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Nutritional Management During Gestation and Lactation on an Integrated Swine Farm. Case study

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ABSTRACT

On the Rescate de Sanguily swine farm, of the Swine Company of Camagüey, whose purpose is to pre-fatten pigs for fattening agreements with farmers, the nutrition of breeding sows and the feasibility of using alternative rations or non-conventional products for nutrition were partially assessed during gestation and lactation. The protein and energy values were higher than the requirements set up for these categories. Replacement of commercial feed by two types of feeds was simulated with the use on non-conventional raw materials during pig gestation and lactation. The goal was to assess the possibility to cut down on the costs of nutrition, close the gap between the requirements and nutrient contribution (CP and DE), and convenience of its inclusion of roughages on the breeder´s diet. A comparison of the costs per ton of feedstuffs showed a difference toward non-conventional products, which may offer some selection criteria to farmers, provided that they are willing to implement diversifying strategies on their farms, or sign agreements with farms seeking profits for the two entities.

Key words: *nutrition, pigs, simulation*

INTRODUCTION

Good manufacturing practices are an essential requisite to guarantee swine health and efficiency; therefore, adequate nutrient administration must be ensured in every ration, together with the necessary amount of balanced feeds, according to the production and reproductive state of animals, in order to meet their nutritional requirements of energy, protein, vitamins, minerals, and water (MINAGRI, 2008).

Thanks to developments in genetic breeding, today´s sows are bigger, less fatty, readier for breeding, and fast growing. They are also, more delicate animals, with less body reserves, so nutritional adjustments must be further studied (Quiles and Hevia, 2003), especially when that daily feed consumption is reduced, which conditions their productive lives (Capdevila, 2006).

Gestation and lactation have different nutritional needs; therefore, feed management must be adjusted in every stage, separately. Breeding sows have an effect on birth and weaning weight and consequently, on growing pig weight. Sow yields are affected during different stages of the reproductive cycle (Hartog and Smits, 2005).

Traditionally, works on nutrition set apart the gestation period of sows in three phases: initial, middle, and final (Coma, 1997, cited by Carrion and Medel (2001). Accordingly, it was necessary to establish some considerations about the age of breeding sows, and define the requirements for young animals, in comparison with multiparous sows, because the restrictions during the first lactation period cause limitations or changes in the reproductive efficiency of the following cycles.

In comparison to other pigs within a breeding system, the lactating sow is the most feed-demanding animal, to ensure high productive efficiency. Frequently, swine farms cannot meet the nutritional requirements of their lactating sows, so it is important to know the physiological background that will improve the chances to set up strategies for better consumption in the stage (Martínez, 2008).

The nutritional levels provided during lactation have a direct influence on milk production, which in turn, is influenced by a series of factors; such as, breast hygiene, litter size, number of farrowing, sow´s body condition, lactation curve, etc. Accordingly, a well-fed sow produces more milk with increased quality, which means larger litters at weaning, and more resistance to disease. Moreover, the nutritional features during lactation will have an effect on the breeding parameters of the following cycle (duration of weaning-estrus interval, proliferation, fertility, and embryo mortality (Quiles and Hevia, 2003).

The effects of low feed consumption during lactation have especially severe after-effects of different kinds. The first manifestation observed was a decline in milk production, leading to low-weight piglets at weaning; thus effecting on poor post weaning weight gains, increased temperature demands, and, therefore, higher energy waste, lower growth rate at later stages, and older commercial age with higher per capita feed consumption. Alternatively, the female undergoes a negative energy balance, which calls for body reserve use. As a result of this, weaning is produced with decreased body condition, lacking nutrients (Martínez, 2008).

Considering these elements and the management characteristics of breeding sows on the Rescate de Sanguily swine farm, the aim of this study was to perform a partial assessment of breeding sows during gestation and lactation; as well as studying the feasibility of using alternative rations.

A comparison of the costs per ton of feedstuffs showed a difference in favor of non-conventional products, which may offer some selection criteria to farmers, provided that they are willing to implement diversifying strategies on their farms, or agreements with producing farms seeking profits for the two entities.

MATERIALS AND METHODS

The case study included assessment of nutritional management information about breeding sows on the Rescate de Sanguily farm.

These data were used to calculate the nutritional contribution (DE and CP) for the gestating and lactating sow category, using commercial feedstuffs without forages. The amount of nutrients consumed by the animals was estimated according to the ration set up by the company, and considering the raw material percent (corn and soybean), reported by the feed producing company, as well as the DE and CP mean values offered by several sources for their main ingredients (tables 1; 2; 3; and 4).

