

Growth Performance of Nursery Pigs Fed Diets Containing Increasing Levels of Corn Distiller's Dried Grains with Solubles

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Distiller's Dried Grains with Solubles (DDGS)

- Co-product of ethanol dry-milling industry
 - 100 kg corn yields:
 - 40 liters ethanol
 - 33 kg carbon dioxide
 - 33 kg DDGS
 - ~ 3x concentration of amino acids, fat, fiber, and minerals compared to corn
- Significant increase in number and capacity of ethanol plants in U.S.
 - “New generation” plants have increased supply of DDGS.



Distiller's Dried Grains with Solubles (DDGS)

- Historically not used in swine diets:
 - Nutrient variability
 - Inferior amino acid profile
 - Poor amino acid digestibility
 - Concerns over energy density and fiber level
- Feeding recommendations:
 - 5% max in nursery (Newland and Mahan, 1990)



Distiller's Dried Grains with Solubles (DDGS)





Recent Research Results

- “New generation” DDGS vs. reference values (NRC, 1998):
 - Less variability of nutrients (Spiehs et al., 2002)
 - Increased metabolizable energy (Spiehs et al., 1999)
 - Greater digestible amino acid levels (Whitney et al., 2000)
 - Improved phosphorus availability (Whitney et al., 2001)
- DDGS from “new generation” ethanol plants:
 - Is of high nutritional quality
 - Should serve as an acceptable partial substitute for corn, soybean meal, and dicalcium phosphate in nursery diets



Objectives

- Evaluate the effect of including increasing levels of DDGS from “new generation” ethanol plants in nursery diets on growth rate, feed intake, and feed efficiency
- Determine the maximum inclusion rate of “new generation” DDGS in nursery diets



Materials and Methods

- 2 growth performance experiments
- 0, 5, 10, 15, 20, or 25% DDGS in nursery diet
- 96 pigs in each experiment
 - Blocked by gender and ancestry, then randomly allotted within each block
 - 4 pigs/pen (0.37 m²/pig)
 - 4 pens/dietary treatment
- 3-phase feeding program
 - Phase 1: commercial, pelleted diet fed first 4 d post-weaning
 - Phase 2: fed for 14 d, meal form
 - Phase 3: fed for 21 d, meal form



Nursery Phase 2 Diets*



Ingredient, %	DDGS inclusion level, %					
	0	5	10	15	20	25
Corn	50.1	45.4	40.5	35.7	30.9	26.1
Soybean meal (47% CP)	23.4	23.2	23.1	22.9	22.7	22.5
DDGS	0.0	5.0	10.0	15.0	20.0	25.0
Whey, dried	15.0	15.0	15.0	15.0	15.0	15.0
Fish meal, select menhaden	6.0	6.0	6.0	6.0	6.0	6.0
Choice white grease	2.5	2.6	2.6	2.7	2.7	2.8
Dicalcium phosphate	1.2	1.0	0.9	0.7	0.6	0.4
Limestone	0.4	0.5	0.6	0.7	0.8	0.9
Other	1.3	1.3	1.3	1.3	1.3	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

* Diets formulated to contain: **3340 kcal/kg ME** **1.35% AID Lys** **0.80% AID Met&Cys**
 0.95% Ca **0.80% P**



Nursery Phase 3 Diets*

Ingredient, %	DDGS inclusion level, %					
	0	5	10	15	20	25
Corn	61.5	57.0	52.3	47.8	43.2	38.7
Soybean meal (47% CP)	32.6	32.2	31.8	31.4	30.9	30.5
DDGS	0.0	5.0	10.0	15.0	20.0	25.0
Choice white grease	2.4	2.4	2.5	2.5	2.6	2.6
Dicalcium phosphate	1.7	1.5	1.4	1.2	1.1	0.9
Limestone	0.6	0.7	0.8	0.9	1.0	1.1
Other	1.2	1.2	1.2	1.2	1.2	1.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

* Diets formulated to contain: 3390 kcal/kg ME 1.15% AID Lys 0.65% AID Met&Cys
0.80% Ca 0.70% P

