Options to Reduce N_2O Production at Breeding Hens by Using of Different Technologies

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Abstract: *The aim of our work was, with the gas analyzer from the Danish manufacturer INNOVA Brüel & Kjaer, to analyze in laboratory conditions the concentration of N_2O from droppings produced by hens housed in enriched cages in the area of laying hens. This was monitored for 120 hours. We compared three breeding technologies, namely: conventional - with transverse air flow in the other technologies used chipped straw stored on dropping band in layer of 50 mm and in the third technology was in air flow optimization in the building lobby. A suitable location exhaust pipe is reached that the resulting gas (N_2O) on dropping belt is sucked through the ventilation outside the hall. By comparison of those three technologies significant differences (0.000 <0.05) occurred.*

Keywords: *hens, furnished cage, production gas*

Introduction

Building of large-scale farms producing eggs for human consumption results in high production of harmful substances and their concentration in those halls. It is therefore important to ensure good ventilation that can during the winter or summer always sufficiently take pollutants out from breeding facility. This is done by large volume ventilation equipment. Improve of the air composition in animal housing buildings can be also achieved by airflow optimizing (Pogran, 2012). Karandušovská (2009) reported different concentrations of pollutants by measuring concentrations of pollutants. Near the tunnel fans ware values lower than in the middle of the hall. This has the effect of creating an area of high flow velocity of air close to the value of 2 ms^{-1}, in other places is sufficiently discharged polluted air, resulting in unfavourable environment for laying hens. It is therefore more important to optimize the layout of ventilation equipment, than increasing of its performance. Pollutants are getting into the air, where they have impact on the surrounding environment (Koerkamp, 1994). It seems to be crucial to improve the amount of emissions in the lobby, namely on the bedding (Knížatová et al., 2009). This can be done in two ways: addition of plant biotechnology in food or water to achieve reduced production of ammonia in the digestive tract, or the possibility of its application to litter. This way achieved lower formation of ammonia, which is then released into the hall environment (Švenková, 2007). The secondary option use by-products formed in primary agricultural production. This is especially done the straw that we used. Our paper aimed to analyze the possibility of reducing the concentrations necessary for good agricultural practices to improve animal welfare, protect and revitalize the air.

MATERIAL AND METHODS

The measurement was carried out in winter, from 25th of January 2012 to 9th February 2012. The tasks are addressed according to the following methodology:

- In the laboratory conditions, we measure the concentration of N_2O from droppings of laying hens housed in enriched cages (10 units, hybrid TETRA - SL, fed the same complete feed mixtures) by mentioned three different technologies
- For each technology, we measured N_2O values during 120 hours. The concentration of N_2O was measured at a height of 800 mm from the floor (head level layers).
- Through the opening made in the front door, which we have fixed by a sieve, to prevent the entry of flying insects, we bring tempered air into the experimental hall from adjacent room. Exhaust pipes are placed on the opposite side, in order to ensure cross-flow of air for the conventional technology and technology with straw (Fig.1).
- In Figure 2 you can see the location of pipelines and ventilation technology with holes for air exhaustion under the grate.
- For technology with chipped straw has been used conventional method of air

exhaustion, in addition that on dropping belt was stored chipped straw on dropping band in layer of 50 mm (Fig.3).

Fig.1. Ventilation technology by conventional method of laying hens.

Fig.2. Location of exhaust pipe under the floor of the cage

Fig.3. Layered chopped straw

MEASUREMENT TECHNOLOGY

To measure the concentration of N_2O was used Photo-acoustic Gas Monitor INNOVA 1412 type with a multipoint sampler type INNOVA 1309 by Danish manufacturer Brüel & Kjaer. At the visual inspection was used digital thermometer and hygrometer test.
A statistical method used to evaluate the results obtained was ANOVA. Poláková (2011) argues that this method is appropriate to use in testing the significance of differences in the impact of a single variable factor.

RESULTS AND DISCUSSION

From the results obtained is easy to see that the maximum concentration of N_2O in layer housing for conventional enriched cage was 1.644 $mg.m^{-3}$ in housing maintained with exhaust air under the grate 1.282 $mg.m^{-3}$ and in housing with layered straw under grid in space at the level of laying hens heads 1.321 $mg.m^{-3}$. We found that among the various technologies ware significant differences ($P = 0.00 < 0.05$), what means that the breeding technology factor is affecting the differences in concentrations of N_2O.

Subsequently, a test of contrasts was made, which tells us, among which means there are significant differences (Table 1). There is an obvious highly significant difference between the compared breeding technologies. From the foregoing is clear that due the

change of technology we achieve more favourable concentrations of N_2O at the operating level, as in the conventional technology.

Tab.1. Multiple Range Tests for N_2O ($mg.m^{-3}$) Method: 95,0 percent LSD

Technology	Count	Mean	Homogeneous Groups
Straw 1	1650	1,04975	X
Ventilation 1	1649	1,05547	X
Conventional 1	1658	1,07617	X

Contrast	Sig.	Difference	+/- Limits
Straw 1 – Conventional 1	*	-0,02642	0,00443
Straw 1 - Ventilation 1	*	-0,00572	0,004436
Conventional 1 - Ventilation 1	*	0,020702	0,00443

* denotes a statistically significant difference.

CONCLUSION

The results obtained show that the lowest maximum concentration of N_2O in the level of layers was achieved with technologies of rearing laying hens in ventilation under grid space, which has been conclusively confirmed by statistical evaluation. Achieved partial results oblige us to continue the verification experiment and find other options to achieve improvements in environmental change and breeding technology to optimize the exchange of indoor air.

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