How to reduce ammonia emissions and improve pig welfare and performance

Rising input costs, together with environmental challenges, such as reducing ammonia emissions, remind us of the importance of managing and valorising the available resources on-farm.

by The For Farm Team, Olmix.
www.olmix.com

The slurry constitutes a complex ecosystem of many microbial populations. Following the change of environment from the animals' digestive tract to the storage pits, this ecosystem faces strong imbalances (growth slow down of some microbial species, strong ammonia concentrations, volatile fatty acids accumulation).

It results in a decrease of diversity and efficacy of the microbial population leading to poor fermentation and the issues encountered by producers (poor room atmosphere, impact on animal health, crusts and sedimentation development, difficult slurry mixing and emptying, decrease of its agronomic value).

Solution based on specific selection of minerals and trace elements

The Z'fix Slurry solution is a dust-free microgranular pellet created by Olmix to provide a targeted support to the microbial populations naturally evolving in the slurry in order to help in their rebalance. Its active ingredient ECO (Enzyme Catalyzer for Organic Substrate) contains specifically selected minerals and trace elements to act at two levels on microbial populations:

- **Enzymatic reactions support:**
These minerals and trace elements act as cofactors to boost the enzymatic reactions carried out by the micro-organisms.
- **Nutritional support:**
A part of these elements is also used for microbial biomass development.

Thanks to these two complementary actions, Z'fix Slurry ensures a better diversity and efficiency of the slurry microbial flora, i.e. a better balance of fermentations for lower gas emissions, better preservation of organic matter and fertilising elements.

Effect on ammonia emissions and preservation of nitrogen

Ammonia is a growing environmental and health concern. Its volatilisation impacts human health, contributes to soil acidification, ecosystems eutrophication and the formation of secondary particles.

Within livestock buildings, prolonged exposure to this gas, even at low concentrations, predisposes animals to respiratory diseases, impacts their well-being and consequently their growth and reproductive performance.

The European community, through the NEC directive, has set the objective of reducing these emissions by 19% for 2030. With the aim of providing the best solutions for agriculture, Olmix has evaluated the efficiency of Z'fix Slurry to reduce these ammonia emissions within livestock buildings but also through the preservation of nitrogen in organic form in slurry to limit its volatilisation during storage and spreading.

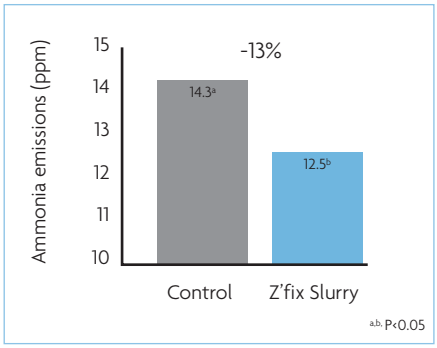

Fig. 1. Ammonia emissions (average of the total trial period).

An in vitro test carried out in the Czech Republic in 2021 measured a reduction of ammonia emissions by 24% for the slurry treated with Z'fix Slurry.

The implemented protocol followed the standard measurement method established by the country in order to validate the integration of a product into the list of 'best available techniques'. Thus, Z'fix Slurry has been recognised in the Czech Republic as an ammonia reduction technology as part of the implementation of the principles of good agricultural practice.

Various field trials have confirmed the product's ability to reduce ammonia emissions between 10-25% depending on the doses applied.

Another trial was carried out at the LVZ Futterkamp experimental farm in Germany from June to September 2021. In total 220 fattening pigs were included in the trial and divided into two groups of 110 pigs. Each group was raised in two identical fattening unit rooms where the slurry pits were completely emptied before starting the trial.

Z'fix Slurry was applied in one room (Z'fix Slurry group). All the animals received three-phase feeding. In these optimal conditions to minimise ammonia emissions the

Table 1. Technical performance.

Technical parameters	Control (n=110)	Z'fix Slurry (n=110)	Difference
Average duration of fattening period (d)	109	98	-11 days
Daily feed intake (kg/d)	2.3	2.4	4.2%*
Daily weight gain (g/d)	809	925	12.5%
Feed conversion ratio	2.9	2.6	-0.3 pt
Medical treatment (nb)	5	1	-80%
Mortality (nb)	4	2	-50%

objective was to evaluate the capacity of Z'fix Slurry applied at low dosage (-20% compared to the recommended dosage) to reduce these emissions. The measurements have been continuously taken with the Dräger ammonia sensors. The results showed a significant reduction of ammonia emissions by 13% in the Z'fix Slurry group compared to the Control group.

