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Growth Performance of Nursery Pigs Fed 30% Distillers Dried Grain with Solubles (DDGS) and the Effects of Pelleting on Performance and Nutrient Digestibility*

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ABSTRACT : Four experiments with 2,020 nursery pigs (Triumph-4×PIC Camborough 22) were conducted at a commercial research site to evaluate the effects of including 30% distillers dried grain with solubles (DDGS) in late nursery diets on pig growth performance and to compare the effects of pelleted and meal diets containing 30% DDGS on growth performance and nutrient digestibility. In Exp. 1, 312 pigs (10.54±0.16 kg) were allotted to two diets: corn-soybean meal based control diet and a corn-soybean meal diet containing 30% DDGS. In Exp. 2, 337 pigs (16.70±0.14 kg) were used to validate Exp. 1 with similar diets. In Exp. 3, 665 pigs (11.77±0.12 kg) were allotted to diets containing 30% DDGS, but in different forms: meal or pellet. Fecal samples were collected during the final day of the trials to measure nutrient and energy apparent total tract digestibility (ATTD). In Exp. 4, 706 pigs (18.40±0.18 kg) were allotted to the same diets as Exp. 3. In Exp. 1 and 2, there was no ($p>0.05$) effect of DDGS on ADG, ADFI or G:F. In Exp. 3, pelleting improved ($p<0.01$) ADG (578 vs. 541 g/d) and G:F (714 vs. 674 g/kg), with no difference ($p>0.05$) in ADFI. The ATTD of most nutrients and energy were improved by pelleting ($p<0.05$). In Exp. 4, ADG (717 vs. 675 g/d) and G:F (680 vs. 648 g/kg) were improved by pelleting ($p<0.01$), with no difference ($p>0.05$) in ADFI. In conclusion, 10-23 kg pigs in late nursery phase can be fed up to 30% DDGS without having a detrimental effect on pig performance, and pelleting the diet will increase nutrient and energy availability. (**Key Words :** Nursery Pigs, Pelleting, Distillers Dried Grain with Solubles)

INTRODUCTION

There has been a rapid increase in the use of distillers dried grain with solubles (DDGS) in late nursery pigs with the increase in price of corn, soybean meal and phosphorus. The inclusion rates of DDGS in late nursery diet have been reported at 22.5% (Barbosa et al., 2008), 25% (Whitney and Shurson, 2004) or 30% (Gaines et al., 2006; Spencer et al., 2007; Burkey et al., 2008), without affecting ADG of the pigs. A decreased ADFI by inclusion of DDGS was reported by Gaines et al. (2006), Barbosa et al. (2008) and Burkey et al. (2008). Improved G:F was reported by Gaines et al. (2006), Feoli et al. (2007), Spencer et al. (2007), and Barbosa et al. (2008). Pelleting of corn-soybean meal based diets improved digestibility of most nutrients and energy (Noblet and Champion, 2003; Noblet and Jaguelin, 2008), which indicated that the nutrient digestibility could be improved by pelleting process. However, we are not aware of any data on effects of pelleting diets containing high level of DDGS on nutrient digestibility and nursery pig performance.

The objective of this research was to evaluate the effects of including 30% DDGS in late nursery diets on pig growth performance and compare the effects of pelleted and meal diets containing 30% DDGS on growth performance and nutrient digestibility.

MATERIALS AND METHODS

All experimental procedures and animal care were approved by the University of Missouri Animal Care and Use Committee.

This research consisted of 4 experiments. Exp. 1 and 2

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were conducted to evaluate the use of 30% DDGS in late nursery pig diet. Exp. 3 evaluated the effects of pelleting diets containing 30% DDGS on growth performance of nursery pigs and measured apparent total tract digestibility (ATTD) of nutrients and energy. Exp. 4 validated the effects of pelleting diets containing 30% DDGS on growth performance of nursery pigs. All the experiments were conducted on the same commercial research farm.

Analyzed composition of the DDGS used in this research was (as-fed basis): 88.52% dry matter, 26.35% crude protein, 0.82% lysine, 0.51% methionine, 0.87% threonine, 0.20% tryptophan, 0.76% phosphorus and 0.03% calcium. All the diets in this study were formulated on a standardized ileal digestible (SID) basis by using the analyzed AA values of the ingredients and digestibility coefficients obtained from NRC (1998). We use the average AA digestibility coefficients from Stein et al. (2006) and ME values from Pedersen et al. (2007) for DDGS were used in this study.