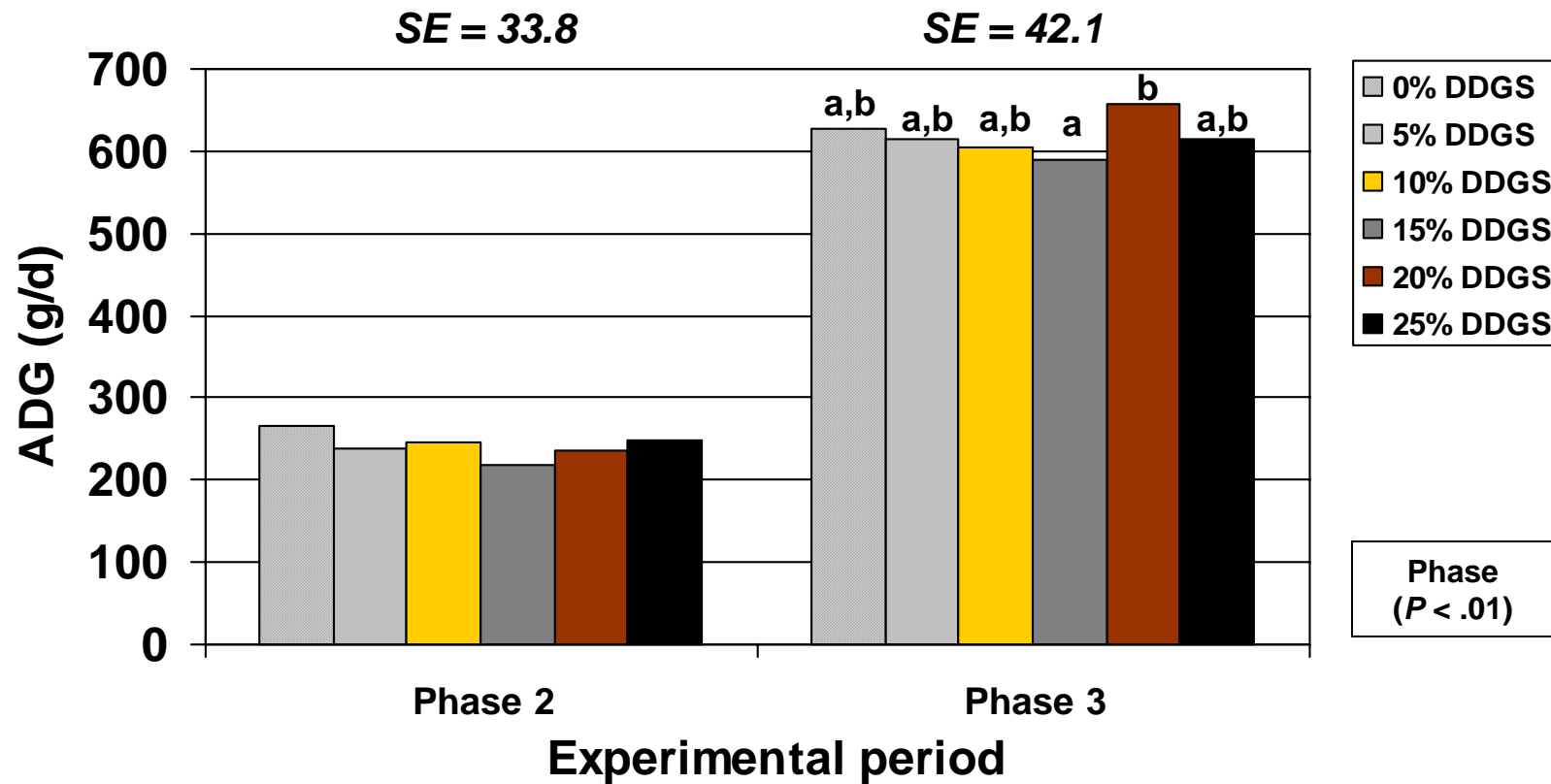


Experiment 1

- Pigs:
 - Weaned at 19.0 ± 0.3 d of age
 - Weighed 7.10 ± 0.07 kg body weight
- Pig weight and feed consumption:
 - Measured for each phase
- Statistics
 - Utilized GLM procedure of SAS with repeated measures in time
 - Pen = experimental unit
 - Orthogonal comparisons to determine linear, quadratic, and/or cubic responses to increasing DDGS level in the diet



