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NOTES ON THE MICROCLIMATE IN INTENSIVE RABBIT-BREEDING IN CENTRAL ITALY

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INTRODUCTION

Aim of the present paper is the control of the microclimate in rabbit breedings in hilly regions of Central Italy.
The microclimatic conditions have been discussed in comparison with the general conditions of the breeding.
It is known that the incidence of the classical infectious diseases has decreased at the same rate with the increase in intensive breeding and the application of wide-range prophylactic programmes. Parallelly, a conditioned pathology has emerged that involves the interaction of microbial and non microbial factors (4, 19).
Among these factors the microclimate in the breeding is of a considerable relevance.

MATERIALS AND METHODS

The investigation has been carried out in an area of the Central Appennines (Valle del Tronto and Valle del Tordino) where the rabbit breeding is increasing and the climatic characteristics should favour the plant of simple and non-expensive structures (7,12).
Four breedings have been selected on the ground of specific peculiarities such as geographical location, structures, number of animals and management (see Table 1).

Table 1

Breeding	Location	Ventilation	No. of animals
1	hill 300 m. a.s.l.	artificial	420 broods female 5,000 fattening heads
2	bottom of the valley 200 m. a.s.l.	artificial	640 broods female 4,500 fattening heads
3	hill 300 m. a.s.l.	natural	80 broods female 400 fattening heads
4	bottom of the valley 250 m. a.s.l.	natural	70 broods female 350 fattening heads

Breedings No. 1 and 2 have artificial ventilation and exhaust- and suction ventilators are located at the ground level on opposite sides. The ventilator regulation is fully automatic and concerns only the environmental temperature, leaving aside the other microclimatic parameters.
The number of air changes/hour is fluctuating within 24hrs as it is directly prportional to the inner temperature. The heating system, in both breedings, directs the warm air-flow from the ceiling.
Such a heating system, for economic purposes, works only during the coldest parts of the day in Winter months.
The cubic metres at disposal of each brood-female or of 10 fattening animals range from 2.3 to 2.9. Faeces are eliminated mechanically every 24 to 48 hrs in the breeding No. 2 and every 2 months in the breeding No. 1.
In breedings with natural ventilation the air change is ensured from 2 rows of windows.
The number of air changes/hour is manual in connection with outer temperature and inner microclimate.
The premises are not heated.
The cubic capacity at disposal of each brood-female or 10 fattening heads varies from 2.6 to 3.0 m^3.
Faeces are eliminated mechanically every 24-48 hrs.
In the abovesaid breedings the microclimatic factors have been ascertained as under:

- Temperature in °C and relative humidity % : with a writing thermo-hygrometer (SIAP-Bologna) that measured both temperature and relative humidity for 7 days. From the graphs the daily average has been extrapolated (see graphs 1 and 2).

- Air speed: it has been measured with the Leonard Hill's catathermometer. The measurements have been performed several times in pre-arranged sites in order to ascertain the mean values.

- Environmental gases: NH_3 - CO_2 - H_2S: with a Dräger detector, type 21/31.

- Total bacterial charge in the environment: measured with a RECESA instrument, PBI manufacturer, located in pre-arranged sites, in single breedings.

RESULTS

The present research has been carried in Spring, Autumn and Winter. The results obtained in Summer 1983 have been left aside since unreliable in that the season has had an anomalous course in comparison with the previous years. (14)

The Spring and Autumn observations have resulted as under:

- in the breeding No. 1, with artificial ventilation the mean temperature (MT) was 17°C, with a temperature range (TR) of 5°C (14 to 19) within 24 hrs. The mean relative humidity (MRH) was 67% the range being nearly 11% (57 to 68%) within 24hrs. NH_3 was nearly 5ppm, H_2S and CO_2 were not detected with our method. The mean air speed (MAS) was 0.08 m/sec. with ranges from 0.12 to 0.05 m/sec. The mean bacterial charge (MBC) was 2,161 germs/m^3 as a whole (see Fig. 1, A-C).

- In the breeding No. 2, with artificial ventilation the MT was 16°C with 7°C TR within 24 hrs (13° to 20°). The MRH was 70% with 20% (55 to 75%)

range within 24 hrs. The NH_3 was nearly 7ppm, trace elements of CO_2, H_2S undetectable. The MAS was 0.07 m/sec. with a range from 0.16 to 0.04m/sec. The MBC was 2,216 germs/m^3 (see Fig. No. 1, A-C).

- In the breeding No. 3, with natural ventilation, a MT of 18°C has been ascertained, the TR being 10°C (14° to 24°) within 24 hrs. The MRH was 52% with 23% (40 to 63%) range within 24 hrs. NH_3 was 2.0 ppm, CO_2 and H_2S absent. The MAS was 0.3 m/sec. with a range from 0.2 to 0.4 m/sec. The MBC was 1,051 germs/m^3 (see Fig. No. 1, B-D).