Exp. 1

Exp. 1 used 312 pigs (Triumph-4×PIC Camborough 22, PIC, Franklin, KY) with an initial weight of 10.54±0.16 kg that were randomly allotted by sex and weight to two diets: corn-soybean meal based control diet and a corn-soybean meal diet containing 30% DDGS, with 7 replicate pens per treatment and 20 to 23 pigs per pen. Growth performance was evaluated for 21 d. The diets were formulated to contain 1.25% SID Lys and 3.41 Mcal ME/kg (Table 1; as-fed basis).

Exp. 2

A total of 337 pigs (Triumph-4×PIC Camborough 22, 16.70±0.14 kg) were used in Exp. 2 to validate the use of

Table 1. Composition of experimental diets (as-fed basis)

Diet	Exp. 1		Exp. 2		Exp. 3 and 4
	Control	DDGS	Control	DDGS	
Ingredients (%)					
Corn	62.53	39.69	62.45	45.01	40.30
Soybean meal, 47.5% CP	29.75	23.50	30.00	18.40	23.50
DDGS	0.00	30.00	0.00	30.00	30.00
Choice white grease	3.00	2.58	3.20	2.50	2.50
Dicalcium P	1.28	0.48	1.28	0.48	0.48
Limestone	0.65	1.09	0.55	1.09	1.10
Salt	0.50	0.50	0.50	0.33	0.50
L-lysine HCl	0.40	0.45	0.26	0.49	0.45
DL-methionine	0.18	0.06	0.12	0.06	0.07
L-threonine	0.21	0.15	0.14	0.14	0.10
Vitamin premix [1]	0.25	0.25	0.25	0.25	0.25
Trace mineral premix [2]	0.15	0.15	0.15	0.15	0.15
Copper sulfate	0.10	0.10	0.10	0.10	0.10
Mecadox [3]	1.00	1.00	1.00	1.00	0.50
Calculated composition					
ME (Mcal/kg)	3.41	3.41	3.42	3.42	3.42
Crude protein (%)	19.95	21.89	19.85	19.96	21.91
SID lysine (%)	1.25	1.25	1.15	1.15	1.25
Ca (%)	0.65	0.65	0.61	0.61	0.60
Available P (%)	0.30	0.30	0.29	0.29	0.30
Analyzed composition					
Crude protein (%)	18.79	19.51	18.82	19.86	19.45
Ether extract (%)	6.13	9.89	6.33	9.79	10.17
NDF (%)	8.13	16.23	8.66	16.27	16.76
ADF (%)	3.14	5.14	3.37	5.35	5.73

[1] Provided per kilogram of final diet: vitamin A, 11,000 IU; vitamin D_3, 1,100 IU; vitamin E, 22 IU; B_{12}, 0.03 mg; vitamin K, 3.99 mg as menadione; thiamin, 3 mg; riboflavin, 8.25 mg; D-pantothenic acid, 28.05 mg; folic acid, 1.5 mg; biotin, 0.5 mg; and niacin, 33 mg.

[2] Provided per kilogram of final diet: Fe, 165.3 mg; Zn, 165.3 mg; Mn, 33 mg; Cu, 16.5 mg; I, 0.3 mg; and Se, 0.29 mg.

[3] Mecadox (Phibro Animal Health, Ridgefield Park, NJ) was supplemented at 50 mg/kg in all the experiments.

30% DDGS in late nursery pig diets. Pigs were randomly allotted by sex and weight to two diets: corn-soybean meal based control diet and a corn-soybean meal diet containing 30% DDGS, with 7 replicate pens per treatment and 20 to 25 pigs per pen. Growth performance was evaluated for 14 d. The diets were formulated to contain 1.15% SID Lys and 3.42 Mcal ME/kg (Table 1; as-fed basis).

Exp. 3

A total of 665 pigs (Triumph-4×PIC Camborough 22, 11.77±0.12 kg) were randomly allotted by sex and weight to one of two diets with 19 replicate pens (17 to 19 pigs per pen) per treatment. Growth performance was evaluated for 21 d. The diets were formulated to contain 1.25% SID Lys and 3.42 Mcal ME/kg (Table 1; as-fed basis).

