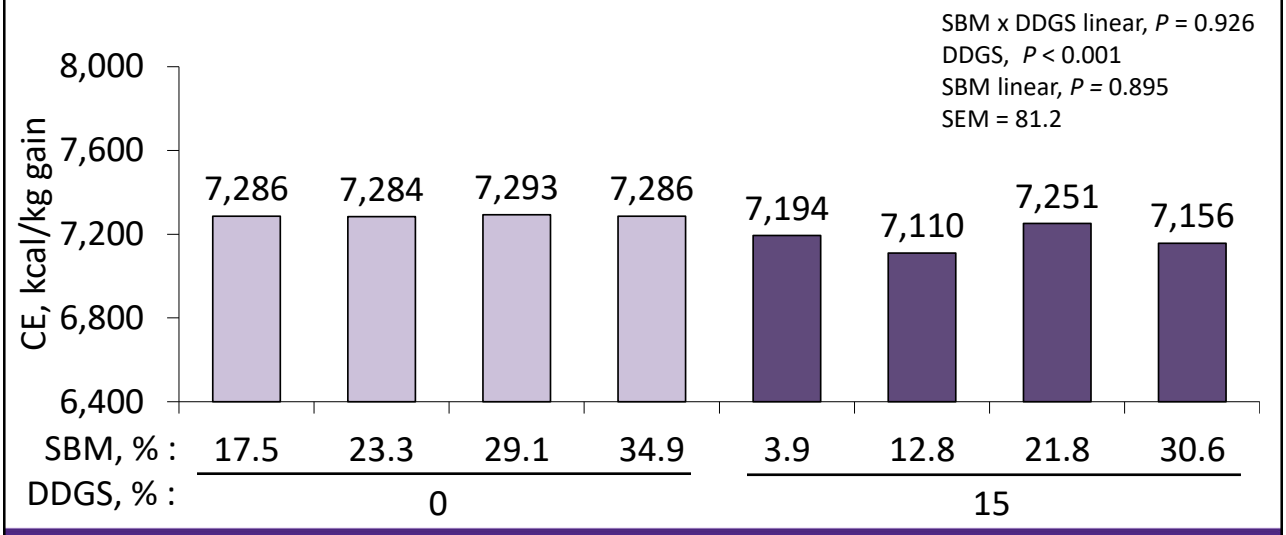
Effects of SBM and DDGS on Caloric Efficiency (79 kg to harvest)



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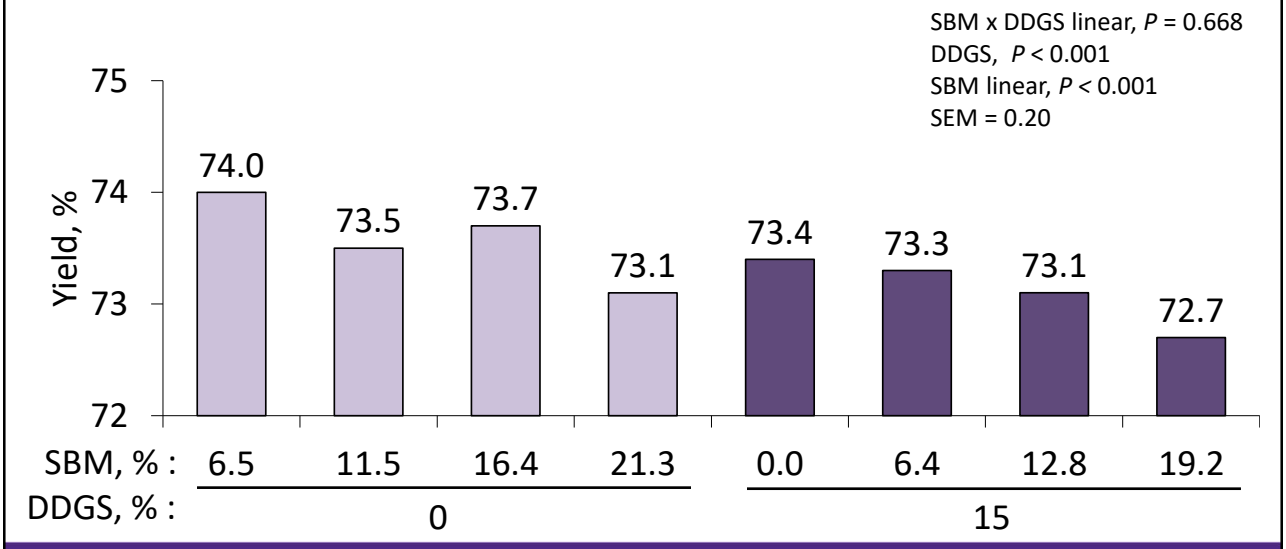
Effects of SBM and DDGS on Yield (79 kg to harvest)



