

# Ammonia (NH<sub>3</sub>) gas reduction at pig stable

*Application of MicroAktiv®- DL & BS in a fattening pig stable of a Romanian Pig producer*  
– QM Study 123

## Introduction

Europig SA in Romania is part of Sergiana Group and includes a pig farm and slaughterhouse unit. The complex spreads over an area of 22 hectares and has a capacity of more than 50,000 pigs / year. Livestock is bred in 32 halls. Of these, four are intended for use as the maternity of the breeding sector, testing unit, freshening and gestation. The specialized engineers in this branch have continually looked for the perfection of the process and getting the best performance. If, in 2000, the breeding cycle was taking 220 days and the fat percentage was 24%, currently the breeding cycle has dropped to 180 days and the fat percentage is between 10 and 12% of the body mass.

The feeding system is one of the strengths of the complex and it is considered one of the best in Romania. The entire process of food preparation, transport and distribution is strictly monitored, with the ability to monitor the economic factors during the entire breeding process. Upgrading investments have taken into account the environmental protection and the improvement of animals' life quality.

This study aims to increase the living conditions for the animals in the stables and increase the efficiency of the draining of the manure transport channels' during the production cycle and at the end when cleaning the stables in preparation of a new cycle.

The study included two identical halls populated at the same time. Each hall contains four compartments, 25 m long and 18 m wide. The halls/shelters have been populated with 2205 and 2206 piglets respectively. Populating is done when each individual piglet has a weight of 27 to 28 kg and depopulating (slaughtering) is done at weights of 100 to 110 kg. The study was carried out between December 13th 2016 and March 7th 2017.

## Treatment Objectives

1. Increasing the living comfort of the livestock, increasing the food conversion and decreasing stress by decreasing the concentration of ammonia (NH<sub>3</sub>) and hydrogen sulfide (H<sub>2</sub>S) in the environment.
2. Manure liquefaction and maintaining a homogeneous

condition (semi-liquid state), preventing sedimentation of solids and avoiding the clogging of the discharge channels.

## Application Program

### **Objective 1:**

In order to achieve objective 1, it was proposed the use of a liquid bioactivator product named MicroAktiv®-BS. Its fully organic nature and ingredients are aimed at restoring the microbiological balance between the different microbial species normally present in animal manure. It stimulates the activity of certain bacterial thus accelerating the mineralization process without releasing ammonia.

MicroAktiv®-BS was applied weekly at a dose of 1 L per 1000 m<sup>2</sup> of stable floor surface. In practice this meant 0.5 l of concentrated product, diluted in the sufficient amount of water, applied in each compartment (2 l product/hall). For the complete duration of the test, 26 litre of MicroAktiv®-BS has been consumed.

### **Objective 2:**

In order to achieve objective 2 the microbial product MicroAktiv®-DL was applied. This formulation contains a wide range of microorganisms selected from nature (naturally occurring), capable to liquefy manure and maintain it into an easy pumping form. MicroAktiv®-DL maintains manure in a homogeneous state and prevents discharge channels to clog.

MicroAktiv®-DL has been applied in 3 steps:

- The first application of MicroAktiv®-DL has been made before populating the hall and 11.3 kg of product was used.
- The second application has been made approximately 30 days after the first application and 22.6 kg was necessary for the entire hall.
- The third application was conducted after the partial discharge of the accumulated manure under the floor grills. A quantity of 2.8 kg of MicroAktiv®-DL has been added to the compartments where partial emptying was done.

In total 4 pails of MicroAktiv®-DL of 11.3 Kg, a total of 45.2 kg, were necessary for the entire breeding cycle.

## Monitoring Program

In order to make a good evaluation of the effect of the treatment with MicroAktiv®-DL and MicroAktiv®-BS the following parameters were monitored during the pilot.

- Ammonia (NH<sub>3</sub>) and Hydrogen Sulphide (H<sub>2</sub>S) monitoring in the shelters
- Physical and chemical analyses of manure
- Microbiological analyses
- Economical analysis

## Results

### Ammonia (NH<sub>3</sub>) and Hydrogen Sulphide (H<sub>2</sub>S) monitoring in the shelters

NH<sub>3</sub> and H<sub>2</sub>S monitoring was carried out by using Dragger gas detectors, Dragger Pac 7000 for NH<sub>3</sub> and Dragger Pac 3500 for H<sub>2</sub>S monitoring.