All the values achieved were compared to the estimated requirements for the gestating and lactating sow categories.

Alternative diets were made for gestation and lactation, including national raw materials, using Confort (1997), and were compared with nutrient contribution and costs between the conventional ration and the alternative ration, using the prices reported for corn and soybean by the Central Bank of Cuba (2015), and the non-conventional raw material prices, based on the information offered by private producers and suppliers.

RESULTS AND DISCUSSION

Table 5 shows the comparative analysis of animal protein and energy consumption (according to the values and standards suggested by NRC, 1998), feed estimation (according to the composition reported), and the values of tabulated raw materials for gestation.

The required amounts was established as the right volume to achieve increased response, up to the moment of no response. Tables of nutritional recommendations, like ACR (1981), or NRC (1998), are based on reports from several papers. NCR recommendations (1998) still include a compilation of previous empirical works, though such recommendations rely on factorial models.

Concerning nutritional supplies, commercial ration consumption leads to a significant high consumption, when compared to the values provided by NCR (1998) for gestating sows (252 and 374, to 511g, respectively). Additionally, these values are higher than the amounts recommended for gestation in the Brazilian charts for swine nutrition (14 to 15.5 %/kg DM) (Rostagno, 2005).

High levels of protein inclusion in animal rations increase costs of commercial feedstuffs. For excessive nitrogen ingestion, it means extra energy waste to eliminate the nutrient´s excess concentrations. The protein in the diet becomes a source of inefficient energy when it is used for other purposes than protein deposition (Van Milgen, 2003).

Marotta and Lagreca (2003) have estimated that the requirements of total digestible energy (maintenance + gain) for normal gestating sows may be covered with a 2.1 kg ration, containing 3.3 Mcal/kg of DM. Therefore, nutrient consumption is above the needs when the commercial feed technology is applied.

Excessive energy supples during gestation might induce body over-conditioning at farrowing. Martínez (1998) claimed that it is common to observe overweight sows coming to the farrowing area. It represents excessive feed waste during gestation, increases fat infiltration to the mammary gland that cause a reduction in the potential for milk production.

Those reserved will be consumed over lactation, and weight loss will be somewhat pronounced in terms of gestation gains. As a result, sows would be considered to be over-fed during the stage (Roppa, 2000).

Goñi *et al*. (2008) noted that overfeeding also represents higher feed expenses per kg of weaned suckling pig, and adult castrated pig kg. Besides, it also affects mammary development, especially between 70 to 100 days of gestation, since adipocyte (fat cells) excess is observed in the mammary glands, preventing development of small conduits and mammary alveoli (milk-producing tissue), thus lowering further milk production. Finally, it decreases post-farrowing consumption, and leads to quick weight loss in the sow.

Additionally, since insulin sensitivity is lost, appetite is reduced and body reserves increase.

Tollardona (2008) notes that it is essential to consider that the nutrition of breeding sows should undergo requirement analysis, whether they are dry animals, during the pre-service period (15 days before insemination or mating), gestating, with two main stages: the first two thirds and the last third of gestation, considering the growing needs of litters, and trying to maintain proper body condition.

In practice, the different stages of the reproductive cycle must not be separated, because there is a strong relation between them. Adequate performance during lactation depends largely on the feeding work made over gestation. For a quick start, it is important for the sow to leave lactation in peak body condition (Troillet, 2005).

There are various criteria about the amount and composition of the rations, and the value of their main nutrients (energy and protein), and animal requirement arrangements, particularly in terms of limiting amino acids in the rations (Tollardona, 2008).

Generally, there is coincidence on the importance of only supplying 5 kg of feed daily. Some authors have commented on the critical first week (post farrowing), when there are differences in consumption between 15 and 20 %. As a consequence, the sows with lower consumption fall into nutritional deficit without milk production, but with significant weight loss (protein and fat), lengthening of the productive estrus-weaning interval, reduction of fertility, and therefore, annual sow reproduction. Differences in productivity are always favorable to the most aggressive systems (Capdevila, 2006). For lactation the values achieved were higher than energy and protein consumption established by the NCR (1998) (Table 6). These needs were estimated according to body weight changes in the sows, and also in litters, whose daily mean gains ranged between 150 and 250 g . The breeding sows on the farm showed none of the parameters above, but in general terms, the number of suckling pigs per litter was less.

