
Evaluation of Different Strategies for Supplementing Distiller's Dried Grains with Solubles (DDGS) to Nursery Pigs

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Background – DDGS in the nursery phase

- Whitney and Shurson et al., 2004
 - Starting 4-d post weaning
 - Reduction in body weight gain
 - Linear reduction in feed intake
- Gaines et al., 2006a, 2006b
 - 11.5 kg BW
 - 3 week evaluation
 - Reduced intake with DDGS addition
 - Improved feed efficiency with DDGS addition
 - Up to 30% DDGS can be used (11-24 kg BW)

Background–Carbohydrase supplementation in pig diets

- Primarily in wheat, wheat byproduct, barley, or flaxseed supplemented diets
 - Kiarie et al., 2006; Northey et al., 2006; Olukosi et al., 2006; Opapeju et al., 2006
- Focused on xylanase addition
 - Improved performance
 - Improved DM, AA, Energy, P, Ca

Monosaccharide content of ingredients (% of total, DM basis)

Total	Corn DDGS	Wheat Middlings	Soy Hulls
Arabinose	6.54 (6.0)	7.24 (4.1)	5.74 (1.9)
Xylose	9.34 (2.1)	11.91 (2.6)	5.17 (0.7)
Mannose	1.26 (22.2)	0.76 (76.3)	6.63 (16.6)
Galactose	1.86 (16.3)	1.33 (56.4)	3.61 (28.8)
Glucose	14.30 (30.7)	38.94 (10.22)	1.49 (58.4)

() = % of monosaccharide that is water soluble

Objectives:

Trial 1

- Determine how the introduction of DDGS to a standard nursery budget impacts piglet performance

Trial 2

- Impact of high DDGS inclusion (30%) into a standard diet on piglet (9 kg BW) performance.
- Efficacy of a mixed carbohydrase when added to a diet containing 30% DDGS

Nutrient analysis of DDGS used for Trial 1 and 2

Nutrient, %	Analyzed DDGS*	Corn (NRC, 1998)
Dry matter	88.40	89.00
Crude protein	25.41	8.30
Ether extract	10.20	3.50
Crude fiber	5.17	1.90
Ash	3.83	1.10
Lysine	0.86 (0.53)**	0.26
P	0.74 (0.52)**	0.28
Calculated ME, kcal/kg	3625.00***	3429.00
NDF	33.29	9.60
ADF	9.94	2.80

Trial 1 – DDGS inclusion to nursery budgets

- **Animals and diets**
 - RCBD with four treatments
 - 1500 pigs were blocked by weight and sex into one of four treatment blocks
 - Start weight of 6.4 kg BW, 18-21d of age
 - 15 pens per treatment with 20-27 pigs per pen
- **Measurements**
 - Weekly pen weights and intake throughout the nursery period
 - ADG
 - ADFI
 - G:F

Trial 1 – DDGS inclusion to nursery budgets

DDGS inclusion level, % of diet

Treatment	1	2	3	4
Phase 1	0	7.5	0	0
Phase 2	0	15	15	0
Phase 3	0	15	15	15
Phase 4	0	15	15	15

Nursery feeding budget

Phase 1 – 1 week post weaning (Pellet)

Phase 2 – 3.63 kg/pig

Phase 3 – 4.54 kg/pig

Phase 4 – to end of 42-d nursery period

Trial 1 – DDGS inclusion to nursery budgets

Ing., %	Phase 2		Phase 3		Phase 4	
	C/SBM	DDGS	C/SBM	DDGS	C/SBM	DDGS
Corn	52.6	39.7	61.2	48.2	66.0	53.1
SBM, 48%	27.4	25.3	28.8	26.8	31.0	28.9
DDGS	----	15.0	----	15.0	----	15.0
Premix	20.0	20.0	10.0	10.0	3.0	3.0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Nutrients, %						
Avail. P	0.49	0.56	0.37	0.44	0.33	0.40
ME, Mcal/kg	3.31	3.33	3.28	3.31	3.34	3.36
SID Lys	1.35	1.35	1.31	1.31	1.20	1.20
gLys/Mcal	4.08	4.05	3.99	3.96	3.60	3.57
M+C:Lys	0.56	0.60	0.56	0.60	0.56	0.60
Thr:Lys	0.60	0.63	0.60	0.63	0.60	0.63