In parallel, slurry samples were taken and sent to LKS laboratory for a complete composition analysis. The results showed a significant increase by 17% ($P<0.05$) of the dry matter, a higher preservation of the organic matter (+15%, $P<0.05$) and a higher amount of total nitrogen (+10%) for the slurry treated with Z'fix Slurry.

These results were in accordance with the lower ammonia emissions measured by the ammonia sensor. Indeed, thanks to a good balance and efficiency of the fermentations in the slurry, the nitrogen has been preserved into organic form, more stable, limiting ammonia emissions in the building and at spreading.

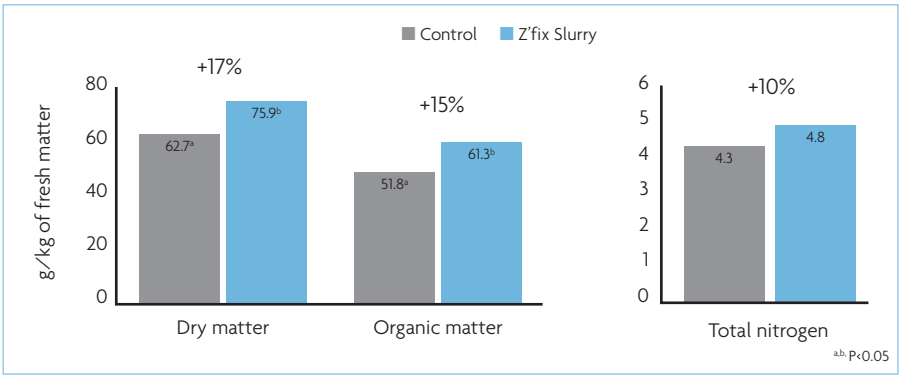

Fig. 2. Slurry analyses (average of the two samplings, 16 samples per sampling).

Positive consequence on welfare and performance

Very often underestimated, the consequences linked to a prolonged exposure of the animals to ammonia emissions can have high impacts on the animals' health and performance.

In the present trial, the mortality rate and the use of antibiotics were lower in the Z'fix Slurry group, respectively (-50% and -80%).

The main cause of mortality in the Control group was the excessive cannibalism leading to lameness. Even if the origin of the cannibalism is multi-factorial, it has been proved that pigs are very sensitive to variations in ambience factors and that ammonia represents an important risk factor in the occurrence of cannibalism.

In parallel, animals from the Z'fix Slurry group also had better technical performance. The daily weight gain was significantly higher over the trial period (+12.5%, $p<0.05$) and the feed efficiency was also improved (-0.3 pt FCR, $p<0.05$).

Consequently, the fattening period duration was reduced by 11 days.

At the slaughterhouse, two additional pigs could be valorised in the Z'fix Slurry group. Also, the carcase quality, qualified by the index (points per kg of slaughter weight) was also higher in this group compared to the Control group (respectively 0.976 and 0.961).

Considering the pig price in Germany during the trial period (€1.23/kg), the return on investment has been calculated.

Based on the total sold weight and the index results per group without taking into account the reduction from the feed costs and vet treatments the results showed a return on investment of 8:1 for the producer.

Table 2. Economic performance.

Parameters	Control	Z'fix Slurry	Difference
Number of sold pigs (n)	106	108	+2
Sold weight (kg)	9,836.8	9,936.0	+99.2
Income (sold weight x index results x pig price) (€)	11,627	11,928	+301
Z'fix Slurry cost (€)	0	33	+33
Final income (without taking into account the reduction from the feed cost and the vet treatments) (€)	4,309	4,707	+268
Return on investment		8:1	

Results

These results show that by improving the diversity and the efficacy of the microbial flora naturally contained in the slurry, Z'fix Slurry can reduce ammonia emissions and improve the fertilising value of the slurry.

The mortality and the use of veterinary treatment can be reduced and the growth performance of the animals improved.

Consequently, more pigs can be valorised at the slaughterhouse with a better carcase quality, ensuring to the farmer a positive return on investment of 8:1.

Slurry management is a daily challenge for producers. These results prove that well managed, slurries could constitute a real economic gain at the farm level and a way to move toward agricultural resilience. ■

References are available from the author on request