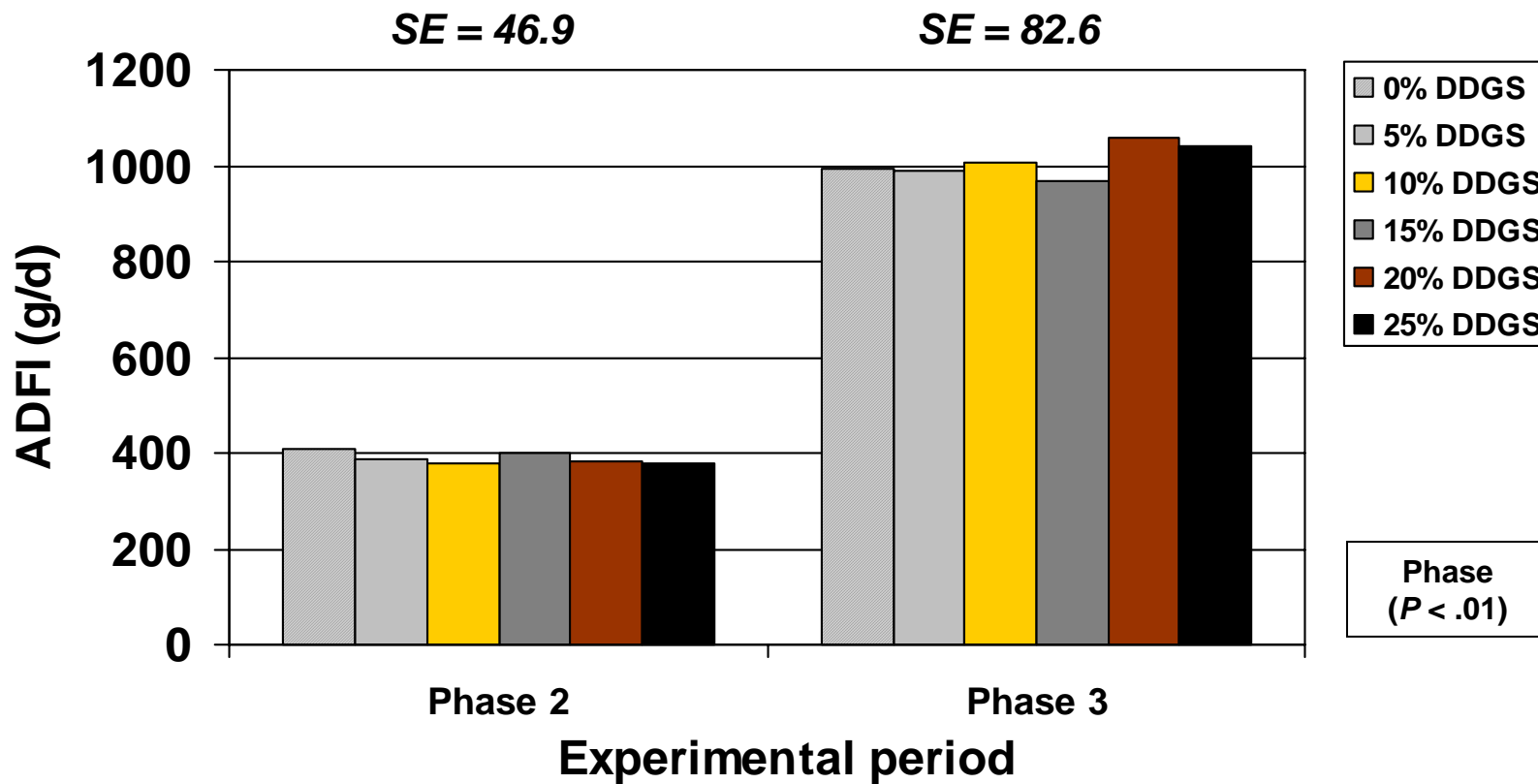
Effect of DDGS Level on Growth Rate, Exp. 1



Means not sharing a common superscript letter are significantly different ($P < .05$)