Even when the demands are met with the administration of commercial feed with higher quantity than the NRC standards (1998), its production cost is high, and hinders the Cuban economic policies, with increased prices of products for swine.

The search for more viable alternatives has also been a concern of industrial economies; for example, American farmers used to include corn and soybean as basic components of gestating sow nutrition. In 2008, increasing corn and fat prices made farmers change the composition of feeds for sows. The results of investigations of Greyner (2010) seemed to indicate that more than 30 % of dried grains from distilleries looked adequate with solubles (DDGs), to formulae feeds for sows during lactation.

Traditionally, feed formulation has relied on the nutritional composition of the raw materials from NRC table values (1998), Amipig (2000), and FEDNA (2003). The values in the tables indicate mean determinations made over a variable number of samples in each ingredient.

Several ingredients or nutrients may have increased variability that leads to a decline in the accuracy of nutritional assessment, and results in the application of broad safety margins, if minimum nutrient contribution is to be guaranteed. On other occasions, the amount of samples used to make the tables has been reduced, so those values must be used with precaution. It would be recommendable to analyze the main raw materials in feeds, before making the formulation.

It must be flexible to raw material prices and the commercial conditions of the area, in terms of nutritional and safety balance, and regulations and standards from the sanitary authorities (García-Contreras *et al.*, 2012).

The nutritional programs for breeding sows during lactation and growth may be overrated in comparison to pig nutrition in the final growth stage. However, with increased animal feed prices, all swine areas must be carefully assessed (FEDNA, 2006).

According to the above comparison of consumption rates between the set standards and requirements, commercial formulation seems larger than necessary, considering the Cuban Standards for nutrition use the NRC values (1998) as reference.

Protein consumption has been studied by several organizations and individual authors, with different results; for example, the values cited by Cuellar (1998) place these requirements between 240 and 150 g/animal/day for gestating sows, and 1050 to 400 g/animal/day for lactating sows.

Enough amino acids must be supplied in order to make use of animal potential for meager tissue deposit, but preventing excess, both energetically and environmentally (Le Bellego *et al.*, 2001, Noblet *et al.*, 2001).

Another remarkable aspect of feed management on the farm is the lack of forage supply to breeding sows.

There are limitations in the tropic as to the use of forage resources by pigs, like fiber digestibility, the presence of anti-nutritional factors, energy and protein contents, etc. The inclusion of diet fiber from forages to the sow ration is an inexpensive source of vitamins and minerals. The features of the intestinal tract of pigs are suited for better use of energy that comes as AGV, due to microorganic activity in the caecum (Savon and Idania, 2007, Campagna, 2005).

Adult pigs have greater potential to digest cellulose materials, and can stay on forage diets when it is supplemented with vitamins and minerals (Varel and Pond, 1985).

The growing demand of energy-rich grains for human consumption and greater availability of fiber-rich products from the industry, have caused an increase in the use of fiber raw materials for swine nutrition (Noblet and LeGoff, 2001).

Moreover, other factors like the ban to use growth promoter antibiotics, the need to reduce ammonium emissions to the environment, when the animal wellbeing should be improved, and reduction of stomach ulcers, have called for more fiber raw materials in the feed (Low, 1985).

González (2007), notes that the main weakness of the reproductive system in Latin America is its fragility to economic changes domestically and internationally, because feeds are based on grains and soybean, with low yields for most tropical countries. Approximately 75 % of raw materials must be imported, causing great foreign dependency.

At the same time, new alternatives must be found for feed production, that include non-conventional raw materials. According to Cuellar (1998), the tropics offer a great deal of advantages for more appropriate animal production relying on the resources available locally.

Table 7 shows the costs of rations for gestating sows, as well as other national feasible sources, collected by simulation, using Confort.

Table 8 shows the cost per ton of alternative feed for lactating sows, based on current prices for raw materials.

The manufacture of commercial feeds for gestating sows was costlier than the alternative ration ($ 315 USD, vs. $ 251, 6 USD), and higher ($ 315 vs. $ 269) than non-conventional feed for the lactation stage (Tables 9 and 10).

The estimated cost of single-feed for animals during the reproductive cycle, according to the existing standards, is approximately $164.64 USD (Table 10), applying the same delivery standards per breeding stage (gestation and lactation) for the use of alternative feed that met the nutritional demands of DE and CP. The estimated costs would be lower, according to Table 11.

