UDK 636.03→614.9

Izvorni znanstveni članak
Original scientific paper

EFFECT OF AIR TEMPERATURE, RELATIVE HUMIDITY AND AIR FLOW VELOCITY ON FUNGI COUNT AND AIRBORNE EMISSION FROM DAIRY BARNS TO THE ENVIRONMENT

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Abstract

An Merck MAS-100 air sampler was employed with respective nutrient agar for capture, incubation and counting of airborne fungi. Microclimate parameters were simultaneously determined by a Testo 400 device. Air sampling was done once a week in the morning, at noon at 12:00) and in the evening (at 19:00) during two autumn months. Within the barn, measurements were performed in the animal housing area along the feedlot, and outside the barn at a distance of 5 m, 25 m and 50 m eastward and westward from the barn. The mean values of total airborne fungi count in the barn air was $7.23x10^3$ CFU/m^3 in the morning, $2.84x10^4$ CFU/m^3 at noon, and $7.25x10^4$ CFU/m^3 in the evening. Fungi count showed a statistically significant decrease as close as 5 m from the barn ($p<0.05$). Study results suggested the keeping conditions, the construction and position of the barn and number of dairy cows to have no impact on fungi count and emission either within inside or outside the barn, thus exerting no adverse effects on animal health and production or environmental contamination.

Key words: airborne contamination, airborne fungi, dairy barn, distance

Introduction

The level of environmental pollution with airborne emissions from the barns can be assessed by comparing the fungi count in the barn air with the fungi pattern in the immediate environmental atmosphere (Seedorf i sur., 1998a, 1998b). Therefore, the aim of the study was to determine fungi count in a dairy barn and its immediate environment, to help establish the borderline value in line with EU recommendations on airborne emissions from animal housings.

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Material and methods

The study was conducted in a dairy barn on a family farm. The barn has been built from the materials usual in the area: the foundations and floor from concrete, longitudinal walls and front from wood and the roof from rolling hardboard. The barn dimension is 12 m x 10.5 m x 3.5 m. The central part of the barn is the feedlot corridor with alongside concrete trough and tying construction above the trough, with watering facility and vacuum milking system. The lying area is a concrete surface daily cleaned (at 06:30 and 18:00 h) and covered with fresh straw bedding. The barn is ventilated by natural air flow through interspaces between the front boards, two windows (100 x 120 cm) on the longitudinal walls, and air apertures on the ridge of the roof. During the study, there were 12 simental lactating cows in the barn.

Measurements were performed once a week in the morning, at noon and in the evening over a two-month period (September – October). In the barn, air sampling was done in the area of animal stay along the feedlot, and outside the barn at a distance of 5 m, 25 m and 50 m eastward and westward from the barn. Air samples for fungi determination were collected by use of a Merck MAS-100 device (Merck KgaA, Darmstadt, Germany) on a commercially available Sabouraud maltose agar (Biolife, Milan, Italy) and incubated at 22 °C for 5 days in a thermostat. Microclimate parameters were simultaneously determined by a Testo 400 device.

At 8 measurements in three sampling times a total of 600 plates, 300 from the barn at three sampling times and 50 from each distance outside the barn at two cardinal points were analyzed. Quantitative fungi content in air samples was determined by calculating grown colonies (CFU/m^3) on a colony counter. Total fungi count and microclimate parameters were analyzed by use of the Statistica 6 softwares and Wilcoxon matched pair test at the level of statistical significance of $p<0.05$.

Results and discusion

Total fungi count in the barn air depends on animal species, keeping conditions, and procedures of animal feeding and grooming. The animals, their feed, bedding and feces are the sources of microorganisms. The exact number of fungi in the barn air is difficult to determine because aerial microorganisms are liable to sedimentation, aggregation, ventilation, dehydration, radiation and other stressors influencing their viability (Cox, 1989; Wilson et al., 2002). According to literature data, total fungi count in animal housing is in the range

of 10^3-10^9 CFU/m^3 (Hartung, 1994, 1998; Duchaine et al., 1999). Comparable results have also been reported by Vinković et al. (2004), Matković et al. (2006).

The mean values of total airborne fungi count in the barn air was $7.23x10^3$ CFU/m^3 in the morning, $2.84x10^4$ CFU/m^3 at noon, and $7.25x10^4$ CFU/m^3 in the evening. Fungi count showed a statistically significant decrease as close as 5 m from the barn ($p<0.05$). The microclimate parameters measured in the barn were within the standard values for dairy barn indoor atmosphere. Study results suggested the keeping conditions, the construction and position of the barn and number of dairy cows to have no impact on fungi count and emission either within or outside the barn, thus exerting no adverse effects on animal health and production or environmental contamination.

Acknowledgments

The results presented were derived from the scientific project entitled Environmental Effects on Animal Health and Safety of Foods of Animal Origin, conducted with support from the Ministry of Science, Education and Sports of the Republic of Croatia, grant No. 053-0531854-1867

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DJELOVANJE TEMPERATURE ZRAKA, RELATIVNE VLAGE I BRZINE STRUJANJA ZRAKA NA BROJ GLJIVICA I ZRAKOM NOŠENU EMISIJU IZ MLIJEČNIH STAJA NA OKOLIŠ

Sažetak

Za hvatanje, inkubaciju i brojenje zrakom nošenih gljivica upotrijebljen je Merck MAS-100 s odgovarajućim hranjivim agarom. Istovremeno su određeni parametri mikroklime pomoću naprave Testo 400. Uzorci zraka uzimani su jedanput tjedno ujutro, u podne (u 12.00) te navečer (u 19.00) kroz dva jesenska mjeseca. U staji su mjerenja obavljana u dijelu gdje borave životnje, uz hranilicu, a izvan staje na udaljenostima od 5, 25 i 50 m prema istoku i zapadu od staje. Srednje vrijednosti ukupnog broja gljivica u zraku staje bile su $7.23x10^3$ CFU/m^3 ujutro, $2.84x10^3$ CFU/m^3 u podne i $7.25x10^3$ CFU/m^3 navečer. Broj gljivica pokazao je značajan statistički pad 5 m od staje (pm>0.05). Rezultati istraživanja pokazuju da uvjeti držanja, konstrukcija i položaj staje, te broj mliječnih krava ne utječu na broj gljivica i emisiju u staji i izvan nje, te tako ne djeluju na zdravlje i proizvodnju životinja ili onečišćenje okoliša.

Ključne reči: koncentracija gljivica u zraku, zrakom nošene gljivice, mliječna staja, udaljenost

Primljeno: 10.6.2008.