- In the breeding No. 4, with natural ventilation, a MT of 16°C with 7.5°C TRs within 24hrs (12.5° to 20°). The MRH was 67.5% with 26.0% (52 to 78%) range within 24 hrs. NH_3 was 18.0 ppm, trace elements of CO_2 and H_2S absent. The MAS was 0.1m/sec. with a range from 0.05 to 0.15m/sec. The MBC was 2,004 germs/m^3 (see Fig. No. 1, B-D).

The Winter observations have resulted as under:

- in the breeding No. 1 the MT was 12°C with 5.5°C (9.5° to 15°) TR within 24 hrs. The MRH was 67.0% with a 14% (54 to 68) mean range within 24 hrs. NH_3 was present at a level of 13.0 ppm, CO_2 at 0.15 vol%, H_2S was absent. The MAS was 0.1 m/sec. with 0.05 to 0.15 changes. The MBC was 2,016 germs per m^3 (see Fig. No. 2, E-G).

- In the breeding No. 2 the MT was 14°C with 4°C (11 to 15°) TR within 24 hrs. The MRH was 70% with 9.0% (65 to 74) range within 24 hrs. NH_3 was evaluated in 11,5 ppm, CO_2 in 0,15 vol%, H_2S absent. The MAS was 0.07m per sec. with a range from 0.05 to 0.15 m/sec. The MBC was 2,420 germs/m^3 (see Fig. No. 2, E-G).

- In the breeding No. 3 the MT was 8.5°C with 4°C (6.5° to 10.5°) TR within 24hrs. The MRH was with 18% (58 to 76%) range within 24 hrs. NH_3 was evaluated in 18.5 ppm, CO_2 in 0.12 vol%, H_2S absent. The MAS was 0.15m/sec. with a range from 0.05 to 0.2. The MBC was 2,250 germs/m^3 (see Fig.No. 2, F-H).

- In the breeding No. 4 the MT was 7.5°C with a 6°C (5.5 to 11.5) TR within 24hrs. The MRH was 78.5% with a range of 18.5% (67.5 to 86.0) within 24 hrs. NH_3 was 16ppm, CO_2 of 0.12vol%, H_2S absent. The MAS was 0.1m/sec. with a range from 0.05 to 0.15. The MBC was 2,100 germs/m^3 (see Fig.No.2, F-H).

DISCUSSION AND RESULTS

The above reported data, even if obtained through 12 months with limited controls, allow some practical remarks to be made.

- The climatic conditions in the hills of Central Italy permit the plant of simple and unexpensive premises, according to what observed in the 4 standard breedings, but adequately insulated and not overcrowded (1,2,8,10,16).
- Factors such as temperature, air humidity and speed, are not to be considered singly. A balanced ratio of these parameters, may allow satisfactory results as to the hygiene. In fact, rabbits do not tolerate any abrupt change in the microclimate even if they can bear relatively uncomfortable conditions (3,5,6,9,17,20).

