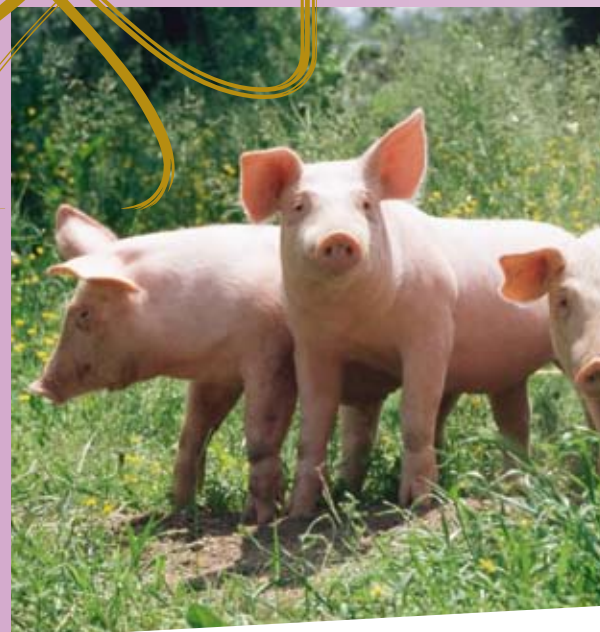


REDUCING MR PIGGY'S CARBON FOOTPRINT



The contribution to global warming from pig production can be reduced by around 4 million tons of carbon dioxide every year if Ronozyme® WX, a xylanase, is used in all European pig feed. This saving corresponds to the annual emissions of nearly 1 million cars.

It is not a well-known fact that pig production has a substantial negative effect on the environment in terms of global warming. The main culprits are CO₂ emissions from feed production and methane emissions from animal manure.

"The Ronozyme WX xylanase is an enzyme that increases the nutritional value of pig feed," says Per H. Nielsen, Environmental Assessment Manager at Novozymes. "We made an environmental assessment of the use of Ronozyme WX CT in Danish pig production, and our results show that feed savings and fewer emissions from animal manure reduce global warming, acidification and smog formation, and in most cases also nutrient enrichment and use of agricultural land."

Getting more out of bran

Many feed ingredients are not fully digested by pigs. One such ingredient is bran, which is a rich source of protein.

Adding digestibility-improving enzymes to the feed increases the absorption of the feed components and enhances the value of the feed as a source of energy, protein, and other nutrients.

"Bran is poorly digested by pigs. If we don't add enzymes to the feed, pigs lose out on all the protein and energy stored in the aleurone layer of the bran. The enzymes open up the cell wall of the bran, so that it is easier for the pig to digest the nutrients enclosed by the indigestible cell

wall," says Dan Pettersson, Science Manager at Novozymes.

With Ronozyme WX, pig farmers can save feed and substitute protein-rich ingredients with cheaper ingredients such as barley.

Xylanase is also used extensively in broiler feed to prevent digestive problems and ensure that the target weight of the broiler is achieved. In broiler production, in general, target weights are of great importance in slaughterhouses, which are automated and cannot work optimally with varying animal weights.

"Pig farmers using xylanases save significantly on feed and consistently achieve the right weight with less variability for their pigs – it is a sort of guarantee for them," says Dan Pettersson.

Saving the planet

Ronozyme P Phytase, another innovative solution from Novozymes, is a nutritional enzyme used in pig production to reduce phosphorus in pig feed.

Phytase and xylanase are often used together in the pig's diet. Without these two enzymes, the pig manure produced would contain higher levels of nitrogen (N) and phosphorus (P), resulting in more nitrous oxide (N₂O) entering the atmosphere, which contributes to global warming. In addition, higher levels of ammonia (NH₃), nitrate (NO₃), and phosphate (PO₄) would enter the environment causing acidification and nutrient enrichment.

Acidification of soil can lead to poor plant growth and water use due to nutrient deficiencies or imbalances, as well as induce aluminum or manganese toxicity. In strongly acid soils, clay minerals decompose, causing a permanent reduction in the productive capacity of the soil.

Nutrient enrichment of water may lead to an increase in algal growth. Too many algae deplete the oxygen in the water, leaving none for the fish to survive on. Aquatic life in many shallow waters around the world is dying due to nutrient enrichment.

"N manure – or manure with nitrogen – serves as a fertilizer in crop production. Reduced N content increases the need for artificial N fertilizer to maintain crop production," says Per H. Nielsen. "Plant uptake of N from artificial fertilizer is, however, more efficient than plant uptake of N from manure so the net result is reduced flow of N from the fields into water courses."

