STRUCTURAL SYSTEMS FOR CATTLE HOUSING 
THEIR INFLUENCE ON THE MICRO-ENVIRONMENT

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Abstract. During the last years, the intense cattle exploitation compelled some farmers to maintain the animals in the housing during the whole exploitation process. The system led to a free stall accommodation, the animals having the opportunity to move inside the shelters. Regarding the structure, the housing evolved, answering to the rising technologies. In the exploitations there are closed constructions, thermal insulated and constructions without a thermal insulation, where the longitudinal walls have been replaced by synthetic material tarpaulins that close or open if needed. The purpose of this work is to check the micro-environment conditions in the insulated and non-insulated shelters. The researches were performed during 2006-2007, a period when the climate in our country was very mild, a fact that determined the main micro-environment recorded parameters in the studied cases to be, generally, in the permissible limits by the current regulations.

INTRODUCTION

The housing systems for the diary cows evolved during time, the constructive solutions answering accurately to the rising and exploitation technologies.

Diary cows are sheltered in housings during the wintertime, a period when they are protected from cold, moisture and wind, and during spring, summer and fall they are let out on the pasture, a place where a simple summer camp may protect them from all the inconveniences. In the last years, the intense exploitation of this species compelled some farmers to give up pasturing, maintaining the animals inside the housing during the whole year. This system led to the free stall accommodation, offering the animals the possibility to move freely inside the shelter, the volume of work caused by the increase of cows per attendant was reduced, as a result of the mechanical feeding and manure disposal. The cows’ comfort was considerably increased and the milk quality increased due to the building of the milking groups.

MATERIAL AND METHOD

The purpose of this work is to check the micro-environment in some housing designated for the diary cows in free stall accommodation. We consider that the housing represents a major factor in selecting the growing technology.

Regarding the micro-environment conditions that may be ensured by a construction, depending on the insulation level of the blanket, the housing may be non-insulated (cold), insulated (warm) or inadequate insulated, when during the cold periods of the year they don’t ensure a temperature included in the thermal comfort zone.

In the project “Integrated Application of the Data Bases for Adapting and Restructuring the Natural and Artificial Factors for the Protection of the Environment in the Agricultural and Animal Breeding Farms”, CEEX-CALIST 6108/2005 contract, we studied two farms of different constructive systems, designated for the diary cows’ rising and
exploitation. The cows are sheltered in free stall accommodation, with similar milk productions.

Case I – S.C. Horticola Seviş S.A. Farm – located in Sibiu County, whose animal breeding sector has an effective of 500 cattle. The diary cows are housed in a thermal insulated shelter, feeding of the animal is realized in the paddock, under a dome and manure’s disposal is performed mechanic, by means of a scraping plough. The milk production is of 6,500 l/head, year.

Case II – Cattle rising and exploitation farm Oradea, with a capacity of 135 heads, housed in free stall accommodation, in a housing without a thermal insulation (cold shelter). Both resting and feeding take place inside the shelter, where manure disposal is performed by means of a tractor with an attached blade. The half-closed housings a recent construction, the constructive solution being used in many countries, with similar weather conditions with those existing in our country. The selection of this constructive solution is justified, first of all, because of economical reasons. A part of the longitudinal walls is replaced with a dome made out of a plastic material, on a support made out of a wire-net. The production realized in this place is of 7,000 l/head, year.

In both cases, during 2006-2007, we traced the micro-environment conditions, recording the temperature, the relative humidity, the foul gases and the speed of the air currents, both in the inside of the housing and the inside of the farms.

A bibliographical study presented us contradictory results, thus some experiences performed in the U.S.A. [3] show us that the milk production realized in cattle exploitation farms is not affected by the variation of the inside temperatures, when these situated between –5 and 30°C. Researches performed in European countries show a decrease of the milk production and changes in their composition in housing with inside temperatures situated below 5°C. In Jensen and Konggaard (1982) researches it is asserted that the animals housed in non-insulated housing suffer with 50% less respiratory diseases and present no leg disease, in comparison cu those housed in insulated housing but the results presented by Mossberg Ingrid (1992) are in contradiction with those presented by other researchers.

