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Inclusion of Efficient Microorganisms in the Diet of Pigs Before Weaning

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Abstract

Context: Because of the high competitiveness of pork in nutrition, modern swine breeders must search for production techniques that help solve the average low weights of weaning pigs.
Aim: To evaluate the inclusion of efficient microorganisms in the diet of pigs before weaning, to increase production yields.
Methods: The preparation of efficient microorganisms was based on dry leaves, rice semolina, molasses, and whey. The experiment consisted of 4 treatments and 3 repetitions per treatment, on a completely randomized treatment, with 6 animals per sty. The animals had equal feeding and handling conditions. The efficient microorganism inclusion rate was 0, 5, 10, and 15mL/kg live weight, respectively. The data were processed through a one-way analysis of variance, using Statgraphics plus 5.1.
Results: The best results were observed in the 15ml/kg live weight (9.33 kg average weight) treatment, with mean daily gain of 0.24 kg, feed conversion of 0.34 kg, and 100% variability, having significant differences from the other treatments ($P<0.05$)
Conclusions: The best treatment was the 15ml/kg live weight in all the variants evaluated, thus indicating the effectiveness of efficient microorganisms in swine production. The average consumption led to weight increases and conversion, thus ensuring greater meat yields in the stages of growth and development.

Keywords: *bacteria, suckling pigs, animal nutrition, weaning weight, viability.*

Introduction

The world population is constantly growing, which also causes higher demands for animal foods, such as meat, milk, and eggs (Bajagai, 2016).

Because of the high competitiveness of pork in today's markets, modern swine breeders must innovate and search for novel tools and production techniques that help solve the average low weights observed in weaning pigs (Cortés & Gómez, 2011).

Swine production in Cuba constitutes one of the most relevant items of the economy; it is expected to balance the consumption needs depending on the amount of meat produced. Unlike other species, pigs have distinctive features that make them the preferred choice to many farmers. For instance, the varied diet, good conversion, adaptability, and high proliferation, along with adequate carcass yields, with high levels of proteins and lipids (Ayala et al, 2014).

Swine is among the animal categories used to increase food production (Sánchez, 2016). FAO (2016) published that "pork is the most commonly consumed red meat worldwide, with an ever-increasing demand in recent decades."

Intensive and specialized swine farming is affected by several factors that cause stress in the animals, which may lead to unbalances in the intestinal microbiota, with repercussions on animal health and productivity (Milián et al., 2017; Rodríguez, 2017).

Currently, an alternative to raise yields in animals is the utilization of additives (biocatalizers, enzymes, essential oils, plant and seed bioactive compounds, and probiotics) in the daily diet (Rodríguez-Fernández et al., 2016).

Efficient microorganisms are a combination of microorganisms that live in nature. They are the base of a technology that uses all their natural potential (FAO, 2016).

The administration of efficient microorganisms has increased the appetite of treated pigs considerably, with excellent results in growing speed and a reduction in enteric-infectious processes in weaned piglets (Cortés & Gómez, 2011).

The EM-based technology is being used in more than 80 countries, with excellent possibilities for pig and cattle farmers, due to its cost-effectiveness and ease of use. It has been observed to produce significant results in stench control, as probiotics, in waste management areas, and the production of organic fertilizers from animal wastes (Video FUNDESYRAN, 2014).

Higher efficiency in intensive and semi-intensive swine farming systems is achieved through nutritional additives (Davies, 2011). Among these alternatives, are probiotics, prebiotics, acidifiers, enzymes, plant extracts, and nutraceuticals (Thacker, 2013).

Accordingly, this paper aims to evaluate the inclusion of efficient microorganisms in the diet of pigs before weaning, to increase production yields.

Materials and methods

This study was conducted in Casimba Arriba, on La Esperanza Farm, in the municipality of Manuel Tames, between April and June 2018, thanks to a swine breeding agreement based on FLACK-DECK. This Chinese system provides excellent comfort in the facilities.

Climatic conditions

The municipality is located in a tropical savanna, with a minimum temperature of 28ºC, and a maximum of 32 ºC (figure 1). May and October are the months with the highest precipitation values.

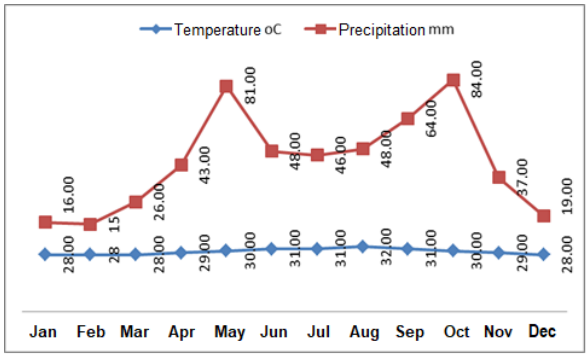

Fig. 1. The weather in Manuel Tames

This research was based on the Bill for Animal Welfare in Cuba.

Preparation of efficient microorganisms

It followed the methodology described by Olivera (2011) in the Cuban conditions.

Solid ingredients for mothers

Rice semolina - 46 kg It was purchased through the mentioned agreement.

Dry leaves - 16.12 kg It was collected in the woody area near Casimba Arriba, Guantanamo, from locations with the least human intervention.

Molasses-8 L. It was collected at the Argeo Martinez sugar mill, in the municipality of Manuel Tames.

Whey - 12 L. Collected from homemade cheese production facility on the farm.