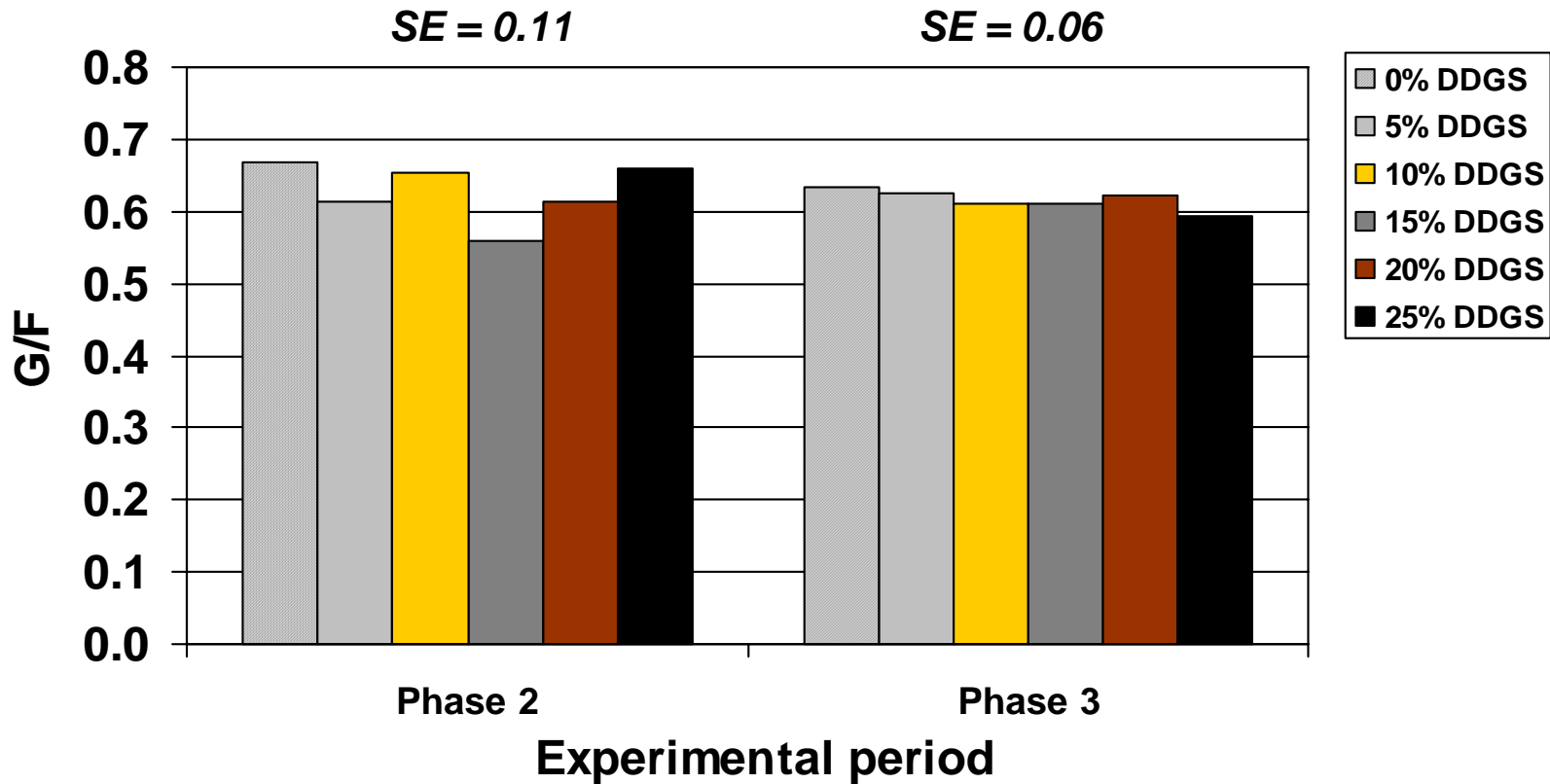


Effect of DDGS Level on Feed Intake, Exp. 1



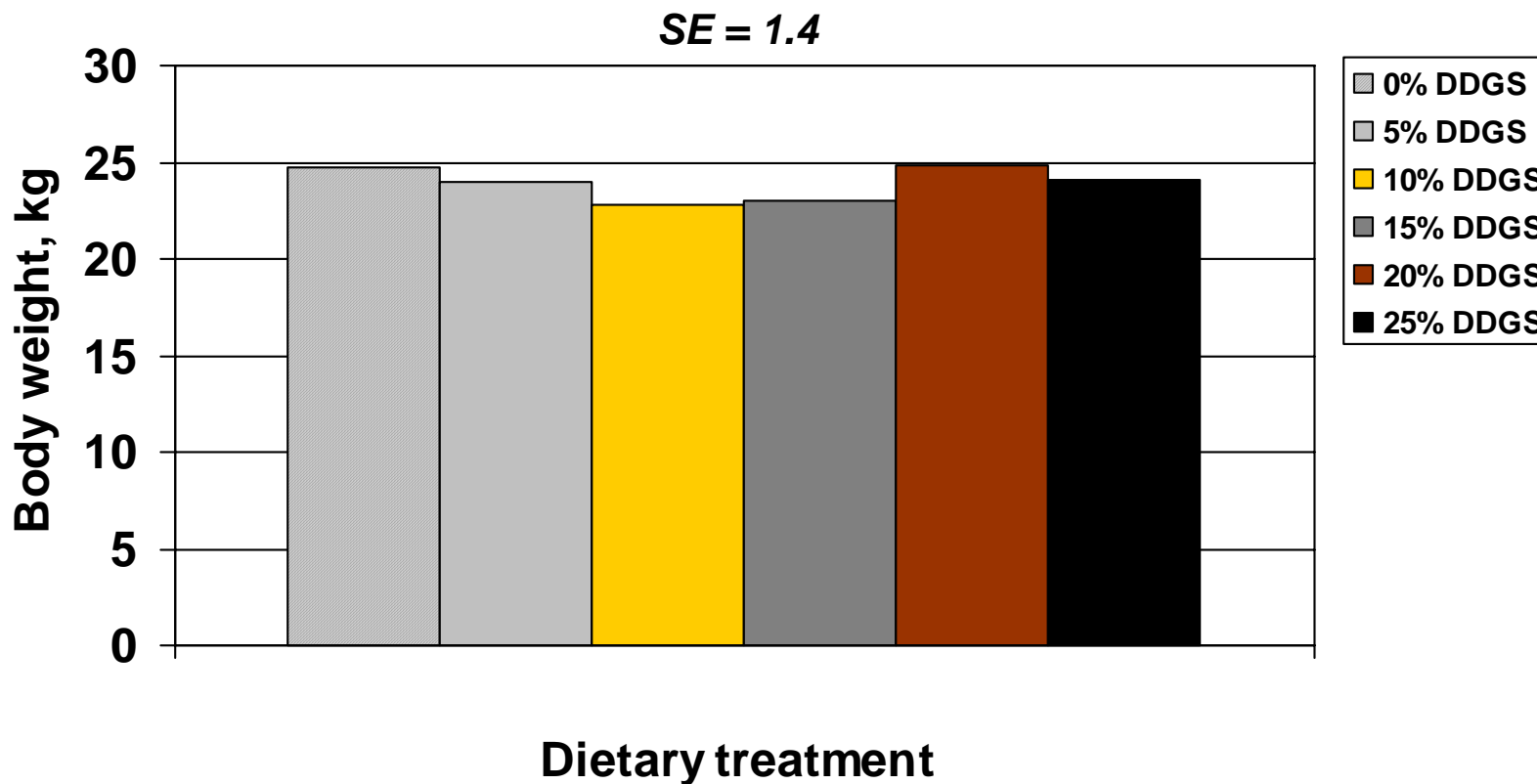


Effect of DDGS Level on Feed Efficiency, Exp. 1





Effect of DDGS Level on Final Body Weight, Exp. 1





Summary of Results – Exp. 1

- No effect of increasing dietary DDGS level on:
 - Growth rate
 - Feed intake
 - Feed efficiency
 - Final nursery weight
- Pigs were able to effectively consume and convert high levels of DDGS (up to 25%) without any apparent adverse effects on growth