Several measurements have been made in the control and test hall and it has been found that NH<sub>3</sub> has not exceeded the value of 25 ppm in the test hall, whilst values of 59 ppm have been recorded in the control hall.



Control hall (left) and test hall (right) NH<sub>3</sub> and H<sub>2</sub>S monitoring.

In the test hall a maximum hydrogen sulphide level of 0.6 ppm was recorded on one occasion. In the control hall the maximum value recorded was 1.2 ppm. It was reported that the animals in the treated stable were more active and curious than in the control stable.

### Physical and chemical analyses of manure

Chemical analyses have been conducted by a Renar (Romanian National certification Agency) accredited laboratory. The samples have been taken according to the sampling and preservation rules for wastewater samples.

### Manure Analysis Report

Sample	COD	NH <sub>4</sub>	N <sub>total</sub>
Control Hall (22/3)	30576 mg/l	3304 mg/l	3950 mg/l
Test Hall (16/2)	37632 mg/l	3980 mg/l	4330 mg/l

As it can be seen from the analysis report, both Total Nitrogen and Ammonium are higher in the sample collected from the treated hall compared to the sample taken from the control hall. This shows the efficiency of the two products that have prevented the release of NH<sub>3</sub> in the air and retain it in the manure. Nitrogen is retained in the manure and accelerates manure mineralization increasing the fertility of the resulting dry substance.



Manure samples taken from the test hall (16/3) and control hall (22/3).

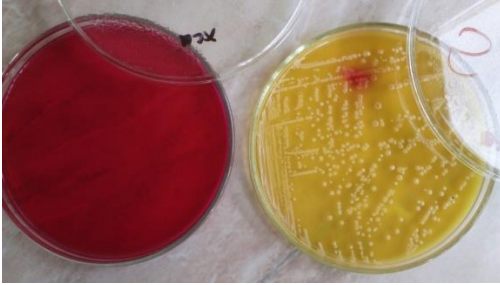


Manure samples 10 days later.

Manure homogeneity results in the significant increase of Chemical Oxygen Demand (COD). Upon final emptying of the manure channels, manure has not settled and has flowed completely into the downstream channels. The workers did not have to mechanically unblock the piping and no settled solid matter has remained under the grills.

### Microbiological analysis

The National Sanitary Veterinary Institution conducted the microbiological analysis of the manure. The laboratory monitored the main types of pathogenic bacteria (*Salmonella SPP*, *Listeria monocytogenes*, *Staphylococcus sp*, *Clostridium perfringens*).



*Salmonella Spp.*- absent.



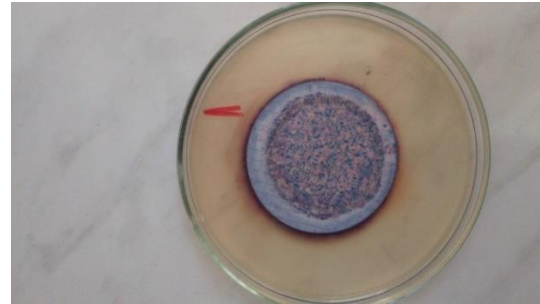
*Listeria monocytogenes* – absent

Plate count analysis has highlighted several types of bacteria such as:

1. ***Escherichia coli*** – aerobic bacteria, facultative anaerobic, gram negative, with exacerbated growth on the plates used
2. ***Intestinal Streptococci*** (fecal Enterococci) – Group of aerobic bacteria, facultative anaerobic, gram positive
3. **Yeasts and molds** – eukaryotic type mononuclear microorganisms that multiply by spores.
4. **Coagulase-negative *Staphylococci*** (depending on the ability to secrete an enzyme called Coagulase) – which are found everywhere and are part of the normal flora of the body (gastrointestinal tract, urethra, etc.- are a Gram positive aerobic coccus.