Trial 1 – DDGS inclusion

Treatment

	1	2	3	4	SEM	P value
Week 1						
St. Wt., kg	6.41	6.40	6.41	6.40	0.186	0.94
ADG	0.08	0.08	0.08	0.09	0.012	0.46
ADFI	0.11	0.11	0.11	0.12	0.009	0.49
G:F	0.69	0.73	0.65	0.76	0.065	0.29
Week 2						
ADG	0.28	0.27	0.29	0.28	0.018	0.22
ADFI	0.31	0.29	0.30	0.30	0.018	0.39
G:F	0.93	0.93	0.96	0.92	0.013	0.06
Week 3						
ADG	0.42	0.43	0.44	0.43	0.013	0.40
ADFI	0.61	0.58	0.61	0.59	0.022	0.17
G:F	0.70	0.74	0.73	0.73	0.015	0.08
Week 4						
ADG	0.46	0.47	0.48	0.47	0.014	0.60
ADFI	0.65	0.67	0.67	0.64	0.024	0.78
G:F	0.71	0.71	0.73	0.74	0.012	0.41

Trial 1 – DDGS inclusion to nursery budgets

	Treatment				SEM	P value
	1	2	3	4		
Week 5						
ADG	0.55	0.56	0.55	0.54	0.02	0.52
ADFI	0.85	0.83	0.84	0.82	0.03	0.23
G:F	0.65 ^c	0.68 ^a	0.66 ^{bc}	0.67 ^{ab}	0.01	0.001
Week 6						
D 42 wt., kg	23.41	23.57	23.64	23.42	0.43	0.68
ADG	0.61	0.62	0.61	0.61	0.01	0.83
ADFI	1.01	1.03	1.03	1.00	0.02	0.20
G:F	0.61	0.60	0.60	0.61	0.01	0.35
Cumulative						
ADG	0.41	0.41	0.41	0.41	0.01	0.81
ADFI	0.60	0.59	0.60	0.59	0.01	0.52
G:F	0.68 ^b	0.70 ^a	0.69 ^{ab}	0.70 ^a	0.01	0.01

Trial 1 – DDGS inclusion to nursery budgets

Conclusions

- DDGS supplementation (7.5% phase 1 and 15% phase 2,3,4) did not negatively effecting pig performance, regardless of when DDGS inclusion starts.
- When replacing corn and soybean meal alone, DDGS supplementation improved feed efficiency.

Trial 2 – Enzyme supplementation to high DDGS diets

- **Objective**

- **Impact of high DDGS inclusion (30%) on nursery pig (9 kg BW) performance in a standard diet**
- **Efficacy of supplemental carbohydrase enzymes to a diet containing 30% DDGS**

Trial 2 – Enzyme supplementation to high DDGS diets

- **Animals**

- RCBD with three treatments
- 300 pigs were blocked by weight and sex
- Start weight 9.0 kg BW, approximately 31d of age
- 10 pens per treatment with 10 pigs per pen

- **Measurements**

- Weekly pen weights and intake
- ADG
- ADFI
- G:F

Trial 2 – Enzyme supplementation to high DDGS diets

Ing./Nutr. %	Control	30% DDGS	30% DDGS +Enzyme
Corn	61.50	35.50	35.45
SBM, 48%	28.50	24.50	24.50
DDGS	-----	30.00	30.00
Enzyme	-----	-----	0.05
Premix	10.00	10.00	10.00
	100.00%	100.00%	100.00%
Ca	0.70	0.68	0.68
Avail. P	0.37	0.51	0.51
ME, Mcal/kg	3.28	3.33	3.33
SID Lys.	1.30	1.30	1.30
g lys/Mcal	3.96	3.92	3.92
M+C:Lys	56.00	64.00	64.00
Thr:Lys	60.00	65.00	65.00