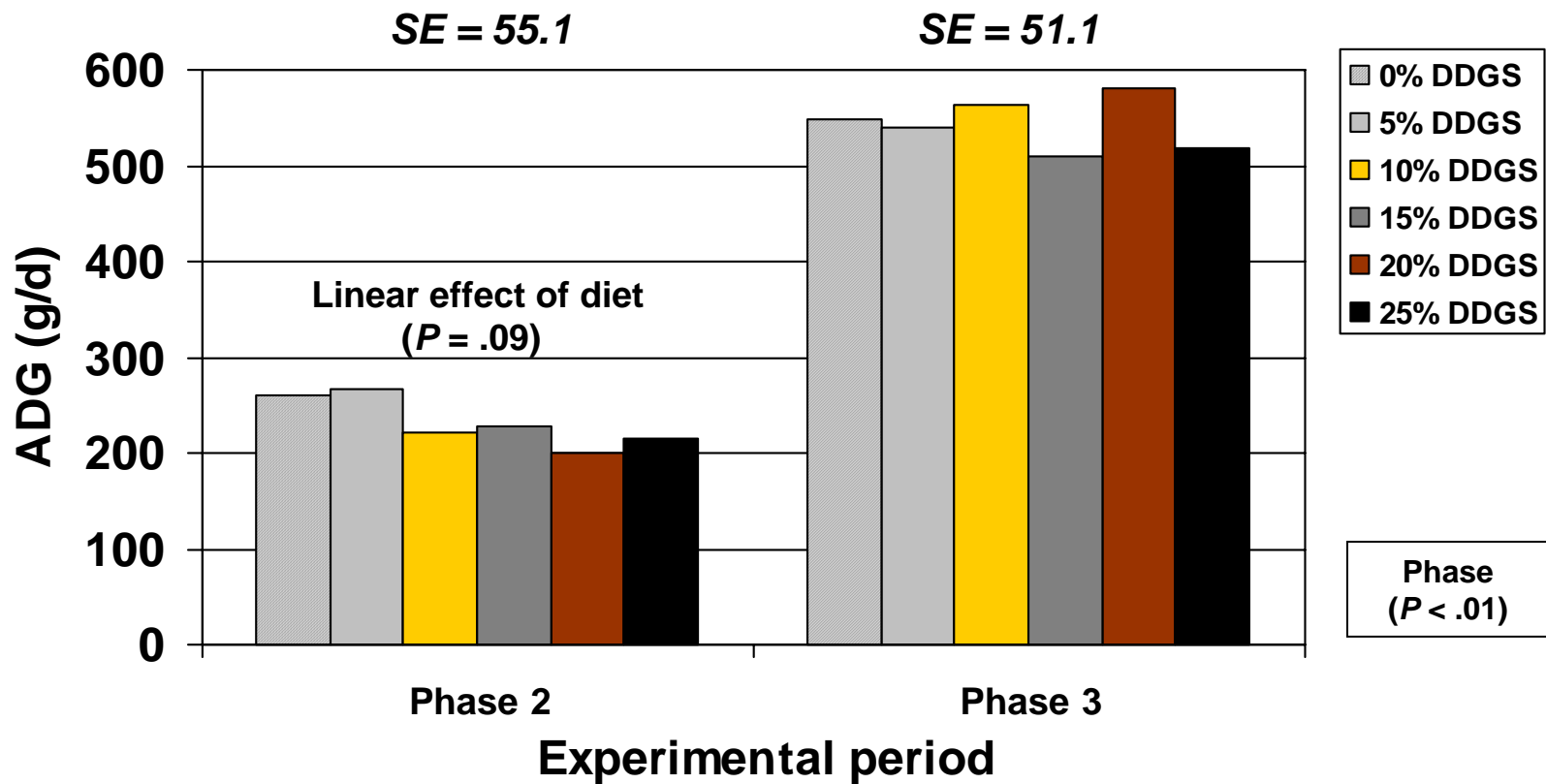


Experiment 2

- Pigs:
 - Weaned at 16.9 ± 0.4 d of age
 - Weighed 5.26 ± 0.07 kg body weight
- Pig weight and feed consumption:
 - Measured for each phase
- Statistics
 - Utilized GLM procedure of SAS with repeated measures in time
 - Pen = experimental unit
 - Orthogonal comparisons to determine linear, quadratic, and/or cubic responses to increasing DDGS level in the diet