The same diets were used in two treatments, but in different forms: meal and pellet. The diets were corn-soybean meal based and supplemented with 30% DDGS. The diets were formulated to contain 1.25% SID Lys and 3.42 Mcal ME/kg (Table 1; as-fed basis) and contained vitamins and minerals that exceed NRC (1998) recommendations. The pelleted diet was steam-conditioned at conditioning temperature of 75°C with a 10-s retention time and pelleted using a 25 HP Master Model HD 1000 California Pellet Mill (California Pellet Mill Co., Crawfordsville, IN) equipped with a 50.8 mm thick die with a 4.8 mm diameter hole.

During the last week of the trial, 0.40% chromic oxide was added to the diets to allow for fecal collections to measure nutrient and energy ATTD, with 10 pens per treatment. Pigs were allowed a 5-day adaptation period before a 2-day collection. Fecal grab samples were collected from each pig twice daily and subsequently mixed, and stored at -20°C. At the end of the experiment, all the fecal samples were thawed and mixed within pen. Fecal samples were freeze-dried and ground before the subsample was collected.

All samples were analyzed in duplicate. Diets and fecal samples were analyzed for DM (procedure 930.15, AOAC 2005). Total nitrogen was analyzed by using combustion analysis (LECO, Model FP-428, LECO Co., AOAC, 1995). Gross energy was determined by bomb calorimetry (model 1281, Parr Instrument Co., Moline, IL). All the samples were analyzed for NDF, ADF using an ANKOM^{200} Fiber Analyzer (Ankom Technology Co., Fairport, MI). The concentration of lipids was determined using the ether extraction method (procedure 2003.06 AOAC, 2005). Chromium content in feed and feces, as the marker, was determined using the procedures of Fenton and Fenton (1979).

The digestibility of nutrients and energy was calculated using the chromium content in feed and feces as the marker according to the following formula (Fan et al., 1995): digestibility (%) = 100-((quantity of nutrient in feces/quantity of nutrient in feed)×(chromium content in feed/chromium content in feces))×100%. By multiplying the analyzed concentration of GE in the diets by the corresponding ATTD for energy, the DE in each diet was calculated.

Exp. 4

A total of 706 pigs (Triumph-4×PIC Camborough 22, 18.40±0.18 kg) were randomly allotted by sex and weight to the same diets as Exp. 3, with 21 replicate pens/treatment and 16 to 19 pigs/pen. Growth performance was evaluated for 14 d.

Pigs in all 4 experiments were housed in the same environmentally controlled research nursery facility located on a commercial farm. Pens (3.05 m×1.82 m) were equipped with a one-cup water unit and a six-hole nursery feeder. Throughout the experiment, pigs were given free access to feed and water. Pigs in each experiment were fed nutritionally adequate diets prior to reaching a targeted body weight.

Statistical analysis

Data were analyzed by GLM procedures of SAS (SAS Inst., Inc., Cary, NC). Treatment means were separated by using the LSMEANS statement and the PDIFF option in SAS. The effects of treatment and block were included in the model in all experiments. In Exp. 4, since pig initial BW was different between treatments, initial BW was used as covariate in the model for each response criterion. Pen was the experimental unit and a probability of $p<0.05$ was accepted as statistically significant.

RESULTS

Exp. 1 and 2

In Exp. 1, inclusion of 30% DDGS in corn-soybean meal based diet had no effect on ADG ($p = 0.11$) or G:F ($p = 0.44$) (Table 2). Pigs fed diet with DDGS had a tendency for decreased ADFI ($p = 0.07$). In Exp. 2, no difference was observed in ADFI ($p = 0.12$) or G:F ($p = 0.40$) for pigs fed the diet containing 30% DDGS (Table 2). ADG tended to be decreased when DDGS was included in the diet ($p = 0.09$). Collectively, inclusion of 30% DDGS had no detrimental effects on 10- to 23-kg late nursery pig growth performance.

Exp. 3

Pigs fed the pelleted diet had a greater ($p = 0.02$) final BW than those fed the meal diet (Table 3). The pelleting process improved ($p<0.01$) ADG (578 vs. 541 g/d) and G:F (714 vs. 674 g/kg), with no difference ($p = 0.69$) in ADFI.