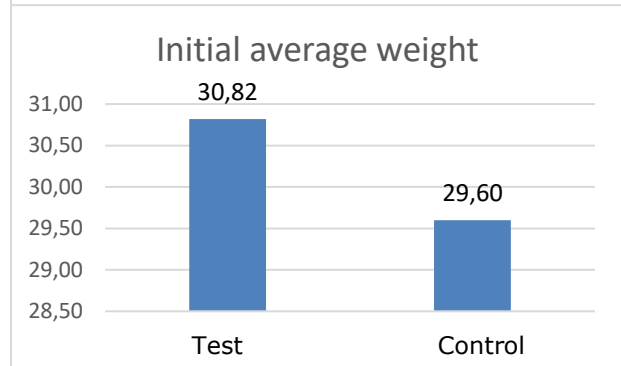
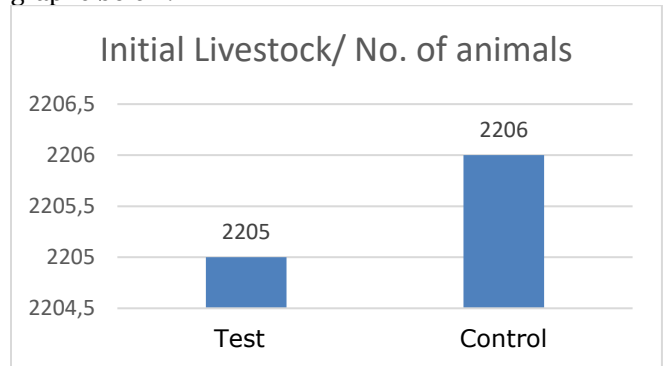
Yeasts and moulds



