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Effects of Different Grinding Levels (particle size) of Soybean Hull on Starting Pigs Performance and Digestibility

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ABSTRACT

Two experiments were carried out to study the effects of grinding of soybean hulls (SH) on starting pigs (15-30 kg) diets. Experiment I consisted of a digestibility trial with 12 barrows, initial average body weight 21.9±1.29 kg ,in which the best digestibility coefficient (DC) of DM and GE was obtained with SH ground through a 2.5mm screen mesh, evaluated for CP and ME, a best DC was attained with 3.0 mm screen mesh. In the Experiment II, five diets with increasing SH (2.5 mm) levels (0, 3, 6, 9 and 12 %) for starting piglets were formulated. A quadratic response in daily weight gain (DWG) occurred, according to SH inclusion. Worst DWG occurred at 7.75 % SH inclusion. Daily feed intake, feed: gain ratio and plasma urea nitrogen were not affected by inclusion levels. In conclusion, although soybean hull grinding improves the digestible nutrients, inclusion of SH on starting pig diets is economically unfeasible.

Key words: alternative feedstuffs, by-product, nutritional evaluation, nutrition, piglets

INTRODUCTION

During the last few years, pig production in Brazil has specialized quickly and become highly competitive; consequently its profit margin is narrow and inconsistent during the year. Actually, entire pork production chain is constantly seeking for alternatives for reducing the costs, improve profits and reduce economic losses.

Feeding may represent over 70% of production costs. Main ingredients used in the elaboration of diets are corn and soybean meal, with prices determined by the international market.

Alternative feedstuffs that might total or partially replace corn and the soybean meal, should be studied to provide options to the pig producer, especially to maintain the performance level while reducing the variable costs.

Soybean hull consists of the external part of the kernel (film) and is obtained by removal during oil extraction when the grains are broken and heated (62ºC) to late lamination (Butolo, 2002). Soybean hull (SH) has about 75% of non-starch polysaccharides (NSP) and around of 60% of them are insoluble in nature (Lo, 1989).

Studies have shown that SH may be an important tool to reduce total N and ammonia in manure, enhancing the control of environmental pollution, which is the object of current concerns (Kendall et al., 1999; Decamp et al., 2001; Keys and Wood,

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2001; Van Kempen et al., 2001). SH in the Brazilian market is largely supplied.

In Brazil, the studies with SH in pig feeding are scarce. Gentilini et al. (1997) found values of 2,233 kcal of DE kg^{-1} and 2,188 kcal $kg^{-1}$of ME for raw SH, and 2,248 kcal of DE $kg^{-1}$and 2,164 kcal of ME kg^{-1}, for toasted SH.

Other studies have evaluated the possibility of SH inclusion in pig diets, in spite of specific limitations. Levels of up to 10 % have not caused impairment in the swine performance (Bowers et al., 2000; DeCamp et al., 2001; Keys and Wood, 2001), although it may reduce the digestibility of some nutrients (Dilger et al., 2002; Moeser and Kempen, 2002).

Lima et al. (1997) did not find any profit decrease when pigs were fed on 6 % SH diets in finishing and on 12 % SH diets in growing and growing-finishing pigs. Results showed that the economic use of SH in growing and finishing pig diets reached up to 6 % since this by-product cost up to 20% of soybean meal.

The digestibility and the energy value of foods are related to their particle size (Owsley et al., 1981, Healy et al., 1992, Healy et al., 1994, Wondra et al., 1995a,b,c,d, Fastinger and Mahan, 2003), which depends on the diameter of the screen hole and can be measured by geometric mean particle size (GMP).

Zanotto et al. (1995) observed that increase of corn GMP decreased the DE and ME in growing pigs. These authors concluded that corn energy value was influenced by its particle size. However, there is no Brazilian literature that proves this effect on soybean hull or the best GMP for starting pigs.

This study aimed to evaluate the feeding value of soybean hull ground with different screens mesh on starting pig (15-30 kg) diets.

MATERIALS AND METHODS

Two experiments (digestibility and performance) were carried out with soybeans hulls (SH) in starting pigs (15-30 kg) diets. SH used was obtained from the a local supplier as raw soybean hull. Soybean hull was ground into four particle sizes, using a hammer mill (28 hammer), powered by a 20CV-3.550 rpm engine. SH passed through four different screen opening diameter (2.0; 2.5; 3.0 and 3.5 mm screen mesh). The GMP of SH grinding followed methodology described by Zanotto and Bellaver (1996).