Financial and price internal control in Cuba encourages prices for domestic goods in relation to the production volumes, but shortages of certain items (fertilizers, pesticides, fuels, and lubricants, etc.) lead to cost increases of products that can replace corn and soybean, which are usually imported materials.

The use of alternative raw materials for animal nutrition to substitute imports, reduces competition with human foods, and preserve the environment which is a challenge for dieticians and small and mid-scale farmers in the search for solutions to improve avian, swine, and rabbit nutrition that can be ecologically strong and efficient (Lon, 1995; Savón, 2006).

Argenti and Espinoza, (1999) noted that due to those reasons, several agricultural research centers, universities and private organizations have worked hard to find alternative non-conventional sources of vitamins, minerals and proteins nationally, in order to substitute the inclusion of corn and soybean, by cutting down the production costs.

Small and mid-scale swine farmers have the choice of national raw materials and industry by-products to feed pigs. Although it is probable that more time will be needed to reach proper weight for the slaughter house at a lower cost. It will mean higher cost effectiveness, less hard currency evasion, and self-supplying. It will eventually stop financing foreign agriculture.

It is also a way to cushion expenses and improve animal nutritional profile, the inclusion of roughage in the feeds, from plants that not only provide low-cost digestive nutrients, but also quality and quantity proteins, and adequate volumes of minerals and vitamins. However, the diet is not completely balanced, so a complementary ration must be supplied to meet the demands of balanced nutrition (Universo porcino, 2015).

CONCLUSIONS

A comparison of the costs per ton of feedstuff showed a difference toward non-conventional products, which may offer some selection criteria to farmers, provided they are willing to implement diversifying strategies on their farms, or agreements with producing farms seeking profits for the two entities.

REFERENCES

INRA-ITCF .(2000). *AmiPig, Ileal Standarised Digestibility of Amino Acids in Feedstuffs for Pigs*. AFZ-Ajinomoto Eurolysine-Aventis Animal Nutrition-INRA-ITCF. Retrieved on May 15, 2016, from sde http://www.feedbase.com/downloads/amipeng.pdf.

ARGENTI, P, y ESPINOZA, F.(1999). *Alimentación alternativa para cerdos*. Maracay, Venezuela: FONAIAP. Retrieved on May 15, 2006, from http://www.fonaiap.gov.ve/publica/divulga/fd61/alimen.html.

BANCO CENTRAL DE CUBA (2015, enero). Información Económica. *Boletín informativo diario*, 18 (4 353). RNPS 2330. La Habana, Cuba: Centro de Información Bancaria y Económica. Retrieved on May 15, 2006, from http://www.bc.gob.cu/espanol/boletines.asp.

CAMPAGNA, D. (2005). *Aprovechamiento de pasturas por cerdos en la etapa de crecimiento-terminación*. IIIº Encuentro Latinoamericano de Especialistas en Sistemas de Producción Porcina a Campo, Facultad de Ciencias Agrarias, Universidad Nacional de Rosario, GIDESPORC, Argentina. Retrieved on May 15, 2006 from www.produccion-animal.com.ar.

CAPDEVILA, J, (2006). *Alimentación de cerdas lactantes I*. Retrieved on April 10, 2015, from http://www.3tres3.com.

ROSTAGNO, H. S. (2005). *Tablas Brasileñas para aves y cerdos: composición de alimentos y requerimientos nutricionales*. Brasil: Departamento de Zootecnia, Universidad Federal de Visoza. Retrieved on April 10, 2015, from http://www.worldcat.org/title/tablas-brasilenas-para-aves-y-cerdos-composicion-de-alimentos-y-requerimientos-nutricionales/oclc/663973330.

CARRIÓN, D. Y MEDEL, P. (2001). *Interacción nutrición reproducción en ganado porcino*. XVII Curso de Especialización FEDNA. Retrieved on April,2015, from http://www.ucv.ve/fileadmin/user_upload/facultad_agronomia/Nutrici%C3%B3n-Reproducci%C3%B3n_en_Porcinos.pdf.

CUÉLLAR, P. (1998). *Alimentación no convencional de cerdos mediante la utilización de recursos disponibles*. Cali, Colombia: Fundación CIPAV. Retrieved on April, 2015, from http://www. cipav. org. co/cipav/research/livestock/piedad.html.