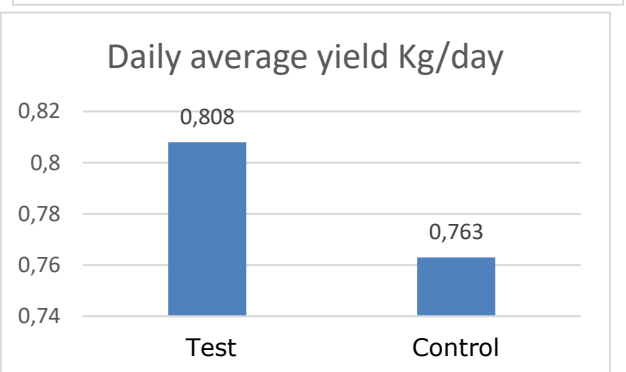
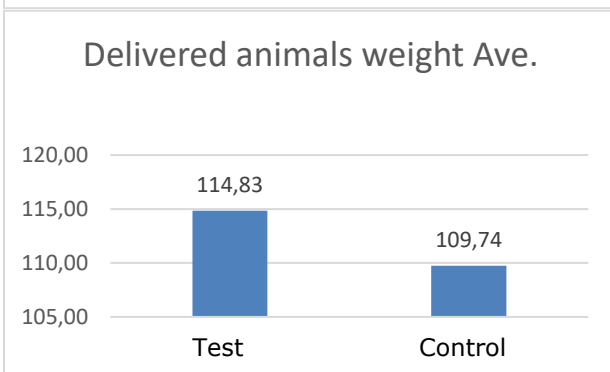
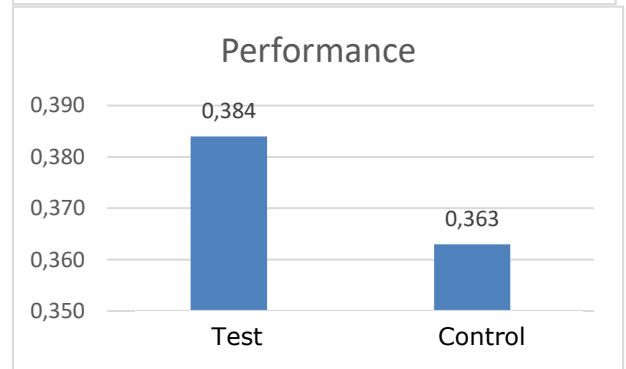
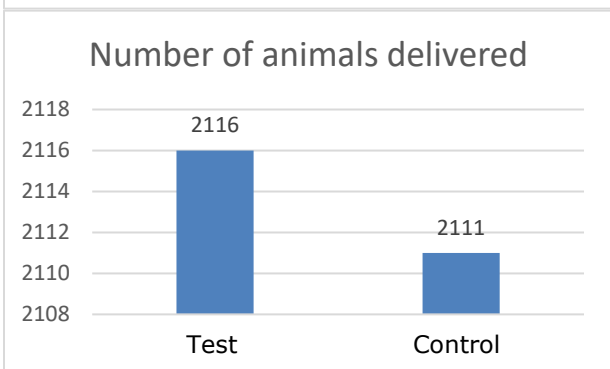
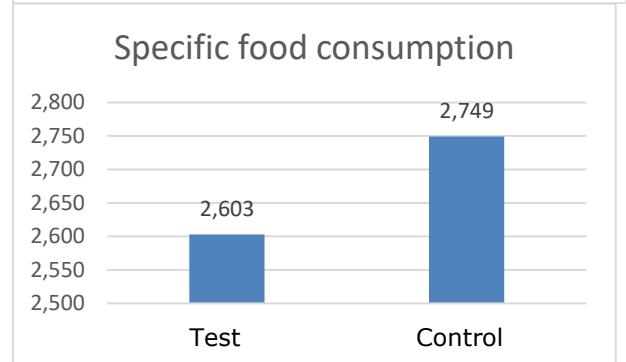
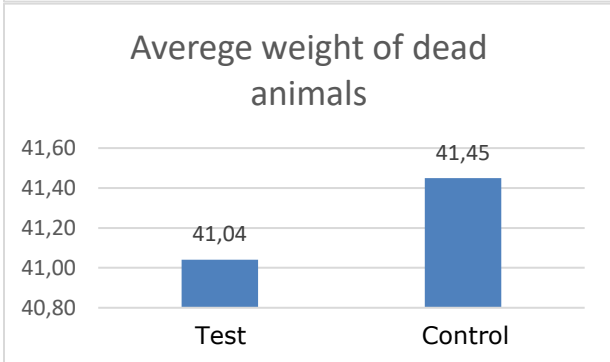
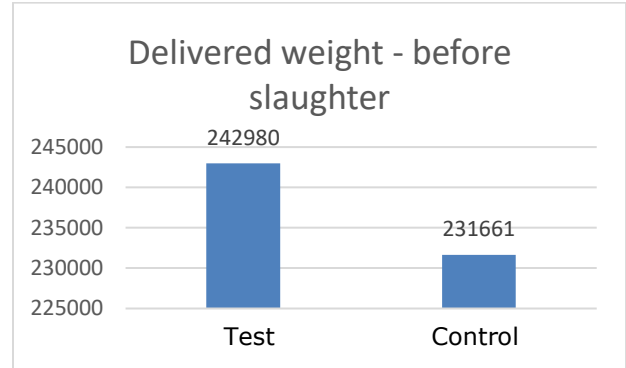
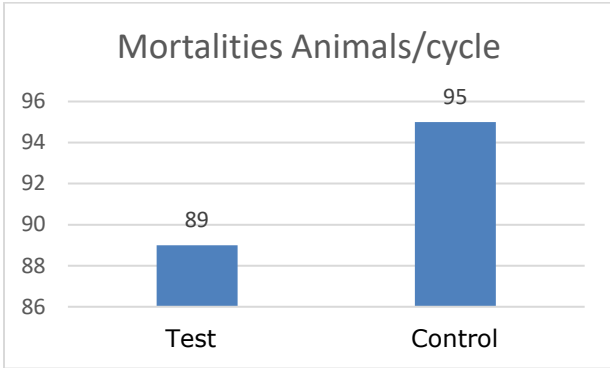
*Intestinal Enterocoli* – present