A U T U M N

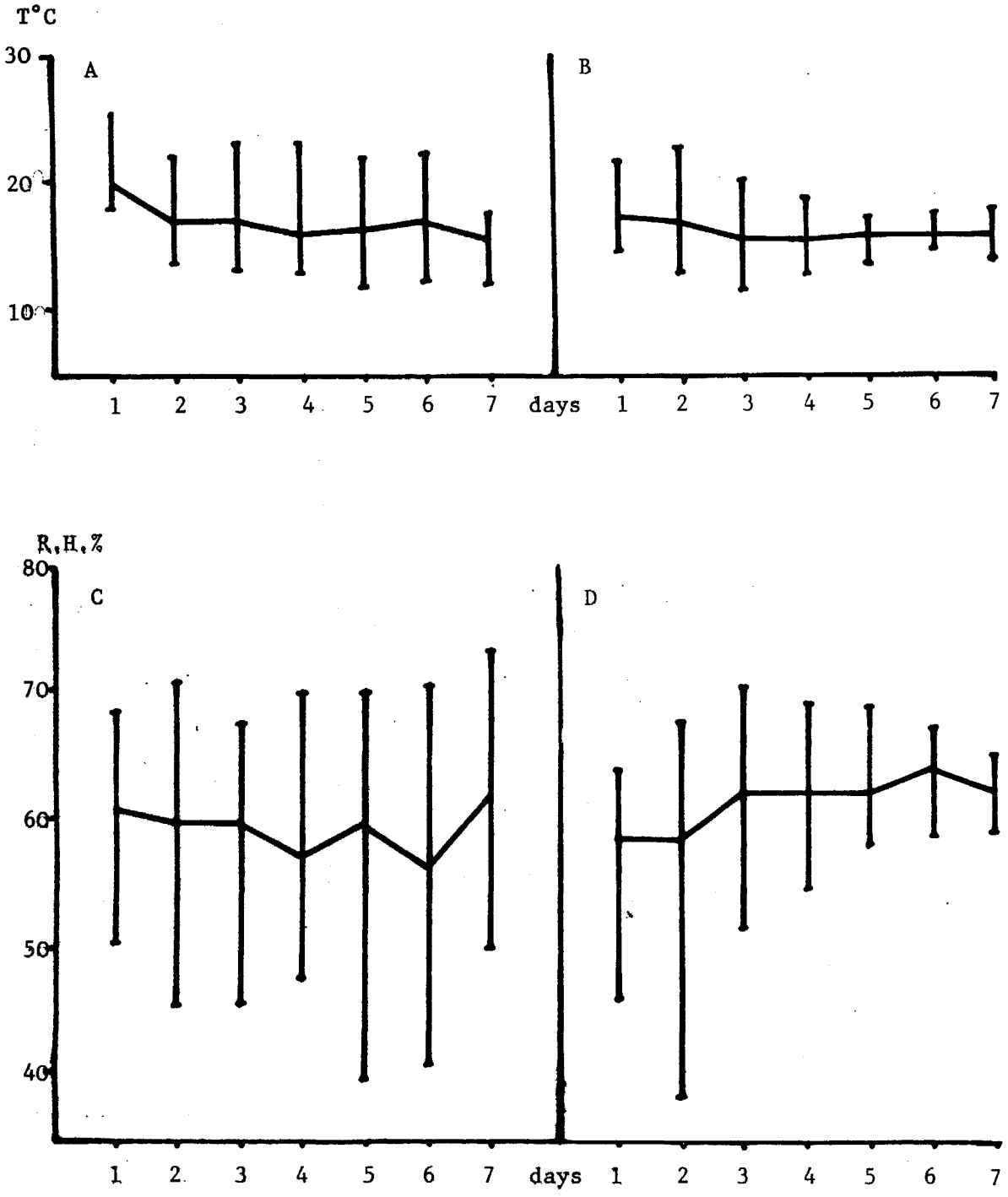

FIG. No. 1: A-C = Temperature and relative humidity in breedings with forced venrilation.

B-D = Temperature and relative humidity in breedings with natural ventilation.