Gross energy of diets, soybean hull, faeces and urine was determined in adiabatic calorimeter (Parr Instruments). Chemical composition of feces, foods and diets was carried at the Animal Nutrition Laboratory of the State University Maringá (LANA-DZO/UEM), according to methodologies described by Silva and Queiroz (2002).

Experiment I (Digestibility trial)

Digestibility trial was carried out with SH ground in different screens and whole SH (WSH), into different geometric mean particle sizes (GMP). Soybean hulls were named P2.0, P2.5, P3.0, P3.5 according to the screen mesh used (2.0, 2.5, 3.0, 3.5mm) and WSH (no grinding).

Twelve barrows (Landrace x Large White), initially weighing 21.9 ± 1.29 kg BW, were individually penned in metabolism crate. After a seven-day adaptation period, total feces and urine were collected during two of a five-day period. There were two observations per pig, ending up four observations per diet.

Basal diet was formulated to meet or exceed the NRC (1998) standards for starting pigs (15 to 30 kg BW) and included (%; as feed basis): yellow corn (69.80), soybean meal (26.95), dicalcium phosphate (1.21), limestone (.630), sodium chloride (.520), soybean oil (.239), vitamin and mineral premix (.650). Diet was provided as mesh form.

Test diets were composed of 70% basal diet (BD) and 30% SH with different GMP.

Pigs were fed twice a day, 55% in the morning (8h) and 45% in the afternoon (16h). Water (100 ml) was added in the meal to prevent the waste, reduce dustiness and improve feed intake. Daily meal supply was stipulated according to metabolic weight ($BW^{0.75}$) for each animal, in agreement with feed intake obtained during pre-experimental period. Ferric oxide (Fe_2O_3) was added (2.0 %) to mark the beginning and the end of collection period. Total feces and urine were collected daily, in plastic bags and stored in a freezer until laboratory analyses (Moreira et al., 2004).

The digestibility coefficients of dry matter (DCDM), crude protein (DCCP), gross energy (DCGE) and the coefficient of metabolization of gross energy (CMGE) of SH were calculated, considering total collection method (Fialho et al., 1979 and Moreira et al., 1994). Digestibility coefficients of SH were calculated by equation described by Matterson et al. (1965).

Coefficients were submitted to variance analysis using the software "System of Statistical Analyses and Genetic" (SAEG, 1997), for randomized block designs.
Digestibility coefficients, excluding 0 g $kg^{-1}$of SH, were submitted to the polynomial regression analysis, with screen mesh and GMP taken as independent variables. Dunnet test (Sampaio, 1998) was used to compare the whole soybean hull (WSH) with each one of different the soybean hull grindings (P2.0; P2.5; P3.0; and P3.5).

Experiment II (Performance trial)
SH ground in 2.5 mm screen-opening diameter were used, with 439 μm of GMP (S2.5), to study the graded levels of SH inclusion (0, 3, 6, 9 and 12%) in starting (15 to 30 kg) piglet diets. SH (S2.5) was chosen because it had the best performance along with S2.0 in the digestibility trial and was cheaper to grinding.
Forty pigs were used (20 males and 20 females) with initial BW of 14.38 ± 1.35 kg. Piglets were kept in a nursery (two per pen) with partially controlled temperature. Each partially-slotted floor pen contained one 5-hole frontal dry-feeder and a nipple drinker water at the back.
Experimental diets (Table 1) were calculated to meet equal energy (3,348 kcal DE kg^{-1}), protein (18.67 % of CP), calcium (.82 % of Ca) and phosphorus (.59 % of total P). Diets were formulated according to NRC (1998) for starting pigs (15 the 30 kg body weight).

Table 1 - Composition of the experimental diets (g kg^{-1}) and their chemical composition (g kg^{-1}; as-fed basis).

Items	SH inclusion levels, %[1]				
	0	3	6	9	12
Yellow corn	68.72	65.67	62.43	59.17	55.93
Soybean hull	0	3	6	9	12
Soybean meal, 45%	28.06	27.59	27.16	26.74	26.31
Soybean oil	0	.53	1.23	1.93	2.63
Limestone	.93	.90	.86	.82	.79
Dicalcium phosphate	1.40	1.41	1.42	1.44	1.45
Sodium chloride	.40	.40	.40	.40	.40
Vitamin and Mineral Mix[1]	.50	.50	.50	.50	.50
Analyzed values [2]					
Crude protein	18.36	18.56	18.03	19.08	18.81
ADF	4.25	4.95	5.91	7.11	6.22
NDF	11.14	13.16	14.46	17.09	15.27
Hemicellulose	6.89	8.21	8.55	9.98	9.05
GMP, μm	634	594	593	585	548

[1] Vitamin and mineral premix for starting pigs [2-] Analyzed values from LANA-UEM: ADF – Acid detergent fiber, NDF – Neutral detergent fiber and GMP- geometric mean particle size.