FEDNA (2003). *Normas para la formulación de piensos compuestos*. España: Ed. Fundación Española para el Desarrollo de la Nutrición Animal, Universidad Politécnica de Madrid. Retrieved on April 10, 2015, from http://www.fundacionfedna.org/normas_fedna_formulacion_piensos.

FEDNA (2006). *Necesidades nutricionales para ganado porcino*. España: Fundación Española para el Desarrollo de la Nutrición Animal, Universidad Politécnica de Madrid. Retrieved on April 25, 2015, from http://www.fundacionfedna.org/sites/default/files/Normas%20PORCINO_2006rev.pdf.

GARCÍA-CONTRERAS, A. C.; DE LOERA, Y. G.; YAGÜE, A. P.; GUEVARA, J. y GARCÍA, C. (2012). Alimentación práctica del cerdo. *Revista Complutense de Ciencias Veterinarias*, *6* (1), 21-50. Retrieved on January 2, 2015, from http://dx.doi.org/10,5209/rev.

GOÑI, D.; BÁRTOLI, F.; CÁCERES, G. y GIANFELICCI, M. (2008). *Nutrición de la cerda durante la gestación*. Retrieved on October 12, 2014, from http://www.porcinocultura.com/artículos/nutricion-porcina.

GONZÁLEZ, C. (2007). *Alimentación alternativa de cerdos en Venezuela*. Conferencia en Instituto de Producción Animal, Facultad de Agronomía, Universidad Central de Venezuela, El Limón, Maracay, Venezuela.

GREYNER, LAURA (2010). *Alimentación de Cerdas Reproductoras y Nulíparas*. *Tecnología porcina VII*. Portal Universo Porcino. Retrieved on October 12, 2014, from http://www.universoporcino.com/articulos/nutricion_porcina_12-2010_alimentacion_de_cerdas_reproductoras_y_nuliparas.html.

Hartog, L. y Smits, C. (2005). *Estrategias de alimentación y manejo para alcanzar la uniformidad y calidad deseadas en porcino*. XXI Curso de Especialización FEDNA. Retrieved on October 12, 2014, from http://fundacionfedna.org/sites/default/files/05CAP_XIII.pdf.

Le Bellego, L.; Noblet, J. y Van Milgen, J. (2001). Effets de l'exposition au chaud et de la réduction du taux de protéines de l'aliment sur les performances du porc en croissance. *Journées de la Recherche Porcine en France*, *33*, 189-195. Retrieved on October 12, 2014, from http://www.journees-recherche-porcine.com/texte/index.htm.

Lon Wo, E. (1995). *Alimentación no convencional para las aves en el trópico*. XIV Congreso Latinoamericano de Avicultura, Santiago, Chile.

Low, A. G. (1985). *Recent Advances in Animal Nutrition*. London: Butterworths.

Marotta, E. y Lagreca, L. (2003). Determinación del requerimiento energético de la cerda reproductora mantenida a campo en base al clima y la etología. *Analecta veterinaria*, *23* (2), 28-35.

Martínez, R. (2008). *Aspectos prácticos de la alimentación de las cerdas lactantes*. Retrieved on January 23, 2015, from http://www.porcicultura.com/porcicultura/home/articulos-interior.asp?cve_art=127.

MINAGRI (2008). Alimentación. En *Manual de procedimientos técnicos para la crianza porcina* (Capítulo 7). Ciudad de La Habana: CIMA.

National Research Council (NRC) (1988). *Nutrient Requirements of Swine*. Washington, D. C.: National Academy Press.

National Research Council (NRC) (1998). *Nutrient Requirements of Swine*. Washington, D.C.: National Academy Press.

Noblet, J. y Le Goff, G. (2001). Effect of Dietary Fibre on the Energy Value of Feeds for Pigs. 28 (1)<*t21*/<t26/> *Feed Sci. Tech.*, *90* (1-2), 35-52. Retrieved on April 25, 2015, from: http://www.animalfeedscience.com/article/S0377-8401%2801%2900195-X/fulltext.

Noblet, J.; Le Bellego, L.; Van Milgen, J. y Dubois, S. (2001). Effects of Reduced Dietary Protein Level and Fat Addition on Heat Production and Nitrogen and Energy Balance in Growing Pigs. *Animal Research, 50* (3), 227-238. Retrieved on April 25, 2015, from http://animres.edpsciences.org/articles/animres/pdf/2001/03/noblet.pdf

Quiles, A. y Hevia, M. (2003). *Últimas tendencias en la alimentación de cerdas durante la lactación: Recomendaciones prácticas*. Murcia, España: Departamento de Producción Animal, Facultad de Veterinaria, Universidad de Murcia, Campus de Espinardo.