Table 2. Effects of diets containing 30% DDGS on nursery pigs performance (Exp. 1 and 2) [1]

Item	Treatment diets		SEM	p-value
	Corn-SBM	30% DDGS		
Exp. 1				
d 0 wt (kg)	10.52	10.55	0.16	0.89
d 21 wt (kg)	22.96	22.74	0.22	0.50
ADG (g)	590	576	5.00	0.11
ADFI (g)	879	849	10.00	0.07
G:F (g/kg)	674	680	2.00	0.44
Exp. 2				
d 0 wt (kg)	16.68	16.71	0.14	0.88
d 14 wt (kg)	26.10	25.67	0.27	0.30
ADG (g)	671	635	13.00	0.09
ADFI (g)	1,067	1,028	15.00	0.12
G:F (g/kg)	631	621	4.00	0.40

[1] Data represent the means of 7 pens/treatment in Exp. 1 and 2.

The pelleting process had no effects on contents of DM, OM, GE, CP, fat, NDF and ADF in experimental diets. These approximate analysis data are not presented. The ATTD (%) of DM (83.0 vs. 80.3), OM (84.8 vs. 82.3), energy (83.1 vs. 79.4), CP (78.8 vs. 76.2), fat (88.7 vs. 81.8), NDF (63.5 vs. 59.2) and ADF (65.7 vs. 61.3) for pelleted and meal diets, respectively, were improved ($p<0.05$) by pelleting (Table 4). Collectively, pelleting process improves most nutrient and energy digestibility. The corresponding DE was 3,973 and 3,818 kcal/kg DM for pelleted and meal diets, respectively. The pelleting process improved the energy utilization in late nursery pigs fed the diet containing 30% DDGS.

Exp. 4

In Exp. 4, ADG and G:F were improved ($p<0.01$) by pelleting the diet containing 30% DDGS (Table 3). Pelleting the diet had no effect ($p = 0.07$) on ADFI. Pigs fed the pelleted diet had a greater final BW than those fed the meal diet ($p<0.01$).

Table 3. Effects of pelleting the diets containing 30% DDGS on nursery pigs performance (Exp. 3 and 4) [1]

Item	Treatment		SEM	p-value
	Meal	Pellet		
Exp. 3				
d 0 wt (kg)	11.78	11.77	0.12	0.93
d 21 wt , kg	23.18	23.98	0.24	0.02
ADG, g	541	578	6.00	<0.01
ADFI, g	804	809	10.00	0.69
G:F, g/kg	674	714	1.00	<0.01
Exp. 4 [2]				
d 0 wt, kg	18.56	17.93	0.18	0.02
d 14 wt, kg	27.66	28.44	0.10	<0.01
ADG, g	675	717	7.00	<0.01
ADFI, g	1,034	1,063	10.00	0.06
G:F, g/kg	648	680	4.00	<0.01

[1] Data represent the means of 19 or 21 pens/treatment in Exp. 3 and 4, respectively.
[2] Initial BW was used as covariates in analysis ($p<0.05$).

DISCUSSION

In Exp. 1 and 2, pigs fed diets containing 30% DDGS had a similar ADG, ADFI and G:F to those fed the corn-soybean meal control diet. This result was consistent with those reported by Whitney and Shurson. (2004) and Burkey et al. (2008), whose DDGS inclusion rates are up to 25% and 30%, respectively, in later nursery diets. Several recent studies have evaluated the effects of DDGS inclusion on nursery pigs performance. Barbosa et al. (2008) reported that adding 22.5% DDGS in the diets improved feed efficiency with no effect on ADG in 12- to 25-kg nursery pig. Feoli et al. (2007) reported that 30% DDGS decreased growth rate with no effects on feed efficiency. Spencer et al. (2007) reported that 9-kg pigs fed diets formulated with

Table 4. Effects of pelleting the diets containing 30% DDGS on apparent total tract digestibility (ATTD) of nutrients and energy (Exp. 3)[1]

Item	Content[2]	ATTD (%)		SEM	p-value
		Meal	Pellet		
Dry matter (%)	89.71	80.32	83.00	0.51	<0.01
Organic matter (%)	93.81	82.32	84.84	0.48	<0.01
GE (kcal/kg feed)	4,299.82	79.44	83.10	0.53	<0.01
Crude protein (%)	19.45	76.22	78.77	0.78	0.03
Ether extract (%)	10.17	81.84	88.74	0.88	<0.01
NDF (%)	16.76	59.18	63.47	1.22	0.02
ADF (%)	5.73	61.34	65.70	1.23	0.02
DE (kcal/kg DM)		3,817.56	3,973.09	25.33	<0.01

[1] Data represent the means of 10 pens/treatment in Exp. 3.
[2] Analyzed composition of the diet (as-fed basis) in Exp. 3.