Diets were provided *ad libitum*. At the end of the 28-day experimental period, pigs were weighed and feed intake computed to calculate daily feed intake (DFI), daily weight gain (DWG), feed: gain ratio (FGR) and cost in diet per kilogram of pig produced (CD). End of experiment occurred when animals reached 28.71 ± 2.99 kg of average body weight.
Blood was collected (Cai et al, 1994) by anterior vena cava puncture in heparenized tubes at the start and at the end of the experiment. Plasma urea nitrogen (PUN) was analyzed according to procedure by Marsh et al. (1965).
The economic feasibility of SH addition, including diet cost (DC) and diet cost per kilogram of pig produced, was calculated according to Bellaver et al. (1985). The economic efficiency index (EEI) and cost index (CI) were calculated according to Barbosa et al. (1992).
A complete randomized design was employed with four replicates and five treatments (0, 3, 6, 9 and 12 % SH inclusion) and two pigs per pen. Results for the inclusion level, excluding level 0 %, were submitted to the polynomial regression analysis. Dunnet test (Sampaio, 1998) compared 0 % SH with each SH inclusion levels (3, 6, 9 and 12 %).

RESULTS AND DISCUSSION

Chemical and energy composition (Table 2) of SH in different screens was different. Variation might be due to physical factors that led to the stratification of particles and, in turn, to irregularity in the homogeneity of material.

Urease activity rates were similar to values (0.35) of Gentilini et al. (1996) who worked with toasted SH for pigs. They reported a decrease in enzyme activity (0.18) when the SH was toasted.

Experiment I - Digestibility trial

The chemical composition, digestibility coefficient of dry matter (DCDM), crude protein (DCCP), gross energy (DCGE), metabolizability coefficient of gross energy (MCGE), and the respective values of digestible nutrients of SH are shown in Table 3.

Table 2 – Chemical and energetic composition (g kg^{-1}) of soybean hull ground in different screens mesh and without grinding (as-fed basis).

	Soybean hull				
	P2.0	**P2.5**	**P3.0**	**P3.5**	**WSH[1]**
Screens mesh, mm	2.0	2.5	3.0	3.5	WSH
GMP[2], μm	436	439	545	751	2043
Items					
Dry matter	92.02	92.29	92.33	91.83	92.55
Gross energy, kcal kg^{-1}	3.803	3.891	3.829	3.860	3.869
Crude fat	2.50	2.94	2.64	2.76	2.42
Crude protein	15.23	17.07	16.02	15.90	14.58
KOH Protein solubility, %	27.12	30.55	30.24	27.99	28.90
Urease activity	0.32	0.35	0.34	0.32	0.29
Calcium total	.44	.46	.44	.44	.43
Phosphorus total	.27	.26	.25	.26	.26
Ash	6.67	7.69	7.26	6.14	5.98
Acid detergent fiber	41.80	39.74	40.24	39.65	40.98
Neutral detergent fiber	61.55	57.34	59.73	60.62	60.21
Hemicelluloses	19.75	17.60	19.49	20.97	19.23

[1]Whole soybean hull; [2] Geometric mean particle size.

Chemical composition (DM = 92.22 %, CP = 15.76% and urease activity = 0.324) and energy (GE = 3,850 kcal kg^{-1}) of SH were slightly higher than those found by Gentilini et al. (1997).

According to Dunnett test results, the contrast between WSH and SH grinding in different particle size indicated that DCDM and DCGE of P2.0 and P2.5 were higher than those of WSH; P3.0 and P3.5 presented similar digestibility coefficient as WSH. DCDM rate (64%) of P2.0 was similar to that (63%) found by Gentilini et al. (1997), who worked with raw SH in starting pigs diets. However, DCCP and MCGE of the P2.0, P2.5 and P3.0 were higher than those of WSH.

Results showed that grinding improved the digestibility of SH nutrients and suggested that WSH and coarse SH were unfit for starting pig feeding. In addition, it was observed that decreasing GMP SH up to 439μm, digestibility of dry matter and gross energy improved, while the GMP SH of 545μm was enough for the crude protein and metabolizable energy (Table 3).

