HYGIENICAL ASPECTS OF DIFFERENT RABBIT HOUSING AND MANAGING SYSTEMS

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Abstract - Present paper deals with the indoor environment of 3 intensive rabbitries near Udine (Northern Italy); concentrations and trends of microbiological contaminants in air and surfaces were monitored during 1 year. Total bacteria count, yeast and moulds were monitored in air using a Surfaces Air System (SAS). Moreover, total bacteria count, yeast, moulds, Enterobacteriaceae, Staphylococci, Streptococci were collected from the surfaces of cages with countact type plates. Hygienical management was similar in the 3 units, consisting in cages flaming, washing and disinfection. Housing system and breeding management, instead, was different, in particular as regards ventilation systems (natural or forced) and manure removal systems (scrapers in fiberglass gutters or in concrete pits).
Thus, prioritary aims of the research were to establish the influences in environment hygiene of housing systems, management and seasons.
Preliminar results showed total bacteria count in air higher in winter and spring than in other periods, as general trend in all the units considered and without significant differences due to housing or management. Microbial contamination of cage surfaces, instead, seemed to be less influenced by seasons.
The housing conditions examined seemed to be satisfactory for rabbit productivity; however, improvement in monitoring methods of hygienical parameters should be established in order to compare, with a closer effectiveness, different housing and managing systems.

INTRODUCTION

Indoor environment is one of the most important factor for animal health which farmers can plan, with house designing, and control or change with house management.
Rabbits require a particular attention for hygienical and sanitary aspects; high levels of noxious gases (in particular ammonia) and dust in environment may have synergic effects with biological agents, being the determining factor of the development of respiratory and digestive syndromes. However, since environment conditions are not always directly perceivable and estimable, farmers often prefer to concentrate their attention in sanitary treatment, disregarding the real source of problems.
Besides, it must be considered that animal environment is also farmer environment for a lot of working hours. Environment conditions not so unfavourable for animals, due to their short productive cycle, could be responsible of strongly negative effects in humans.
A little number of researches on hygienical aspects of rabbit house environment were carried out in Italy. CHIUMENTI *et al.* (1990) tested an ionization system for air cleaning in a rabbit house; they found total bacteria count (TBC) ranging from 430 to 1000 CFU m^{-3}. Higher levels were found by CASAMASSIMA *et al.* (1989), which reported TBC ranging from 38900 to 117300 CFU m^{-3} in different rabbit houses. NAVAROTTO *et al.* (1995) carried out tests in order to evidence pathogens in air; they found species of moulds ranging from 8 CFU m^{-3} to very high concentration (not contable with sampling method used).

Since the great interest in rabbit production of Friuli region (Northern Italy), Agricultural Engineering Division of Udine University carried out an experimental research in rabbit houses, with the prioritary objective of evaluating the influence of housing system and management in indoor environmental heath. During one year, temperature, relative humidity, carbon dioxyde, ammonia, hydrogen sulphide, dust, microbiological contamination of air and surfaces were monitored.
Present paper, in particular, deals with the results of hygienic parameter monitoring (Total Bacterial Count, Yeast and moulds, Enterobacteriaceae, Staphylococci, Streptococci).

MATERIAL AND METHODS

Trials were carried out during summer-autumn 1994 and winter-spring 1995 in 3 rabbit houses near Udine (Friuli-Venezia Giulia region).

Description of the rabbittries (Table 1)

In unit "A" are 275 doe nests and 2464 fattening rabbits. House is naturally ventilated through continuous ridge on the roof and lateral windows in two levels each wall (below eaves and at floor level). During winter a fan-jet system allows air heating to mantain internal temperature not lower than 12°C.
Manure collection and removal is performed by means of scrapers moving in fiberglass gutters under cages; cleaning operations are worked out every 2 days.
In unit "B" there is only breeder compartment, with 760 doe nests and about 300 rabbits as replacements. This unit is naturally ventilated and has emergency heating system, similar to that previously described.
Manure, in winter, is stored in pits under cages and removed after 3 months; in other periods manure is removed by mean of scrapers every one week.
In unit "C" there are 300 doe nests and 2690 fattening rabbits. Ventilation is transversal forced type through 7 fans; an electronic central unit regulates ventilation rate, changing fan speed on internal temperature; maximum airflow rate is 14 m^3s^{-1}. Manure removal is daily performed by scrapers on concrete pits.