30% DDGS had greater G:F than pigs not fed DDGS. Stein and Shurson (2009) recently summarized 10 experiments and concluded that nursery pigs from 2 to 3 wk post-weaning may be fed diets containing up to 30% DDGS without any negative impact on pig growth performance. Similar growth performance of late nursery pig fed diets containing DDGS had been reported by our laboratory. Gaines et al. (2006) used diets containing 0, 15 or 30% DDGS in two experiments to estimate DDGS inclusion rate in approximately 3 week post-weaning 11- to 24-kg nursery pigs. In Exp. 1, there was no effect of DDGS level on ADG, ADFI, or G:F. In Exp. 2, DDGS improved G:F by lowering ADFI, with no effect on ADG. Based on these data, Gaines et al. (2006) concluded that up to 30% DDGS can be used in 11- to 24-kg pigs without affecting late nursery pig performance. The same PIC product pigs and DDGS were used in current research and Gaines et al. (2006). All of our trials were conducted on the same commercial research farm. Collectively, these data from our laboratory indicate that up to 30% DDGS from modern ethanol plants can be used in 10- to 23-kg pigs without affecting late nursery pig performance. Since there was no difference in pig growth performance between the corn-soybean meal based control diet and the corn-soybean meal diet containing 30% DDGS, we did not include the corn-soybean meal based control diet in Exp. 3 and 4.

In Exp. 3 and 4, pigs fed pelleted diet containing 30% DDGS had a greater ADG and G:F compared to those fed the meal diet, with no effect on ADFI. The results from the present research are in agreement with Larsen and Oldfield (1960) and Jensen and Becker (1965), using the barley and corn based diets, respectively, in nursery pigs. Similarly, improvements in ADG and G:F of nursery pigs by pelleting were observed by Traylor et al. (1996) and Xing et al. (2004), using the corn soybean meal based diets. Hanke et al. (1972) and Wondra et al. (1995) also reported improvements in both ADG and G:F from pelleting of corn-soybean meal diets in growing and finishing pigs. However, no effect of pelleting on pig growth performance was also reported by Gamble et al. (1967) and the NCR-42 Committee (1969). Hancock and Behnke (2001) summarized eight studies and concluded that pelleting resulted in an average improvement of 6% in ADG and 6 to 7% in feed efficiency.

The reasons for the increased growth performance and improved feed efficiency with pelletted diet are not well understood. Growth performance improvements introduced by pelleting process has been attributed to increased bulk density of diets, reduced dustiness, improved palatability (Skoch et al., 1983a) or decreased feed wastage (Hancock and Behnke, 2001). However, the improved palatability had no effect on feed intake in the current experiment. Since there is no effect of pelleting on ADFI, the improved ADG and G:F in this study could be attributed to greater digestibility of most nutrients and energy in the pelleted diet. Pelleting process may gelatinize starch and make it more susceptible to enzymatic digestion, thus improve growth performance (Jensen and Becker, 1965). The improved digestibility of DM, protein, energy and fat by pelleting in this research is in agreement with reports by Skoch et al. (1983b), Wondra et al. (1995), Noblet and Champion (2003), Xing et al. (2004) and Noblet and Jaguelin. (2008), using the corn-soybean meal basal diets. In the present study, pelleting improved the digestibility of most nutrients, and this improvement was greater for fat, which subsequently contributed to greater digestible energy. The improved digestibility of most nutrients and energy could contribute to the improved growth performance and feed efficiency in pigs fed the pelleted diets containing 30% DDGS.