Trial 2 – Enzyme supplementation to high DDGS diets

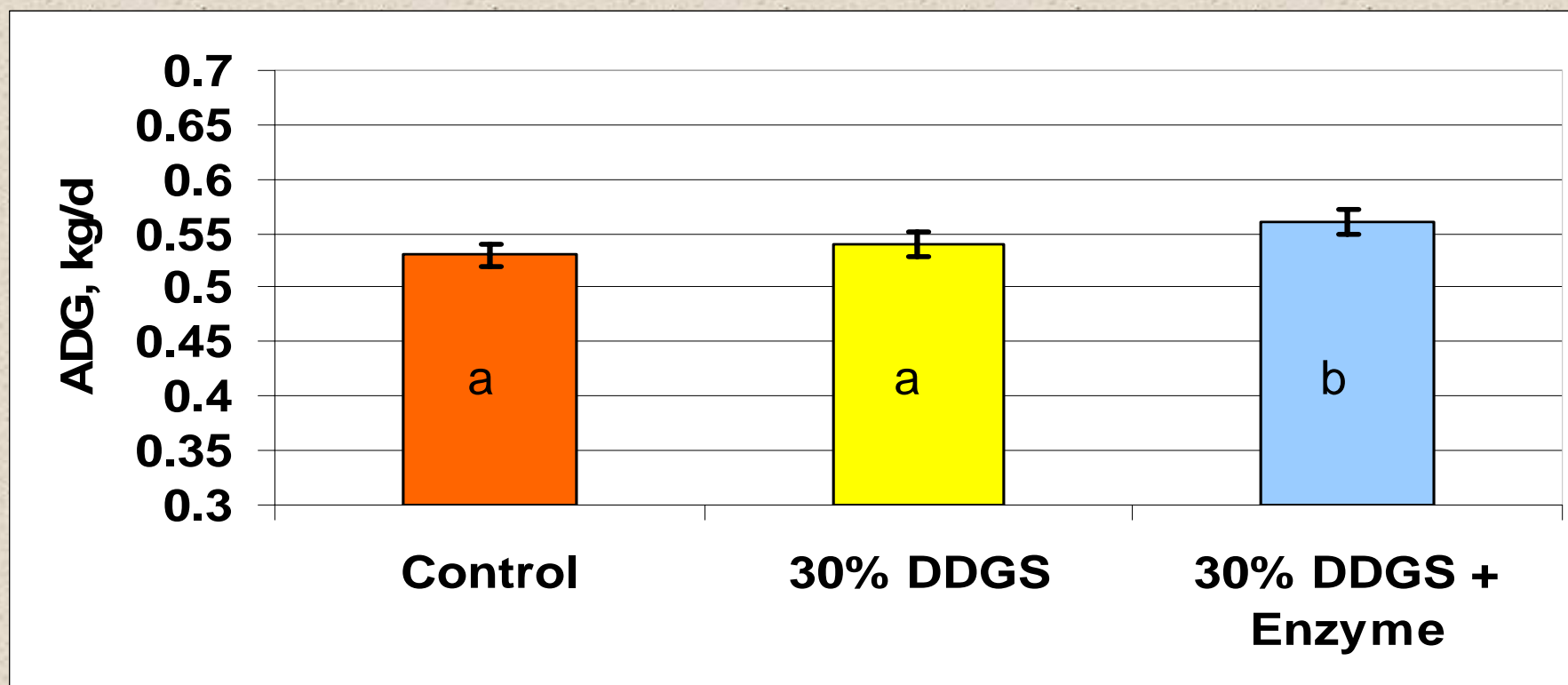
Main carbohydrase activity, Units/kg diet

Alpha-galactosidase	3.5
Galactomannanase	11.0
Xylanase	150.0
Beta-Glucanase	110.0