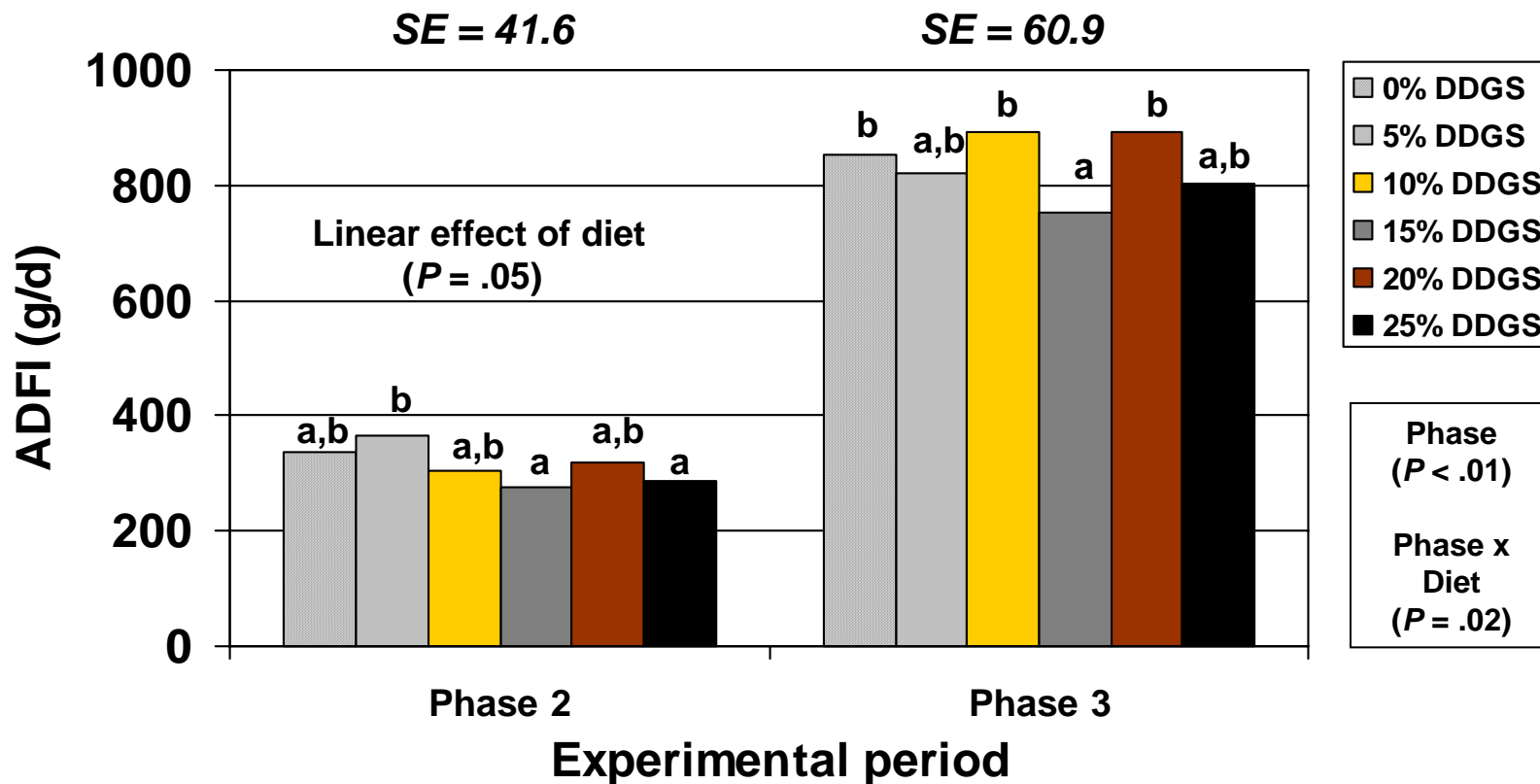


Effect of DDGS Level on Growth Rate, Exp. 2





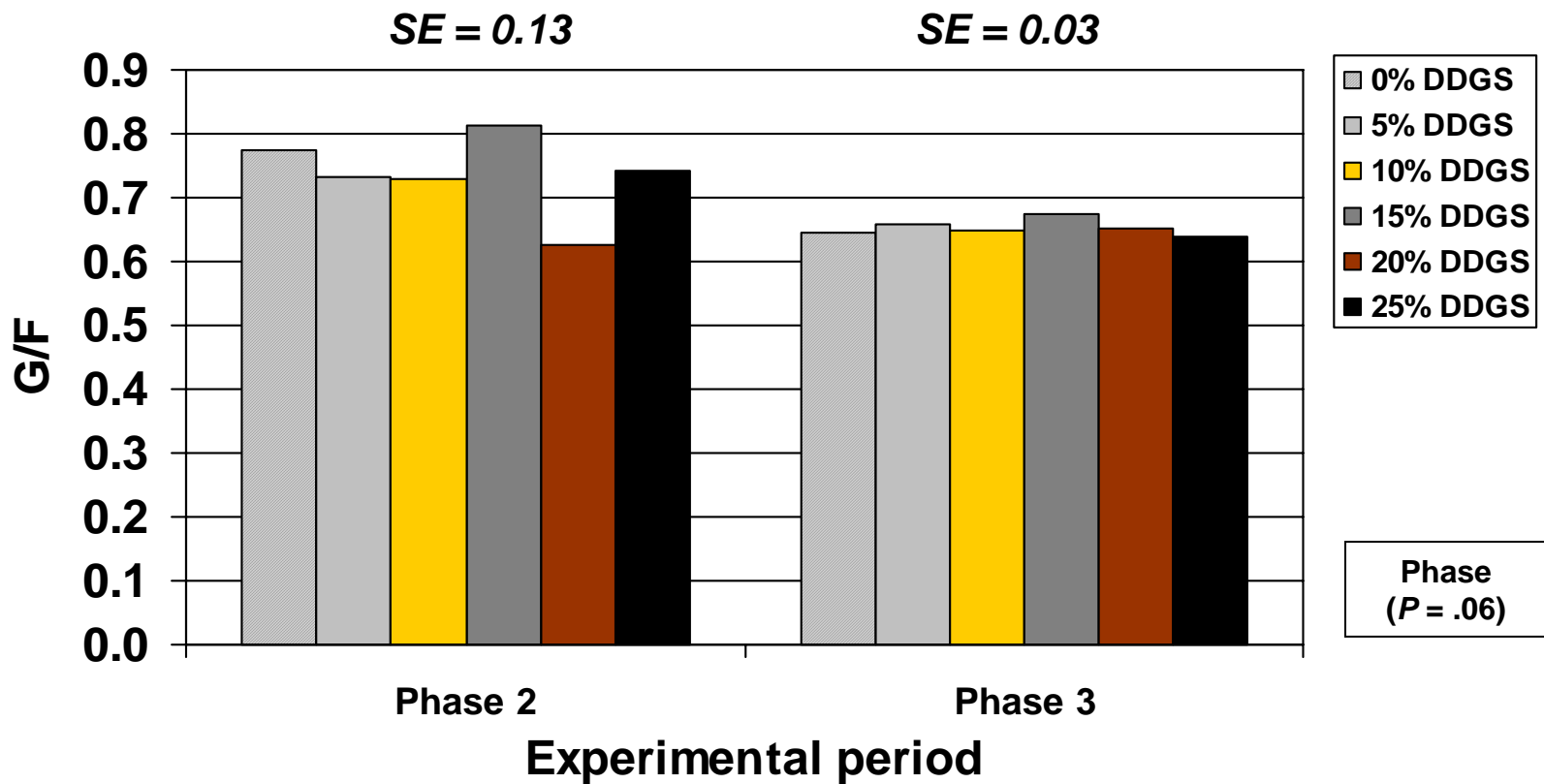
Effect of DDGS Level on Feed Intake, Exp. 2



Means not sharing a common superscript letter are significantly different ($P < .05$)