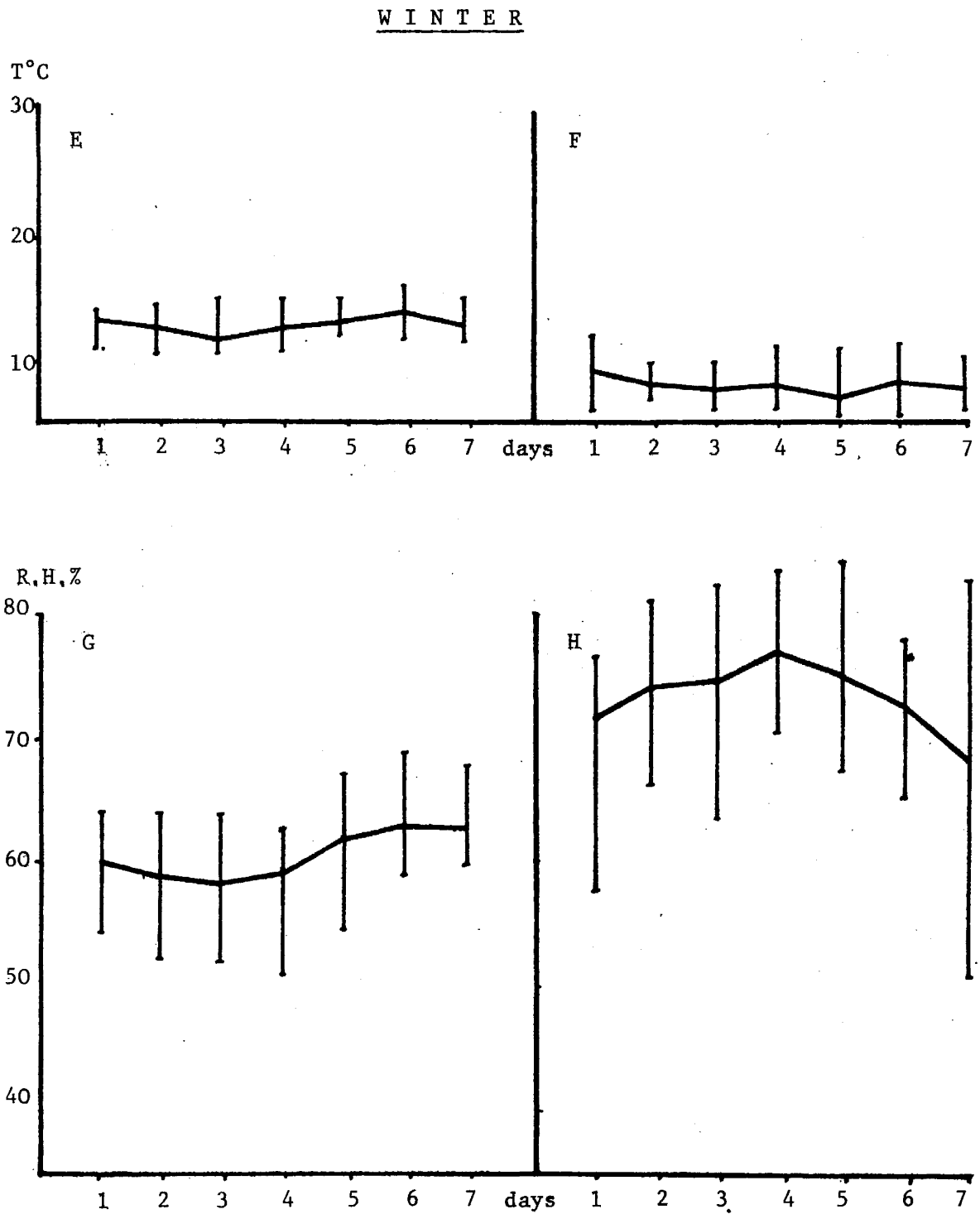

FIG. No. 2: E-G = Temperature and relative humidity in breedings with forced ventilation.

F-H = Temperature and relative humidity in breedings with natural ventilation.

- Being the microclimate constant the spread of the microbial agents is rather negligible. In fact, in the surveyed breedings the total of the microbial charge was about 2,000 germs/m^3 that is much lower than 250,000 germs/m^3, maximum allowed in intensive breedings, with no risk of pathological problems (9,15).
- The chemical factors such as CO_2, NH_3, H_2S in the premises of the examined breedings present at very low amounts (9,11,13).
  It would prove that a well controlled ventilation would ensure a proper change of air and prevent toxic gases from concentrating in sheds (18).

SUMMARY

The control of the microclimate in rabbit breedings in hilly areas has been investigated. The research has been carried out in an area deemed appropriate, in that it reflected the whole characteristic og hills in Central Italy. In standard breedings both with forced and natural ventilation the main microclimatic factors sich as temperature, relative humidity, air speed, presence of NH_3, CO_2, H_2S, environmental microbial charge have been found. It has been seen that some microclimatic factors in the breeding, such as temperature and relative humidity, may not be optimal. Yet, they do not determine sanitary problems if balanced with the other factors. In relatively small breedings some arrangements are needed for the benefit of animals. If marked variations are avoided within short times, the productivity of the breeding can be obtained even in non optimal conditions. In fact, in small and medium sized breedings, with a number of brood-females between 70 and 600, it is not possible the planing of sophisticated conditioning equipments. They would be a too heavy burden both from managerial and economical viewpoints.

RIASSUNTO

NOTE MICROCLIMATICHE IN ALLEVAMENTI CUNICOLI INTENSIVI DELL'ITALIA CENTRALE. - Scopo dell'indagine è stato il controllo del microclima in allevamenti di conigli di zone collinari. L'indagine è stata svolta in una zona ritenuta rappresentativa, per posizione geografica e clima, delle zone di media collina dell'Italia Centrale. Negli allevamenti-campione sia a ventilazione forzata che a vantilazione naturale, sono stati rilevati i principali fattori microclimatici (temperatura, umidità relativa, velocità dell'aria, presenza di ammoniaca, anidride carbonica, idrogeno solforato, carica microbica ambientale). Dall'indagine è risultato che alcuni fattori microclimatici dell'allevamento, (temperatura e umidità relativa) possono essere in condizioni non ottimali, tuttavia essi non creano preblemi sanitari se opportunamente equilibrati con gli altri fattori. In allevamenti di dimensioni relativamente modeste sono sufficienti pochi accorgimenti per ottenere il benessere degli animali. Se vengono evitate notevoli variazioni in tempi brevi, la redditività dell'allevamento può essere ottenuta anche in condizioni microclimatiche non ottimali. Infatti negli allevamenti di dimensioni medio-piccole, con un numero di fattrici variabile fra 70 e 600, non è possibile impiantare attrezzature di condizionamento sofisticate. Queste graverebbero in maniera insopportabile sia per l'ammortamento che per la conduzione.

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