Table 1 : Main characteristics of the 3 rabbit units

	UNIT (A)	UNIT (B)	UNIT (C)
Housing area per rabbit (m^2)	0.11	0.07	0.11
Housing volume per rabbit (m^3)	0.48	0.24	0.36
Ventilation system	natural	natural	forced
Window rate (area in/out)	2.2	3.8	-
Maximum airflow rate (m^3s^{-1})	-	-	14.0
Cleaning system	Fiberglass gutter & scrapers	Concrete pit & scrapers	Concrete pit & scrapers

Breeding and hygienical management

Breeding management of the 3 units is continuous during all the years, without all-out periods; doe inseminations occur every one week in unit A and B and every 2 weeks in unit C (Table 2).
Hygienical management is similar in the 3 units. Periodically, in the empty cages adequate hygienic measures take place. The most common interventions are:

- flaming of cage surfaces to eliminate coats and organic matter;
- washing off with warm water (80°C) and detergents;
- nebulization of disinfectant solutions of iodine or chlorine

(these operations take place once a week at housing level).

Table 2 : Main managing parameters of the 3 units

	UNIT (A)	UNIT (B)	UNIT (C)
Manure removal frequency	2 days	- 3 months (winter) - 1 week (other periods)	1 day
Breeding management	1 week	1 week	2 weeks
Hygienic interventions	- flaming - washing - disinfection	- flaming - washing - disinfection	- flaming - washing - disinfection

Microbiological analyses

Air sampling was performed by mean of S.A.S, instrument (Surface Air'System™, PBI-Italy); this equipment consists of an air suction unit and a support for plates (Countact type). With this system air sampled (from 60 to 180 litters) flows immediately over the plate and microrganisms are viable recovered.
Surface sampling was performed with countact plates directly leaned on external surfaces of cages.
Air and surface samples were taken every 1 week with 5 repetitions each unit.
The following microbiological parameters were monitored in air:

- total bacteria count;
- yeast and moulds.

In addition to these, surfaces of cages were sampled in order to determine also:

Enterobacteriaceae;
- Staphylococci;

- Streptococci.

Methods are described in Table 3.

Table 3 : Selective agar and incubation periods for microbiological analyses

Microrganism	Selective agar	Incubation
Total Bacteria Count	Plate Count Agar (Casein-peptone Dextrose Yeast Agar)	48 hours at 30°C
Yeast and Moulds	YGC Agar (Yeast Extract Glucose Chloramphenicol Agar)	72-96 hours at 25°C
Staphylococci	BAIRD-PARKER Agar (Staphylococcus Selective Agar Base + Egg-yolk tellurite emulsion)	48 hours 37°C
Streptococci	Kanamycin Esculin Azide Agar	48 hours at 37°C
Enterobacteriaceae	VRBD Agar (Violet Red Bile Dextrose Agar)	24 hours at 30°C

Statistical analysis of data was performed with Duncan test, in order to point out significative effects of different seasons and/or different housing systems.

RESULTS

Seasonal average of total bacteria count in air ranged from 160 to 1824 CFU m^{-3} (Table 4). The highest levels (significant differences) were found in winter and spring, as general trend in all the units (without differences among the different housing systems). Yeast and moulds in air ranged from 123 to 892 CFU m^{-3} (Table 5), differences are difficult to explain.