The environmental impact

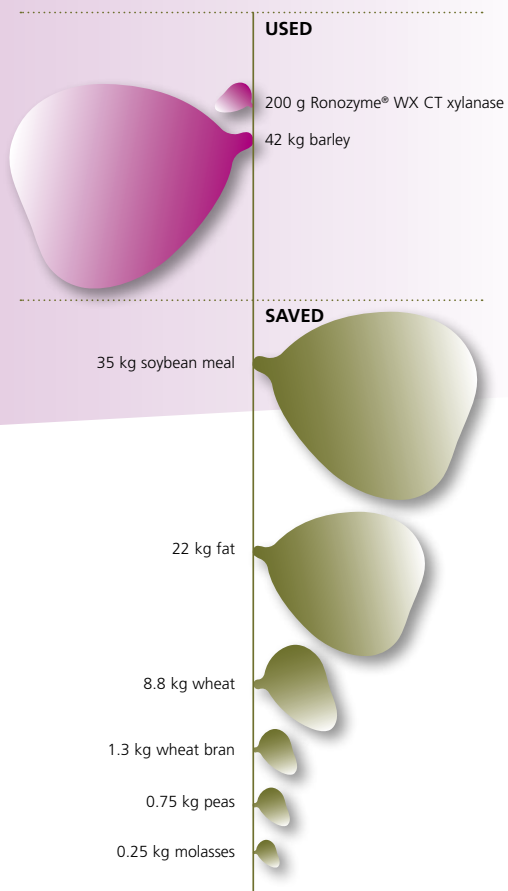
Enzyme production also impacts the environment due to energy and raw material consumption during production, transportation, and other processes.

Enzymes are, however, added in very small amounts to the pig feed, and the environmental impact generated by the enzyme production is small compared with the savings.



SAVINGS PER TON OF FEED WITH RONOZYME® WX

Ronozyme WX saves about 25 kg of feed when used in 1 ton of pig feed. The savings are distributed throughout all the ingredients; and especially soybean meal, which is the main source of protein in the pigs' diet.



“Considerable environmental improvements can be achieved in terms of all considered impact categories when Ronozyme WX is used to increase the energy and protein value of the pig feed,” says Per H. Nielsen.

The reduced contribution to global warming for the most part is driven by the reduced use of expensive soybean meal, given to pigs for protein. Reduced amounts of soybean meal lead to reduced nitrous oxide emissions from soy fields; but reductions in wheat and fat consumptions plus reduced emissions of methane and ammonia from manure storage and the fields also play a role.

The use of Ronozyme WX saves on average 185 g CO₂ per kg meat produced, and the total greenhouse gas emission from pig production is reduced by 3–8%.

A cleaner tomorrow

Current analyses show that the total potential for reduction in greenhouse gas emissions from European pig production is roughly 4 million tons per year if Ronozyme WX is implemented in all European feed.

However, environmental reasons are not the driving force for the use of xylanases in meat production. Since 50–60% of meat production costs are directly related to feed, reducing feed costs is a very strong motivator for meat producers to add xylanases.

“The use of Ronozyme WX is driven by overall

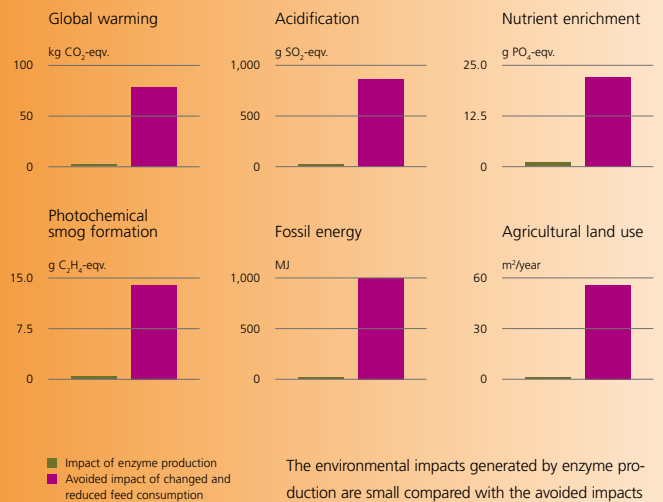
cost savings in animal production; the fact that it also helps the environment is seen as a welcome side benefit by meat producers and not as an important criterion in the buying decision process,” says Ulrich Altemüller, Global Marketing Manager for Swine at DSM. Ronozyme WX and other animal feed enzymes are developed and marketed jointly by Novozymes and DSM.

“Currently, xylanases have penetrated about 30% of the European feed market and the remaining CO₂ remediation potential is in the order of 2.8 million tons annually. We intend to further promote Ronozyme WX in the rest of the market with a clear cost-cutting message,” says Ulrich Altemüller. ■

“Pig farmers using xylanases save significantly on feed,” says Dan Pettersson, Science Manager at Novozymes.



ENVIRONMENTAL IMPACTS OF ENZYME PRODUCTION VERSUS IMPACTS AVOIDED THROUGH ENZYME USE (PER TON OF FEED)



The environmental impacts generated by enzyme production are small compared with the avoided impacts from changing and reducing the pigs' feed consumption. The avoided impacts are explained by the saving of feed, change of feed composition, and reduction of emissions from manure in the pig stable and in the field.

This article builds on studies conducted by Novozymes in collaboration with the University of Aarhus, the Technical University of Denmark, and DSM. For more information Novozymes recommends reading the following papers:

Nielsen, P.H., Wenzel, H. (2006): Environmental Assessment of Ronozyme® P 5000 CT Phytase as an Alternative to Inorganic Phosphate Supplementation to Pig Feed Used in Intensive Pig Production. *Int J LCA*, DOI: <http://dx.doi.org/10.1065/lca2006.08.265.2>

Nielsen, P.H., Dalgaard, R., Korsbak, A., Pettersson, D. (2007): Environmental Assessment of Digestibility Improvement Factors Applied in Animal Production: Use of Ronozyme® WX CT Xylanase in Danish Pig Production. *Int J LCA*, DOI: <http://dx.doi.org/10.1065/lca2007.07.352>

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