DE of P2.0 and P2.5 was higher (2,358 and 2,397kcal kg^{-1}) than that of WSH (1,476 kcal kg^{-1}). These rates are higher than those found (2,233 kcal kg^{-1}) by Gentilini et al. (1997) in two experiments with pigs 16.00 of 58.63 kg of live weight. Higher rates could be explained by the fact that SH evaluated in current experiments had better chemical composition and urease activity.

Improvement in SH digestibility, as GMP decrease, could be the result of better exposition of smaller particles to digestive enzymes of piglets (Hedemann et al, 2005). Although working with other feedstuffs, Zanotto et al. (1995) observed decrease in DE and ME with an increase of ground corn GMP in growing pig diets.

Table 3 - Chemical composition, digestibility coefficient of dry matter (DCDM), crude protein (DCCP), gross energy (DCGE), metabolizability coefficient of gross energy (MCGE) and digestible nutrients of soybean hull ground in different grinding and without grounding for starting pigs (15-30 kg)

	Soybean hull						
	P2.0	P2.5	P3.0	P3.5	WSH[1]		
Screens, mm	2.0	2.5	3.0	3.5	WSH		
GMP, μm	436	439	545	751	2043		P=
			Chemical composition			CV[2]	D[3]
DM, %	92.02	92.29	92.33	91.83	92.55	-	-
CP, %	15.23	17.07	16.02	15.90	14.58	-	-
GE, kcal kg^{-1}	3,803	3,891	3,829	3,860	3,869	-	-
			Digestibility coeficiente				
DCDM	63.61a	69.14a	55.57b	52.83b	38.28b	17.79	0.001
DCCP	47.39a	47.42a	50.74a	29.51b	23.37b	21.63	0.036
DCGE	62.00a	61.61a	53.21b	47.80b	38.16b	16.60	0.000
MCGE	58.04a	58.54a	50.45a	45.97b	34.24b	16.27	0.000
			Digestible nutrients				
DM, %	58.5	63.8	51.3	48.5	35.4	-	-
DP, %	7.24	8.09	8.12	4.71	3.39	-	-
DE, kcal kg^{-1}	2,358	2,397	2,038	1,845	1,476	-	-
ME, kcal kg^{-1}	2,207	2,278	1,932	1,775	1,325	-	-

[1-] Whole soybean hull (soybean hull without grinding); [2-] Coefficient of variation; [3-] Dunnet test; Means with different letters in the same row are different ($P < 0.05$).

Gentilini et al. (1997) found higher rates of DE (2,248 kcal kg^{-1} of DE) for roasted SH when compared to raw SH (2,233 kcal kg^{-1} of DE). These authors suggested that, for better utilization, SH must be roasted and ground in screen with up to 2.5 mm mesh diameters. Roasting reduced the anti-nutritional factors and grinding allowed better contact between SH particles and digestive enzymes.

Tables 4 and 5 show regression equations and their respective predicted rates for dry matter, crude protein and gross energy digestibility, in function of the screen mesh and GMP of SH. DCDM was not influenced (P≥0.05) by screens used in SH grinding.

Table 4 - Regression equation and respective predicted values of digestibility coefficient of dry matter (DCDM), crude protein (DCCP), gross energy (DCGE) and metabolizability coefficient of gross energy (MCGE), according to screens mesh used to grind soybean hull (X, mm)

Equations	**Screens mesh, mm**					
	2.0	**2.5**	**3.0**	**3.5**	**CV[1], %**	**P=**
DCDM =0.85535-0.091819X	0.67	0.63	0.58	0.53	17.34	0.0849
DCCP =-0.8267+1.0685X-0.21257X^2	0.46	0.52	0.47	0.31	20.15	0.0496
DCGE =0.84211-0.10201X	0.64	0.59	0.54	0.49	15.70	0.0265
MCGE =0.7761-0.08858X	0.60	0.55	0.51	0.47	13.92	0.0354

[1-] Coefficient of variation.

Table 5 - Regression equation and respective predicted values of digestibility coefficient of dry matter (DCDM), crude protein (DCCP), gross energy (DCGE) and metabolizability coefficient of gross energy (MCGE), according to soybean hull GMP (X, µm)

Equations	GMP, µm				CV[1], %	P=
	436	439	545	751		
DCDM = 0.83781-0.000433X	0.65	0.65	0.60	0.51	16.65	0.0603
$DCCP = -0.680+0.0045X-0.000004X^2$	0.53	0.53	0.59	0.45	21.86	0.0060
DCGE = 0.80480-0.00044813X	0.61	0.61	0.56	0.47	15.18	0.0254
MCGE = 0.74636-0.000394X	0.57	0.57	0.53	0.45	13.42	0.0316

[1-] Coefficient of variation.

