Economic reduction of ammonia emissions

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Ammonia based gas emissions from animal husbandry and its effect on the climate and the environment is increasingly becoming a topic for public discussion.

Besides its environmental effects ammonia can also have an effect on animal health, especially when weather conditions require reduced ventilation (for example, in winter to keep the warmth in the barn). The occurance of higher NH_3 concentrations can cause diseases such as inflammation of the eyes (especially conjunctiva and cornea) or of the respiratory tract.

Against the background of animal welfare but also the follow up costs of those diseases that often require treatment, it is advisable to reduce NH_3 emissions.

Both the environmental and the animal welfare aspects have been considered to an increasing degree by recent revisions of legislation.

Two examples from Europe include:

- An amendment to the German technical instructions on air quality control regulations state that house extensions or new building projects are to be examined for the effects of ammonia on the ecosystem or plants for enterprises that fall under the Federal Emission Control laws.
- The new European council directive 43/2007 ECC from June 2007 contains explicit maximum levels for NH_3 and CO_2 in the house air. When special criteria concerning barn climate (including NH_3 content) are met farmers are able to request the allowed maximum stocking density at the farms to be raised from 33kg/m^2 up to a maximum of 39kg/m^2 which certainly would have a large economic impact.

Reduction strategies

Farmers are already well advised about including strategies to decrease noxious gas emissions in the environment and for the improvement of house climate by the design of new building or reconstruction. The NH_3 issues can be clearly reduced depending on the method of feeding, husbandry, and handling of excrement.

As is known, for example, husbandry methods for litter, as is customary in poultry fattening, generally leads to a higher ammonia emission rate than methods not using litter. In particular, damp litter, due to bad storage conditions, defective water troughs, high air humidity or damp excrement (for whatever reasons) drastically escalates the emission problem.

Well stored and dry litter is a prerequisite for low dampness in the house and leads to lower microbial conversion rate.

On the feeding side, the composition of the diet can contribute to the reduction of the ammonia rate, for example, by adaptation of the feed ration to the theoretical need of the animals within the framework of a multiphase feeding regimen which surpasses the usual practice of 3 or 4 phase feeding regimen for broilers or 6 or 7 phase feeding for turkeys.

However, this measure is not always feasible on account of high logistic expenditure (smaller production batches in the mixed feed production, additional technical equipment for storage and forwarding of feed to the farms and also inside the farms).

Another option could be an increased application of highly digestible raw materials that decrease the excretion of undegraded nutrients (especially nitrogen), but the additional cost associated with these components is very high.

So, in view of the continuously strained income situation for farmers these components will not play an important role, especially in later phases of fattening period when feed consumption is high.

An affordable alternative can be the application of feed additives of plant origin. These products are called phytogenic additives and consist mainly of a mixture of essential oils, other plant extracts, secondary plant content substances, herbs or a combination of several or all of these material groups.

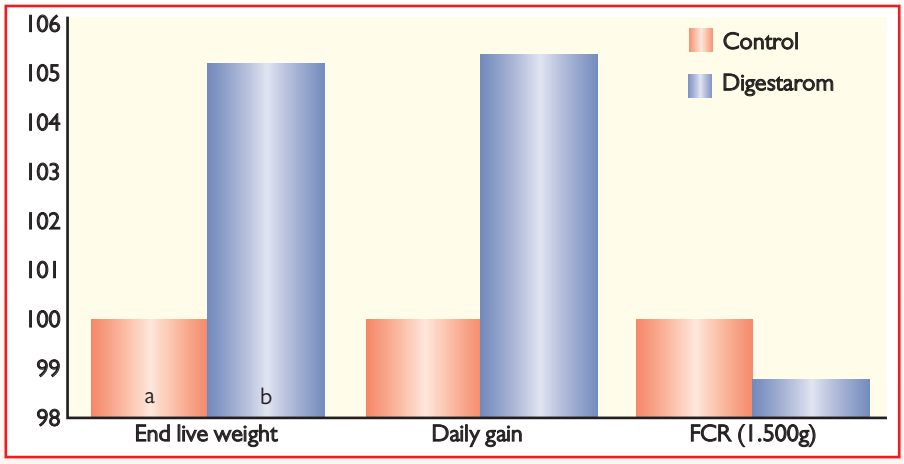

Fig. 1. Comparison of zootechnical parameters (Control=100) (Fattening duration: 35 days). Different indices show a statistically significant difference with p<0.001.