There are many factors that influence production and the animals’ health, factors that depend on the housing system. The interaction of the whole conditions ensured for the animals during their growth and exploitation will determine the production level.

We present in the tables below the variation of the significant values of the parameters recorded during 2006-2007.

Table 1

<table>
<thead>
<tr>
<th>Inside temperature °C</th>
<th>Outside temperature °C</th>
<th>Inside relative humidity %</th>
<th>Outside relative humidity %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>Maximum</td>
<td>Minimum</td>
<td>Medium</td>
</tr>
<tr>
<td>9.87</td>
<td>10.7</td>
<td>8.5</td>
<td>8.2</td>
</tr>
<tr>
<td>Air currents speed inside the shelter. m/s</td>
<td>Air currents speed outside the shelter. CO2 concentration inside the housing ppm</td>
<td>CO2 concentration outside the housing ppm</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>Maximum</td>
<td>Minimum</td>
<td>Medium</td>
</tr>
<tr>
<td>0.02</td>
<td>0.07</td>
<td>0.0</td>
<td>1.33</td>
</tr>
</tbody>
</table>

Table 2

Case II – The variation of the micro-environment parameters in the cattle shelter. Oradea Farm
<table>
<thead>
<tr>
<th>Inside temperature °C</th>
<th>Outside temperature °C</th>
<th>Inside relative humidity %</th>
<th>Outside relative humidity %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>Maximum</td>
<td>Minimum</td>
<td>Medium</td>
</tr>
<tr>
<td>3.83</td>
<td>5.54</td>
<td>1.39</td>
<td>2.19</td>
</tr>
<tr>
<td>Air currents speed inside the shelter, m/s</td>
<td>Air currents speed outside the shelter</td>
<td>CO₂ concentration inside the housing ppm</td>
<td>CO₂ concentration outside the housing ppm</td>
</tr>
<tr>
<td>Medium</td>
<td>Maximum</td>
<td>Minimum</td>
<td>Medium</td>
</tr>
<tr>
<td>0.49</td>
<td>0.80</td>
<td>0.40</td>
<td>1.4</td>
</tr>
</tbody>
</table>

**Inside temperature in Seviş Farm, Sibiu**

**Inside relative humidity in Seviş Farm, Sibiu**
Inside temperature in the cattle shelter, Oradea Farm

On Seviş Farm, Sibiu County, the average inside temperature of 9.87°C was high above the average outside temperature and the relative humidity, of 71.79% was similar to the outside one while CO2 was of 593.5 ppm, at an air currents speed of 0.02 m/s. In this shelter, nature ventilation is functioning, the building being endowed with intakes for fresh air and draft chimneys for the vicious air.

On Oradea Farm, in Decembre 2006, the average inside temperature was of 3.83°C and an inside relative humidity of 83.55%, similar values with the outside ones and the average value of CO2 was of 424 ppm, values permitted by the local regulations, at an air currents speed, at the animal level, of 0.8 m/s. The high inside humidity is due to the fact that the housing is not closed.

In both cases, generally, the inside environment satisfies the biological requirements of the animals. We also have to consider the technical parameters of the shelter, such as: surface, density, volum of air per animal, factors that contribute to the quality of the environment.
CONCLUSIONS

For cattle growing and exploitation both structural systems may be used if the execution (with a technical view) of the housing follows with fidelity a good project.

Housing with a thermal insulation must ensure during winter an air temperature situated between the extremes of the neutral thermic interval. The limits are not rigoursly stipulated, depending on the feeding level, the insulation of the shelter, bedding type, number of the animals sheltered per surface unit, etc. Along with a good thermal insulation, the ventilation must not be neglected in order to ensure the quality of air. If needed, natural ventilation may be supplemented with mechanical ventilation, despite its inconveniences (an additional power consumption and a higher level of noise inside the housing).

The initial costs needed to build non-insulated housings are smaller than those needed to build insulated shelters, if referring to 1m² of construction and not the whole built area, which is greater. The housings ensure a uniform distribution of fresh air, each animal benefits of fresh air, in the summer it protects the animals from the sunshine and in the winter, from wind and rain or snowfall. In case of negative outside temperatures, the water in the watering places may freeze, a reason for insulating the housings.

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