Regression analysis, excluding WSH, indicated decrease (linear, P≤0.05) of DCGE and MCGE with wider screen meshes (Table 4). Likewise, decrease (linear, P≤0.05) of DCGE and MCGE was observed with increase of GMP (Table 5). Dilger et al. (2002) evaluated the effect of SH inclusion in barrow (33.11 kg of BW) diets and found linear decrease of GE digestibility with increasing SH (0, 30, 60 and 90%) levels.

Decrease in nutrient digestibility was expected, since digestion efficiency was influenced by the exposition of food particles to digestive enzymes and by the transit speed of gastrointestinal contents. Since there was reduction in nutrient digestibility with increase in GMP, this indicated that SH grinding improved the digestible nutrients for starting pigs.

There was a quadratic effect (P≤0.01) of screen mesh used in SH grinding and its respective GMP on DCGE. Derivation of quadratic equations ($DCCP = -0.8267 + 1.0685X - 0.21257X^2$ and $DCCP = -0.6801 + 0.00451X - 0.000004X^2$) showed a better DCCP at 2.51 mm screen mesh and 563.75µm GMP.

Experiment II- Performance trial

Table 6 shows the performance results and PUN according to graded level of SH ground in 2.5 mm screen mesh (GMP = 439 µm) of starting pigs diets.

Increasing SH from 30 to 120 g kg^{-1}tended (linear, P = 0.106) to increase the daily feed intake (DFI). At its lowest levels (3 and 6 % of SH), DFI was lower when compared to diets without SH (0%). As added SH increased, dietary fibers increased too; soybean oil was also added to maintain diets equal in energy level. It could be possible that at SH lowest level (3 and 6 %), with less oil, the impairment effect of SH on DFI prevailed. On the other hand, at SH's highest levels (9 and 12 %), with more oil (1.93 and 2.63%), DFI increase was probably due to improvement of diet flavor and appearance.

Table 6 - Daily feed intake (DFI), daily weight gain (DWG), feed: gain ratio (FGR) and plasma urea nitrogen (PUN) of starting pigs fed on diet with graded levels of soybean hulls.

Items	SH inclusion levels, %					CV[1]	P=	
	0	3	6	9	12		Reg[2]	D[3]
Average initial weight, kg	14.63	14.06	14.50	14.28	14.42	-	-	
Average final weight, kg	30.27	28.96	26.81	28.22	29.27	-		
DFI, kg	1.323	1.179	1.177	1.232	1.336	8.75	NS	-
DWG, kg	0.711a	0.678a	0.560b	0.634a	0.675a	10.03	Q=0.019	0.02
FGR	1.860	1.767	2.157	1.962	1.988	16.19	NS	-
PUN, mg/dL	9.38	8.51	8.32	9.56	8.67	18.17	NS	-

[1] Coefficient of variation; [2] Regression analysis: Q= Quadratic effect, $DWG= 0.819148 - 0.06425X + 0.004432X^2$; [3] Dunnet test; Means with different letters in the same row are different (*P* < 0.05).

A quadratic effect (P = 0.019) was reported with an increase in SH levels in DWG. Derivation of quadratic equation ($DWG = 0.819148 - 0.064250X + 0.0004432X^2$) indicated (Table 6) lower DWG at 7.25 % of SH inclusion. Reduction in DWG up to 7.25 % of SH inclusion and posterior recovery, reflect the numerical ($P \geq 0.05$) improvement of DFI (Table 6). Although working with growing pigs, Lima et al. (1997) did not find impairment in weight gain of pigs fed on diets containing up to 6 % of SH.

Dunnet test showed that, in the case of DWG, only 6 % of SH inclusion level was different ($P \leq 0.05$) from 0 % of SH. An interaction between the dietary fiber and lipids, might exist which could have led to inadequate nutrient utilization (Dilger *et. al.*, 2002, Moeser and Van Kempen, 2002), especially oil energy.