**Economical analysis**

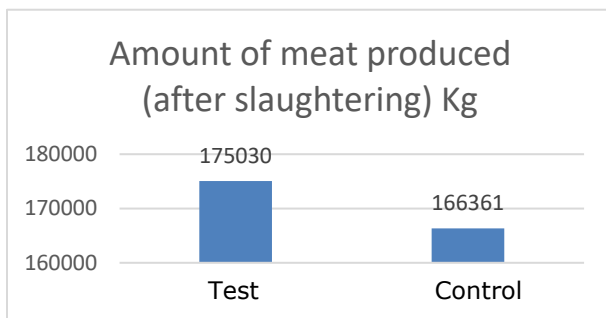
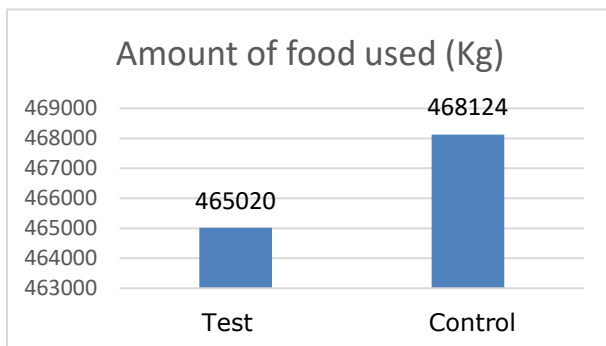
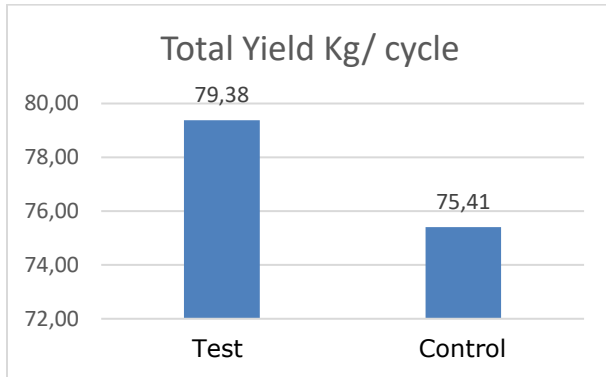
The economical analysis has been performed based on the comparative productivity report between the two halls. The results of this comparison is displayed in the graphs below.



*Coagulase-negative Staphylococcus* - Present







According to the graphs, 2116 animals have been delivered for slaughtering, with an average investment of 2.07 Eur/head.

## Results & Discussion

### **Ammonia (NH<sub>3</sub>) and Hydrogen Sulphide (H<sub>2</sub>S) monitoring in the shelters**

The NH<sub>3</sub> and H<sub>2</sub>S measurements clearly indicate a positive effect of the product MicroAktiv®-BS on the atmospheric conditions inside the treated hall. After the treatment, ammonia levels have decreased by 2.5 times. H<sub>2</sub>S has recorded significant decreases. In three of five measurements it has been determined to be 0 ppm in the treated hall. In the control hall values never went below 0.4 ppm. The effect of NH<sub>3</sub> on the growth has been extensively studied and it has been demonstrated that ammonia breathed by young pigs reduces their growth rate<sup>1</sup>.

### **Physical and chemical analyses of manure**

Visual inspection of the manure demonstrated that the manure remained in a homogeneous condition. Sedimentation was prevented and the coarse part separated much better on the existing parabolic screens. The chemical analysis demonstrated that mineralization was taking place even when the manure was still in the hall/shelter.

### **Microbiological analysis**

Microbiological analyses have not identified bacterial species dangerous to humans or animals in the treated hall. This proves that the products do not have a negative effect on the microbial population and will not promote disease causing microorganisms.

### **Economical analysis**

The analyses carried out have shown that the treated hall clearly produced superior results in all aspects. Mortality in the treated hall was 6% less than in the control hall and although food consumption in the treated hall was 0,66% lower compared to the control hall, the amount of meat produced was 4,95% higher in the treated stable.

Delivered meat difference between the control and treated hall is 8669 kg in favour of the treated hall.

1. ("Effects of Aerial Ammonia on growth and health of young pigs", by John G. Durmond<sup>2,3</sup>, Stanleye. Curtis<sup>4</sup>, Joseph Simon<sup>5</sup> and Horace W. Norton<sup>4</sup>, Vol. 50 No. 6, p. 1085-1091 Journal of Animal Science)

## Conclusions

MicroAktiv®-DL and MicroAktiv®-BS demonstrated their effectiveness in improving the living conditions inside the stable by improving the stable atmosphere and manure composition. The easier transport of the manure out of the manure basement underneath the stable reduces times needed for cleaning in between production cycles. The investment in the products is returned after the end of the production cycle due to increased meat production. Correct use of the products lead to increased profits for the pig breeder.