Pelleting increased dietary DE content (3,973 vs. 3,818 kcal/kg DM) in this study. This result is in agreement with Skoch et al. (1983b), Wondra et al. (1995) and Xing et al. (2004). The energy value of ingredients for swine depends mainly on their chemical composition. Dietary fiber contributes to reduction of energy concentration whereas fat increases energy content (Noblet and Champion, 2003). Unlike Baird (1973) who reported that pelleting the corn-soybean based diet had no effect on apparent digestibility of crude fiber, the digestibility of NDF and ADF was also improved by pelleting in the present research. Improved digestibility of NDF and ADF may release more protein and fat, all of which will contribute to more digestible energy. Improved digestibility of DM, OM, CP, energy and fat was observed in pelleted corn (Noblet and Champion, 2003; Noblet and Jaguelin, 2008), which could partially justify the improved digestibility observed in the present research. Pelleting increases the energy digestibility of feeds by about 1% (Noblet, 2006). This is most important for some fat rich ingredients such as full fat rapeseed or (high oil) corn for which pelleting improves the digestibility of fat with subsequent marked differences in their DE value between mash and pellet forms (Noblet, 2006; Noblet and Jaguelin, 2008). The concentration of fat in DDGS is approximately 10%, which is about 3 times greater than in corn (Stein and Shurson, 2009). The increased DE content of pelleted diet in this study can be attributed to the improved fat digestibility in this study. Further research should be conducted to evaluate the effect of pelleting process on the nutrient and energy digestibility of DDGS.

In the current study, energy digestibility was 79.4 and 83.1% for meal and pelleted diets, respectively, indicates that pelleting improves the energy digestibility. Pelleting can affect energy digestibility of corn, and this may exclusively related to the higher fat digestibility by pelleting (Noblet and Jaguelin, 2008). The 8.4% increase in fat digestibility could contribute, in part, to the increased dietary DE by pelleting process in this study. The digestibility of energy in this study was relatively lower than those 85.5% vs. 87.6% for meal and pellet, respectively, and 88.4% vs. 90.3% for meal and pellet, respectively, reported by Skiba et al. (2002) and Noblet and Champion (2003). Le Goff and Noblet (2001) reported that the energy value of diets or ingredients changed according to the type of animal fed, with differences depending on the amount and origin of dietary fiber. This relatively lower energy digestibility in the present study could be attributed to the nursery pig and the higher fiber content introduced by DDGS inclusion. Energy digestibility is affected by animal factors (Noblet, 2008). In growing pigs, energy digestibility increases with increasing body weight (Noblet, 2006). Gastrointestinal system development of the young pig is far from complete, even by 4 weeks of age (Cranwell and Moughan, 1989), which also contribute to low energy efficiency in this study. Feed ingredients that contain fiber, such as DDGS, result in a reduction in energy density, increase in the rate of ingesta passage in digestive tract, and finally a reduction in nutrients and energy digestibility (Ewan, 2001).

The fecal fat digestibility of 81.8 and 88.7% for meal and pelleted diets, respectively, in our study was considerably greater than 61 and 77% reported by Noblet and Champion (2003). Pelleting improved fat digestibility in both the Noblet and Champion (2003) and the present study, but there was a greater difference in fat digestibility in the current study. Our results were more consistent with Skiba et al. (2002) that reported a fat digestibility of 81 and 86% for meal and pelleted diets, respectively. The discrepancy between Noblet and Champion (2003), Skiba et al. (2002) and the present study could be attributed to the different diets composition. High level of fat rich ingredient, full fat rapeseed (20%, as-fed basis) and DDGS (30%, as-fed basis), was used in Skiba et al. (2002) and the present study, with calculated dietary fat contents of 14.2% in Skiba et al. (2002) and analyzed fat content of 10.2% in the present study. On the contrary, the dietary fat content of Noblet and Champion (2003) was calculated to be 4.0%. In the digestive tract, fat has the effect of slowing passage rate, which will improve the digestibility of nutrients (Azain, 2001). Apparent digestibility of fat increased with increasing dietary fat levels (Eusebio et al., 1965; Xing et al., 2004), and the magnitude of this increased fat digestibility was greater when the diets were fed in meal form compared with pelleted form (Xing et al., 2004).

Results of this research suggest that 30% DDGS from modern ethanol plants can be used in 10- to 23-kg late nursery pigs without affecting growth performance. Pelleting the diets containing 30% DDGS improves pig growth performance and feed efficiency by increasing most nutrients and energy digestibility. Collectively, the results of this research indicate that 10- to 23-kg pigs in late nursery phase can be fed up to 30% DDGS without having a detrimental effect on pig performance and pelleting the diet containing 30% DDGS will increase nutrient and energy availability.

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