Roppa, L. (2000). *La nutrición y la alimentación de las hembras reproductoras*. Congreso Mercosur de Producción Porcina, Buenos Aires, Argentina. Retrieved on April 25, 2015, from-https://www.bdpa.cnptia.embrapa.br/busca?b=ad&id=438151&biblioteca=vazio&busca=autoria:%22CONGRESO%20MERCOSUR%20DE%20PRODUCCION%20PORCINA,%202000,%20Buenos%20Aires,%20Argentina.%22&qFacets=autoria:%22CONGRESO%20MERCOSUR%20DE%20PRODUCCION%20PORCINA,%202000,%20Buenos%20Aires,%20Argentina.%22&sort=&paginacao=t&paginaAtual=1.

Savón, L. (2006). *Alimentación no convencional de especies monogástricas: utilización de alimentos altos en fibra*. VIII Encuentro de Nutrición y Producción de Animales Monogástricos, 2 y 3 mayo. Retrieved on April 25, 2015, from http://avpa.ula.ve/eventos/viii_encuentro_monogastricos/curso_alimentacion_no_convencional/conferencia-4.pdf.

Savón, Lourdes e Idania, S. (2007). *Factores antinutricionales en recursos alimentarios tropicales para especies monogástricas*. IX Encuentro de Nutrición y Producción en Animales Monogástricos, Montevideo, Uruguay.

Tollardona, D. (2008). *Nuevas consideraciones nutricionales en porcino*. Retrieved on December 8, 2014, from http://www.Porcicultura.com/Artículos13.htm.

Troillet, J. C. (2005). Productividad numérica de la cerda, factores y componentes que la afectan. Producción Porcina, [online], Retrieved on January 15, 2015, fromhttp://www,produccion-animal,com,ar,

Universo Porcino (2015). Nutrición Porcina, Alimentación del cerdo. Retrieved on March 15, 2015, fromhttp://www.universoporcino.com/articulos/nutricion_porcina_04-03-2015_alimentacion_del_cerdo.html.

Van Milgen, J. (2003). *La energía en la nutrición de los cerdos en crecimiento: el animal, la dieta y el medio de producción*. Saint-Gilles, France: Unité Mixte de Recherches sur le Veau et le Porc Institut National de la Recherche Agronomique.

Varel, V. H. and Pond, W. G. (1985). Enumeration and Activity of Cellulolytic Bacteria from Gestating Swine Fed Various Levels of Dietary Fiber.

Appl. Envirom. Microbiol., *49*, 858-862. Retrieved on March 15, 2015, from http://aem.asm.org/content/49/4/858.full.pdf+html.

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Table 1. General mean composition of corn and soybean

Raw material	CP	DE (Mcal/kg)
Corn (USA)	8.1	3.4
Soybean (44)	44	3.3
Corn (Spain)	7.7	3.44
Soybean (toasted)	36.3	4.13
Corn (France)	8.3	3.43
Soybean (44)	46.9	3.36
Corn (Cuba)	8.5	4.03
Soybean	43.5	3.9
Corn average	8.15	3.6
Soybean average	42.7	3.7

Source: FEDNA(2003), Manual of Feed Production (2005)

Table 2. Composition and nutrient contribution (kg/DM) of feed for breeding sows

Raw material	Inclusion percent	Contribution (for 100 % of feedstufs)		Fact. Correc.	
		DE (Mcal/kg DM)	CP (g/kg DM)	DE	CP
Corn	67	2.4	54.6	2.3	52.4
Soybean	29	1.05	126.2	1.0	118.0
Salt	2	0	0	0	0
Pre-feedstuff mixture 1	2	0	0	0	0
Total	100	3.45	180.8	3.3	170.4

Estimates based on reports by the feed manufacturer

Table 3. Feed consumption by breeding sows

Animal category	Consumption (kg/day)
Empty sow	3.00
Mounted sow (five weeks)	2.20
Gestating sow (6-12 weeks)	2.50
Gestating sow (13-16 weeks)	3.00