Phytogenic additive

In 2006 the influence of phytogenic additive digestarom 1317 Poultry Premium from Micro-plus Konzentrate GmbH in Stadtoldendorf, Germany, was examined under an institutional setting at the International poultry test station – Medizinarodni Testovani Drubeze – in Ustrasice, Czech Republic, for the zootechnical performance of broiler fattening and the level of NH_3 in the air of the house.

Some 360 day old chicks of the genotype Ross 308 were randomly divided, independent of gender, into two groups (control and trial). The animals were housed in groups of 45 animals each; the average live weight was the same in all groups. The animals were fed according to the recommendation of the breeder, a 3 phase feeding regimen where the rations differed only by

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the inclusion of digestarom 1317 Poultry Premium in the feed of the trial group for the entire trial duration at the manufacturer's recommended dosage of 150g/t mixed feed. In addition to the collection of zootechnical parameters, the NH_3 concentration in the air of the house was measured over a 24 hour period (one measurement per hour) on the 28th day.

Results

The animals in the digestarom group showed, in contrast to the control group, a significantly higher final weight of about 5.2% (p>0,001). Correspondingly, the daily weight gain in the trial group lay around 5.3% higher than in the control group. The feed utilisation (revised to a uniform final weight of 1.500g) improved about 1.2% (see Fig. 1).

Based on the zootechnical data and presumption of recent costs and earnings for the farmer (prices for feedstuff and digestarom, payment from slaughter after delivering the birds) the difference between the control and the trial group in gross profit is more than 10% in favour of digestarom.

Therefore, only on the basis of improving the animals´ performance the farmer has a cost benefit ratio of more than 1:5.

The determination of NH_3 concentration in the air of the house and the subsequent calculation indicate that the application of digestarom 1317 Poultry Premium reduced the release of ammonia by approximately 9%. Fig. 2 represents this result.

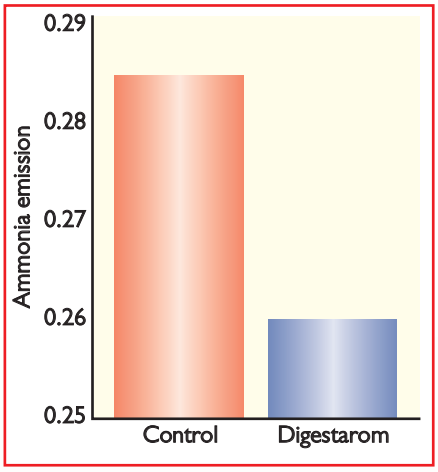

Fig. 2. The influence of digestarom on ammoniac emission in broilers (kg per animal x year).

In relation to the quantity of feed supplied in nitrogen, the nitrogenous loss of NH_3 decreased more than 14%.

Regarding the new European Council Directive 43/2007 ECC the measured reduction of NH_3 would allow the digestarom using farmers to request their stock density be raised from 33 up to 39kg/m^2.

The additional effect in gross profit on base of the abovementioned zootechical data would not be just 18%/m^2 (simple effect from raising the stock density), but about 30%/m^2.

Summary

The growth performance of broilers of the genotype Ross 308 was in some degree significantly improved by the application of digestarom 1317 Poultry Premium.

These results can also be traced back to the numerous examinations of other animal species in improving the digestibility of feed supplied nutrients by an increase in the secretion of gastric acid and enzymes.

Furthermore, the nitrogen excretion via ammonia relevant to the climate and animals' health was drastically reduced. This effect was already observed in 2000 by fattening pigs and leads back to the abovementioned increases in the digestibility of feed supplied nutrients (in this case, proteins and NPNs) as well as to the stabilisation of the physiological intestinal flora.

By calculating with this data, the economical benefit in gross profit only from an improvement of animals' performance is more than 10%.

In the event that the legislation appreciates the reduction of NH_3 emissions relevant to climate and animal welfare by allowing a higher stock density this effect would be even bigger. ■