Non-starch polysaccharides (NSP) in SH (Kohlmeier, 1996) might have negatively influenced nutrient utilization, since NSP viscosity could modify biliary acid secretion and consequently result in important wastage of those acids through feces. According to Choct (2001), NSP may bind to biliary acid, lipids and cholesterol, with an increase hepatic biosynthesis of biliary acid of cholesterol to restore the pool of these substances in the enterohepatic circulation. The continuous drain of biliary acid and lipids by sequestrum and wastage may influence the absorption of lipids and cholesterol in the gut. Since these effects interfere in digestive dynamics and absorption, they impair the assimilation of nutrients by animals.

Bowers et al. (2000) concluded that inclusion up to 3 % of SH on finishing pigs (70.75 kg) diets did not influence animals' performance. Likewise, DeCamp et al. (2001) showed that addition of 10 % SH in corn-soybean meal based diets did not impair the performance of finishing pigs (85.4 kg of BW).

Increased levels of SH had no effect ($P \geq 0.05$) on NUP, which suggested that dietary protein quality was not modified with SH inclusion.

Regression analysis, with 3, 6, 9 and 12 % SH levels, showed (Table 7) a quadratic effect ($P \leq 0.05$) of added SH on the diet cost per kilogram of pig produced (DC). Higher DC at 8.42 % of added SH was observed by mean derivation of quadratic equation ($DC = 0.699045 + 0.0428779X + 0.000254739X^2$).

Comparison of SH inclusion levels (3, 6, 9 and 12 %) with level 0 % (Dunnet test) indicated that DC at all levels was higher ($P \leq 0.01$) than 0 % of SH. Diet cost was influenced by the amount of soybean oil added to keep the same dietary energy. Diet cost is, thus, dependent on soybean oil price.

Presents results were different from those by Lima et al. (1997), who showed that SH could be added on growing-finishing pig diets up to 6 %, without any economic loss, since SH costs were up to 20% of soybean meal price. It could be concluded that economic use of SH on pig diet is dependent on the relative cost of ingredients used, especially soybean oil costs.

This study indicates that SH is energy poor and has a negative influence on piglets (15-30 kg) feed intake.

Table 7 - Diet cost per kilogram, diet cost per kilogram of pig produced (DC), economic efficiency index (EEI) and cost index (CI) of starting pigs fed on different levels of soybean hull.

Items	SH inclusion levels, %						P=	
	0	**3**	**6**	**9**	**12**	**CV[1]**	**Reg[2]**	**D[3]**
Feed: gain ratio	1.860	1.767	2.157	1.962	1.988	-		
Diet cost, R$	0.415	0.422	0.433	0.444	0.455	-		
DC, R$/kg BW gain	0.784a	0.792b	0.902b	0.841b	0.859b	3.869	Q=0.011	0.001
EEI	100.0	98.98	86.89	93.24	91.24	-		
CI	100.0	101.03	115.08	107.25	109.60	-		

[1]Coefficient of variation; [2]Regression analysis: Q= Quadratic effect, $DC= 0.6990 + 0.0428779X - 0.0002547X^2$; [3] Dunnet test; Means with different letters in the same row are different ($P < 0.05$).

The results showed that digestible energy rates of whole soybean hull (without grinding) and soybean hull ground in screens mesh of 3.5, 3.0, 2.5 and 2.0 mm, were respectively: 1,476, 1,845, 2,038, 2,397 and 2,358 kcal DE kg^{-1}. Grinding of soybean hull improved the digestible nutrient values for starting pigs. The use of the soybean hull on starting pig diets is economically unfeasible depend on soybean oil price.

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RESUMO

Foram conduzidos dois experimentos para estudar os efeitos da moagem da casca de soja (CS) nas dietas de leitões na fase inicial (15-30 kg). O Experimento I consistiu de um ensaio de digestibilidade com 12 suínos machos castrados, com peso inicial médio de 21,9±1,29 kg. O melhor coeficiente de digestibilidade (CD) da MS e EB foi obtido com a peneira 3,0 mm. No Experimento II, foram formuladas cinco dietas com níveis crescentes (0, 3, 6, 9 e 12%) de CS (2,5 mm) para suínos na fase inicial. Foi obtida resposta quadrática para ganho diário de peso (GDP) em função dos níveis crescentes de CS. Pior GDP ocorreu com 7,75 % de inclusão de CS. Consumo diário de ração, conversão alimentar e nitrogênio da uréia plasmática não foram influenciados pela inclusão da CS. Conclui-se que, embora a moagem melhore a digestibilidade dos nutrientes da casca de soja, a sua inclusão nas dietas de suínos na fase inicial é economicamente inviável.

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