Formulation of the preparation

Solid substrate- 62.12 kg.

Molasses 8 L

Whey 12 L

It was filled up with water to 200 liters.

Then the mixture was poured into a plastic tank sealed with nylon (figure 2) and remained sealed for 10 days in anaerobic conditions. Then the container was opened and the solid substrate was separated from the liquid substrate with gaze, to use EF free from particles that can compromise the proper application. The preparation (Figure 3) was light brown, with a sweet wine-like smell and taste, and slightly salted, pH 3.4.

Fig. 2. EM preparation container

Fig. 3. Efficient Microorganisms

For animal selection, 72 young female and castrated male pigs (Yorkshire x Landrace) were selected in equal proportion.

Treatments and design The experiment consisted of 4 treatments and 3 repetitions per treatment, on a completely randomized treatment, with 6 animals per sty. The animals had equal feeding and handling conditions. The efficient microorganism inclusion levels were 0, 5, 10, and 15mL/kg live weight (LW).

The data were processed through a one-way analysis of variance, using Statgraphics plus 5.1.

Variables of the study

- Weight (kg) It was measured every week until weaning.
- Mean daily gain (MDG) This value indicates the weight gained by a single animal a day.

It was determined using this formula:

$$MDW = \frac{FW-IW}{D} \quad \text{Eq. (1)}$$

FW = Final Weight

IW = Initial Weight

D = Days

- Conversion (C). This value indicates the efficacy of the animal can transform ingested feed into body mass (meat).

It was calculated using this formula:

$$C = \frac{AC \times D}{I} \quad \text{Eq. (2)}$$

C = Conversion

AC = Average consumption

I = Weight increase

- Variability (V). Variability in the piglets relates to their probability of survival. A viable piglet is one born with the proper weight (over 1 kg), and not too many farrowing complications, which makes it robust. On the contrary, an inviable piglet is born with enormous problems threatening the animal's survival likelihood.

Variability was calculated using this formula:

$$V = \frac{IE}{2} + I - \frac{FE}{2} \quad \text{Eq. (3)}$$

V = Viability (%)

IE = Initial existence

I = Input

FE = Final existence

Results and discussion

The production indicators (Table 1) show the best results with the application of 15 ml of efficient microorganism per live weight, with significant differences in all the other treatments, it occurs because the efficient microorganisms help balance the intestinal microflora of pigs, and consequently,

enhance conversion and weight gain thanks to an increase in nutrient intake.

Table 1. Behavior of the productive indicators at 33 days

Indicators	Treatments					
	Control group without EM	5 ml/LW	10 ml/LW	15 ml/LW	SE	W
Initial weight	1.39	1.40	1.39	1.40	0.03	0.9
Final weight	7.24^{d}	8.27^{c}	8.62^{b}	9.33^{a}	0.005	0.00
Mean daily gain	0.17^{d}	0.20^{c}	0.22^{b}	0.24^{a}	0.001	0.00
Feedstuff consumption (kg)	1.98	1.98	1.98	1.98	3.26	0.8990
Increase (kg)	5.8^{d}	6.8^{c}	7.2^{b}	7.9^{a}	0.005	0.00
Conversion (kg).	0.25^{d}	0.27^{c}	0.28^{b}	0.34^{a}	0.002	0.00
Viability (%)	100	100	100	100	-	-
Initial weight	1.39	1.40	1.39	1.40	0.03	0.9

Values with unequal superscripts differ significantly p (0.05)

There was a positive influence in relation to the health of the animals, with 100% viability. This occurs thanks to the utilization of microorganisms such as Lactobacillus and Saccharomyces as successful probiotics in animal production.

Increases in the dose of microorganisms per live weight are directly connected to the variables evaluated. These results have been corroborated by Perrachón & Irigiyen (2003), who noted that the activity of these beneficial microorganisms releases substances, such as vitamins, organic acids, minerals, and antioxidants at higher populations, thus promoting a healthier and more productive soil-plant-animal system.

Similar results were reported by Rodríguez (2013) in newborn and fattening pigs. Beruvides et al. (2018) observed better behavior in animal health, with 15 ml of efficient microorganism/kg live weight. Ferrín (2017) and Montejo-Sierra et al. (2017) demonstrated that the inclusion of efficient microorganisms in the balanced diets of pigs causes favorable changes in the final weight and daily weight gain.

Ojeda-García et al. (2016) reported similar results when they used efficient microorganisms in the diet of fattening pigs, and demonstrated that the mean daily gain and growth speed were higher when the biopreparation was administered, with shorter fattening cycles, which means fattening more pigs in the same time interval, and higher cost-effectiveness in production.

Montejo-Sierra et al. (2015) reported live weight increases in piglets, pre-fattening, starter fattening, and final fattening, using fermented soil microorganisms.

Conclusions

1. The best treatment was 15ml/kg live weight in all the variables evaluated, thus indicating the effectiveness of efficient microorganisms in swine production.

2. The average consumption led to weight increases and conversion, thus ensuring greater meat yields in the stages of growth and development.

Author contribution statement

Rolando Rolo López Rivera: research planning, formatting, analysis of the results, redaction and review of the manuscript, and final review.

Ramona Gamboa Castañeda: analysis of the results, redaction and review of the manuscript, final review.

Felícita D. Lorez Diaz: analysis of the results, redaction, and review of the manuscript, final review.

Conflict of interest statement

The authors declare the absence of conflicts of interest

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