Source: Manual of Technical Procedures for Swine Raising

Table 4. Feeding technology of gestating breeding sows

Category	Consumption (kg/d)
Pre-farrowing sow	2.0
1-day post farrowing sow	1.0
2-day post farrowing sow	2.0
3-day post farrowing sow	3.0
4-day post farrowing sow	4.0
5-day post farrowing sow	5.0
6-day post farrowing sow	6.0
7-day post farrowing sow, until weaning	6.5
Stage average	6.0

Source: Manual of Technical Procedures for Swine Raising

Table 5. Comparison of demands for gestation (NRC, 1998), and contributions of CP and DE per single feed

Feed consumption (real) kg/day Gestation	Feed consumption NRC kg/d	CP demands (g/d) NRC (1998)	Single feed contribution CP (g/d)	DE demands (Mcal/d) NRC (1998)	Single feed contribution DE (Mcal/d)
First third (2,2)	1.96	252	374.9	6.38	7.26
Second third (2.5)	1.96	252	426	6.38	8.25
Third third (3.0)	1.96	252	511.2	6.38	9.9

Table 6. Comparison of demands for gestation (NRC, 1998), and contributions of CP and DE per single feed

Demands	
Feed consumption (real) kg/day/lactation	6.5
Cons. X feed kg/d NRC	5
X CP demands (g/d) NRC (1998)	894
Single feed contribution CP (g/d)	1 105
X DE demands (Mcal/d) NRC	17
DE contribution single feed (Mcal/d)	21.45

X = Mean values NRC (1998)

Table 7. Cost estimation of a ton of alternative feed for breeding sows (gestation)

Raw material	Inclusion percent of the feed mixture	Cost kg (USD)	Cost x kg feed mixture (USD)	Cost ton.
Corn meal	50	0.29	0.145	145
Soybean meal	10	0.49	0.049	49
Broken rice grain	15	0.15	0.0225	22.5
Sunflower	7	0.25	0.0175	17.5
Sugar	5	0.33	0.0165	16.5
Wheat spent grains	10	0.11	0.011	1.1
Salt	1			
Pre-feedstuff mixture	2			
Total	100		0.252	251.6

Feed mixture based on data provided by the Central Bank of Cuba (Economic Report), and retail sales research

Table 8. Cost estimation of a ton of alternative feed for breeding sows (lactation)

Raw material	Inclusion percent of the feed mixture	Cost kg (USD)	Cost c kg feed mixture (USD)	Cost ton.
Corn meal	40	0.29	0.116	116
Soybean meal	14	0.49	0.0686	68.6
Broken rice grain	15	0.15	0.0225	22.5
Sunflower meal	10	0.25	0.025	25
Sugar	8	0.33	0.0264	26.4
Wheat spent grains	10	0.11	0.011	11
Salt	1			
Pre-feedstuff mixture	2			
Total	100		0.269	269.0

Mixture made using Confort software, and data from the Central Bank of Cuba, Economic Report, (01/10/15)
Values of the alternative raw materials are taken from retail sales people

Table 9. Estimation of ton cost of single feed, used for breeding sows

Raw material	Inclusion percent of the feed mixture	Cost kg (USD)	Cost x kg feed mixture (USD)	Cost ton.. USD
Corn meal	67	0.29	0.194	194.3
Soybean meal	29	0.49	0.121	121.0
Total	96	0.84	0.315	315

Data from the Central Bank of Cuba (Economic Report (01/10/15)

Table 10. Estimated cost of single feed use on one breeding sow during a production cycle*

Reproductive stage	Days	Consumption (kg/d)	Cost/stage (USD)
Empty	17	3.0	16.065
Gestating (first third)	38	2.2	26.33
Gestating (second third)	38	2.5	32.3
Gestating (third third)	38	3.0	29.93
Latation start	(1 to 6)	21.5	6.77
Lactation	26	6.5	53.24
Total	159		164.64

*From standard values of days in each cycle stage .The values used are calculated from delivery standards and current price of the raw material analyzed

Table 11. Estimated cost of alternative feed use on one breeding sow during a production cycle (gestation and lactation)*

Reproductive stage	Feed type	Days	Consumption (kg/d)	Cost/stage (USD)
Empty	Gestation	17	3.0	12.85
Gestating (first third)	Gestation	38	2.2	21.07
Gestating (second third)	Gestation	38	2.5	24.04
Gestating (third third)	Gestation	38	3.0	28.84
Latation start	Lactation	(1 to 6)	21.5	5.78
Lactation	Lactation	26	6.5	45.46
Total		159		138.04

*From standard values of days in each cycle stage