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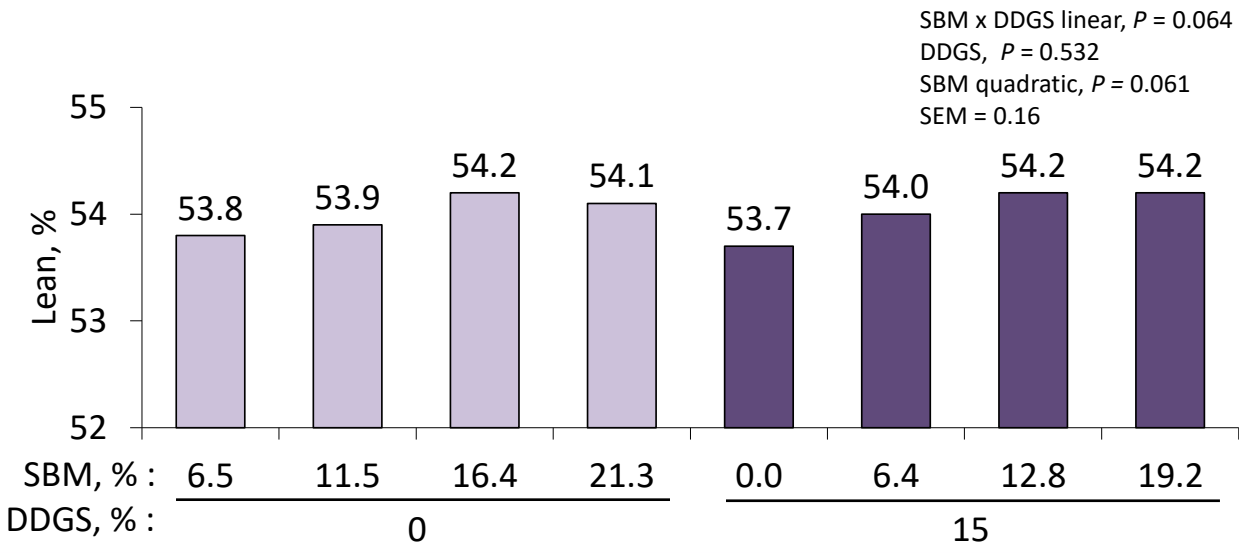
Effects of SBM and DDGS on Lean % (79 kg to harvest)



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*Simple effect of SBM in diet without DDGS (linear, $P = 0.006$)
*Simple effect of SBM in diet with 15% DDGS (linear, $P = 0.013$)

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Summary

- Linear improvement in G:F as SBM increased.
  - More noticeably in corn-SBM diets.
- Increasing SBM and DDGS decreased carcass yield, while carcass lean increased with increasing SBM.
- Pigs fed DDGS tended to have decreased ADG and G:F compared to those fed corn-SBM diets.
  - Replacing SBM with DDGS and feed-grade amino acids negatively affected ADG and G:F suggesting some minimal level of SBM is needed in the diet.

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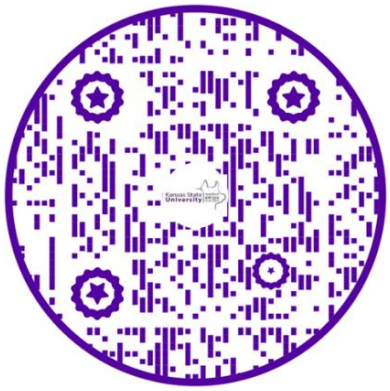
Thank you!



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