Trial 2 – Enzyme supplementation to high DDGS diets

Cumulative 21-d ADG, kg/d

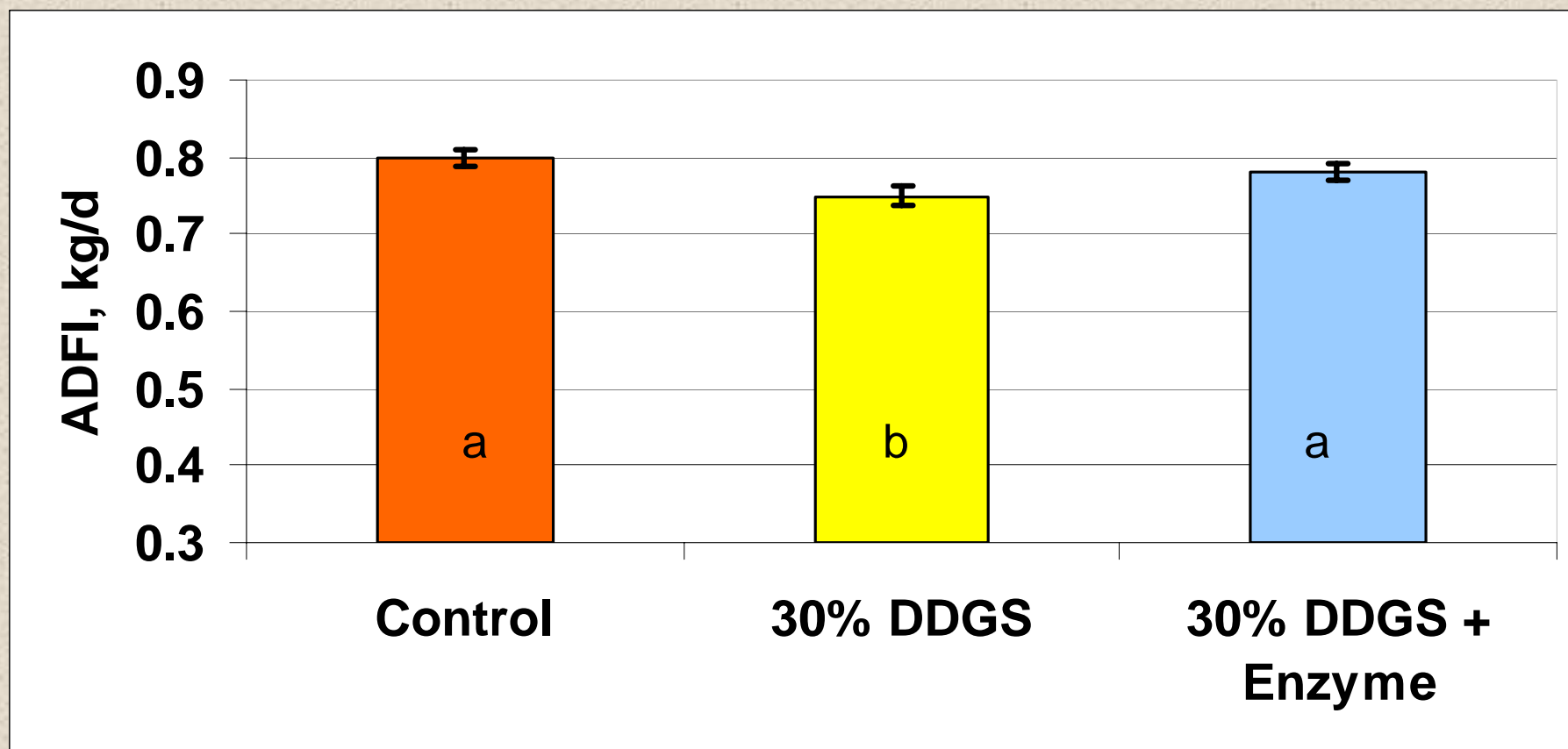
SEM = 0.011, P value = 0.07



Trial 2 – Enzyme supplementation to high DDGS diets

Cumulative 21-d ADFI, kg/d

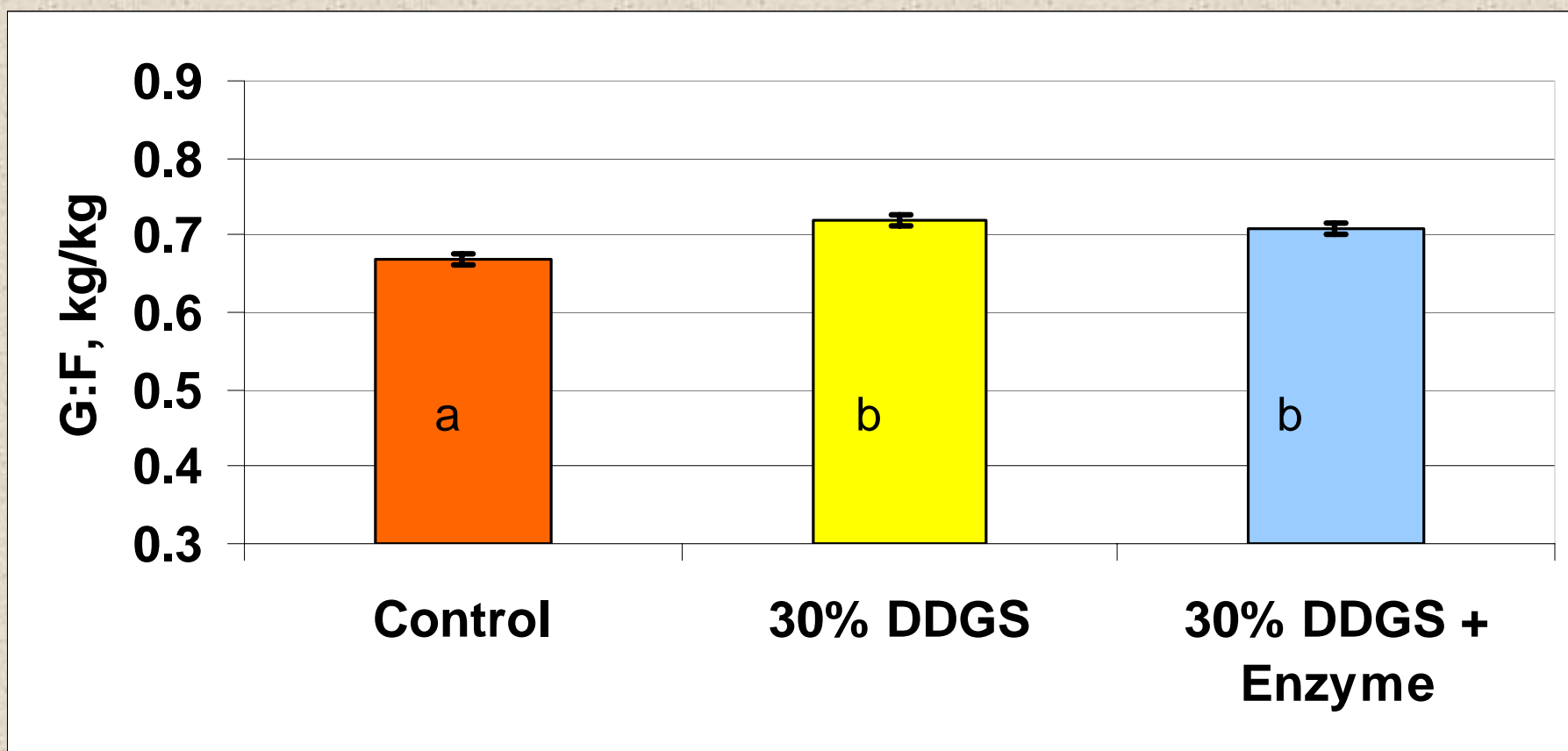
SEM = 0.015, P value = 0.01



Trial 2 – Enzyme supplementation to high DDGS diets

Cumulative 21-d G:F, kg/kg

SEM = 0.007, P value = 0.01



Trial 2 – Enzyme supplementation to high DDGS diets

Trt.	Control	DDGS	Enzyme	SEM	P value
Week 1					
St. wt, kg	9.10	9.19	9.10	0.20	0.37
ADG	0.40 ^b	0.44 ^a	0.46 ^a	0.01	0.01
ADFI	0.60	0.58	0.60	0.01	0.16
G:F	0.67 ^b	0.76 ^a	0.76 ^a	0.07	0.01
Week 2					
ADG	0.55	0.55	0.56	0.03	0.82
ADFI	0.83	0.77	0.80	0.02	0.10
G:F	0.65 ^a	0.70 ^b	0.70 ^b	0.02	0.03
Week 3					
21d wt, kg	20.31	20.50	20.83	0.38	0.56
ADG	0.65	0.63	0.66	0.02	0.28
ADFI	0.98 ^a	0.89 ^b	0.95 ^a	0.02	0.01
G:F	0.67 ^a	0.71 ^b	0.70 ^b	0.01	0.04

Trial 2 – Enzyme supplementation to high DDGS diets

Conclusions:

- Inclusion of 30% DDGS (at the expense of corn and SBM) without enzyme supplementation improved feed efficiency by reducing feed intake.
- Enzyme supplementation ameliorated the negative impact of DDGS on intake, resulting in improved growth rate and feed efficiency.

Cumulative Implications – Trial 1 and Trial 2

- **DDGS can be supplemented (7.5 to 15%) anytime in the nursery program without reducing piglet growth rate or feed intake, and may result in improved feed efficiency.**
- **The supplementation of exogenous carbohydrase enzymes offers further opportunities to improve animal performance when using high levels of DDGS in nursery diets**
- **Inclusion of high levels of DDGS:**
 - **Reduced ADFI**
 - **Antinutritional factors in DDGS?**
 - **Increased digesta and fecal volume?**
 - **Overestimation of weight gain and feed efficiency?**

Thank you.