Table 4 : Total Bacteria Count, in the air (CFU m^{-3})

	UNIT (A) Mean	UNIT (B) Mean	UNIT (C) Mean
Summer	160 a	414 a	313 a
Autumn	550 a	766 a	539 a
Winter	1576 b	1204 b	1824 b
Spring	1014 b	1167 b	1220 b

Means followed by different letter are significantly different at the 5 % level

Table 5 : Yeast and moulds in the air (CFU m^{-3})

	UNIT (A) Mean	UNIT (B) Mean	UNIT (C) Mean
Autumn	395 a	576 a	208 b
Winter	123 b	231 b	227 b
Spring	455 a	516 a	892 c

Means followed by different letter are significantly different at the 5 % level

Microbial contamination of cage surface, as general trend, was less influenced by seasons. Mean values ranged from 93 to 329 CFU m^{-2} of cage and from 32 to 235 CFU m^{-2} (total bacteria Table 6, and yeast and moulds Table 7, respectively). In winter, bacterial CFU m^{-3} were significantly higher in unit C than in others, while in spring unit a had a significant lower contamination.

Table 6 : Total Bacteria Count on cage surfaces (CFU m^{-2})

	UNIT (A) Mean	UNIT (B) Mean	UNIT (C) Mean
Autumn	93 b	108 b	160 b
Winter	105 b	149 b	329 a
Spring	178 b	237 a	329 a

Means followed by different letter are significantly different at the 5 % level

Table 7 : Yeast and moulds on cage surfaces (CFU m^{-2})

	UNIT (A) Mean	UNIT (B) Mean	UNIT (C) Mean
Autumn	53 a	77 a	107 a
Winter	32 a	159 a	235 a
Spring	90 a	89 a	103 a

Means followed by different letter are significantly different at the 5 % level

Enterobacteriaceae were only occasionally found at very low concentrations (maximum 11 CFU m^{-2} of cage). Streptococci ranged from 14 to 209 Cm m^{-2}; the highest values were found in unit C during winter (a similar trend to that above described for total bacteria). Staphylococci ranged from 2 to 158 CFU m^{-2} of cage.

Table 8 : Streptococci on cage surfaces (CFU m^{-2})

	UNIT (A) Mean	UNIT (B) Mean	UNIT (C) Mean
Autumn	40 b	59 b	60 b
Winter	14 b	85 b	209 a
Spring	17 b	131 b	70 b

Means followed by different letter are significantly different at the 5 % level

Table 9 : Stafilococci on cage surfaces (CFU m^{-2})

	UNIT (A) Mean	UNIT (B) Mean	UNIT (C) Mean
Autumn	10 a	15 a	22 a
Winter	16 a	2 a	158 a
Spring	7 a	24 a	53 a

Means followed by different letter are significantly different at the 5 % level

DISCUSSION AND CONCLUSIONS

As mentioned in introduction, present work aimed to be a preliminary approach to study different factors - in particular housing systems and management - which could influence rabbit house environment, hygiene and health.

As concerns air contamination, results didn't show any significant difference due to house characteristics, ventilation systems, manure removal systems or breeding management. Differences due to seasons, instead, were found; in particular, during winter and spring, CFU m^{-3} air were significantly higher than in other periods. That could be explained by lower airflow rates in cold periods, while 'pollution' sources (animals -number and live weight-, feaces and urines, food) persist invariable during all the year. These aspects were also confirmed by an experimental research carried out by NAVAROTTO *et al.*, which showed that fodder and litter were the main responsibles of environment biological contamination. One other research carried out by CASAMASSIMA *et al.*, showed that ventilation rate reduction from 16 to 3 air changes per hour, established a higher air contamination (from 60500 to 78900 CFU m^{-3} air). Therefore, ventilation rate independently by ventilation systems adopted (natural or forced) seem to influence air contamination.

As concerns contamination of cage surfaces (TBC and Streptococci), the higher values in unit C, adopting forced ventilation, could be explained by the different breeding management. In fact, in unit C, emptying of cages allows flaming and washing operations only every 2 weeks, while these interventions are weekly performed in others.

It is important to underline that evaluation of housing system influence on environment hygiene seems to require an improvement in monitoring methods. Air samples should be more frequently taken and monitoring periods would have to be shortened. In this way should be possible to discriminate the sources of contamination, establishing their contribution to environment quality. Besides, seems very important to develop and standardize air sampling methods in order to perform a more effective comparation between various researches.

Acknowledgements - Authors wish to acknowledge Department of Aficrobiology, University of Udine) for the contribution in microbiological analyses.

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