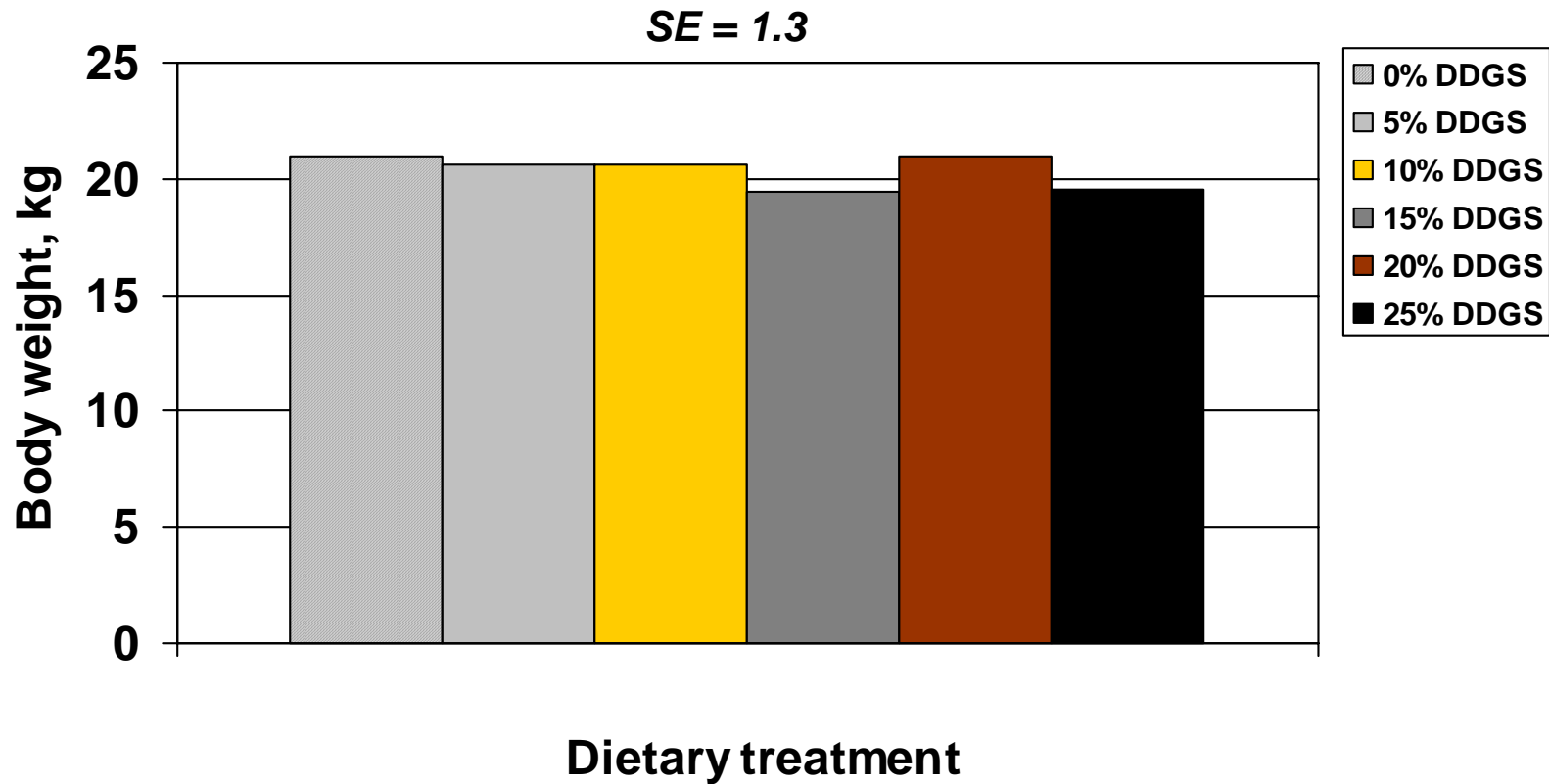


Effect of DDGS Level on Feed Efficiency, Exp. 2





Effect of DDGS Level on Final Body Weight, Exp. 2





Summary of Results – Exp. 2

- Increasing level of DDGS during Phase 2:
 - Decreased feed intake
 - Tended to decrease growth rate
 - No effect of feed efficiency
- No effect of DDGS on ADG, ADFI, or G/F during Phase 3
- No effect of DDGS on ending nursery body weight



Implications

- DDGS from “new generation” ethanol plants is an acceptable partial substitute for corn, soybean meal, and dicalcium phosphate in nursery diets
 - Formulate diets on ME and digestible amino acid basis
 - Can include up to 25% DDGS in Phase 3 with no detrimental effects on growth performance
 - In younger, lighter pigs, including greater than 5% DDGS in Phase 2 may decrease feed intake and subsequent growth rate
 - No detrimental effect in older, heavier pigs
 - No difference in body weight at end of the nursery period



Acknowledgement

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