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EFFICIENCY OF THREE DIFFERENT HOUSING SYSTEMS IN REDUCING HEAT STRESS IN RABBITS *

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ABSTRACT

Three different rabbit housing systems have been compared with reference to animal exposure to heat stress.

The experiment has been performed in Egypt during the hot month of August. The ambient temperature and body temperature trends during the day were recorded according to the housing system.

The cage system appeared to be less efficient in comparison with the traditional hut and underground experimental systems. From 12.00 to 16.00, when the ambient temperature in the shade ranged between 32 and 34°C the body temperature of the does housed in the traditional huts and in the partly underground experimental system was lower than in does housed in cages (respectively -0.34 to -0.67 °C and -0.54 to -0.67 °C). The differences were statistically significant ($P < 0.01$).

INTRODUCTION

Rabbit systems other than cage breeding technology are seldom described in developing countries where they would be more justified. These systems have existed for centuries (Arrington and Kelly, 1976; Finzi et al., 1988), and it would be worthwhile to study them to know their potential productivity in the field. New technologies could also be developed on the basis of local advantages and constraints.

Heat stress is an acknowledged limiting factor in many tropical developing countries (Casady et al., 1962; Gonzales et al., 1971; Nichelmann, 1971; Nichelmann et al., 1973; Gonzales et al., 1974; Prud'hon, 1976; Eberhart, 1980; Matheron and Martial, 1981; Whaley, 1983; Kadlecik 1983; Camps et al., 1985;). With regard to this factor three different breeding systems have been compared in order to get valuable background data for

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rural advisory work. The breeding systems are: industrial cage, traditional hut and a newly-developed underground cell system.

Body temperature has been studied in relationship to ambient temperature to evaluate the immediate physiological effects of heat stress as a part of a wider research on productivity in the three breeding systems.

MATERIAL AND METHODS

To study the various breeding technologies and their efficiency during the hot period, three different housing systems for rabbits were built in the Rabbit Breeding Station, in West Noubaria, Egypt.

The breeding systems were:

i) Cage system: normal flat-deck.

ii) Hut system: small stone and adobe round-based houses with small windows for light. The huts were built according to local technology. The huts measured 2.6 m in diameter and 1.2 m in height.

iii) Underground system: the system is a local adaptation of a prototype formerly introduced to West Noubaria in 1987 (Finzi, 1987), consisting of an underground unit connected to an external cage through a short pipe. The animals are free to choose the most convenient environment. The underground unit is a pot-shaped clay-cell with a lid which is covered with earth and grass and moderately watered every day.

The measurements are:

- clay-pot floor diameter;	50 cm
- clay-pot height;	40 cm
- cage area;	75 x 40 cm
- cage height;	40 cm
- pipe length;	30 cm
- pipe diameter;	15 cm

The three breeding systems were shaded by a loose woven reed roof. This was done for different reasons: to improve cage-breeding conditions, permitting better ventilation and lowering humidity according to the open air technology developed in the warmer regions of Spain, Italy and more recently France (Finzi et al.,1986; Blocher and Koehl, 1990; Roca, 1991), and to simulate the conditions of a field hut placed in the shade of a tree.

The rabbits used in the experiment were young does of both New Zealand White and Californian breeds. The does had an average weight of 2000gr +/- 170gr and were randomly distributed over the three systems. Ten does were lodged individually in the cage and in the underground systems respectively; 12 does were lodged in groups of four in the three huts. The feed during the experiment consisted of rabbit pellets and a little fresh alfalfa.

The experiment was designed to compare system-efficiency in reducing heat stress in

rabbits through a control of the body temperature.

The temperature measurements were carried out three days in August; every two hours between 06.00 and 20.00. The measurements were obtained both for the micro-environment of the housing system and of the rectal temperature of each animal. The instruments used were digital thermometers.

RESULTS AND DISCUSSION

Figure 1 shows the ambient temperature during the day in the three systems. From the figure it is seen that the measurements of temperature inside each housing system were nearly the same until 08.00. After this time, the temperature inside the cage increased faster than that of the other two systems. The temperature remained high in the cage until 18.00 when it reached the same level again as underground and hut at 20.00 hours.

The temperatures of the hut and underground systems had similar trends, but the temperature in the huts rose slower and decreased slower with a delay time of about one hour. The reason is due to the fact that the air in the huts has a large volume and takes longer to warm and cool. The temperature in the cage was 1.6-2.0 °C higher than the other two systems between 14.00 and 16.00.

With regard to the ambient temperature, both the underground and the hut system seem to have a similar efficiency, and both are significantly cooler ($P < 0.01$) than the cage during the hottest part of the day.

The body temperature trend is illustrated in figure 2. The high value recorded in the early morning for all rabbits is due to the natural higher physical and metabolic activity in the night. The temperatures began to decrease simultaneously in the cage and the underground system. After 08.00 the temperature in the underground system continued to decrease and reached a minimum around noon. The body temperature of the rabbits then began to increase as an effect of a new phase of activity corresponding to the decline of ambient temperature shown in figure 1. In the cage system the body temperature increased from 10.00 hours, and it is evident that the animals were not able to even lose their metabolic heat since they were observed to lie passively all day avoiding any form of activity. The data measured on the other two days coincide with the first day.

The body temperature of the animals in the huts had an intermediate trend showing the good efficiency of this traditional breeding system. The difference in the trend between the underground and the hut system can be explained, apart from the difference in activity level observed, by the fact that inside the underground cell the floor surface is slightly moist. When the animal lies inside, internal body heat can more easily be dissipated by contact with the surface kept cool through evaporation.

The management aspects of the underground system permitting the individual control of does, while the huts is a colony breeding is not discussed here.

As a conclusion it is evident that the housing system is an important factor influencing

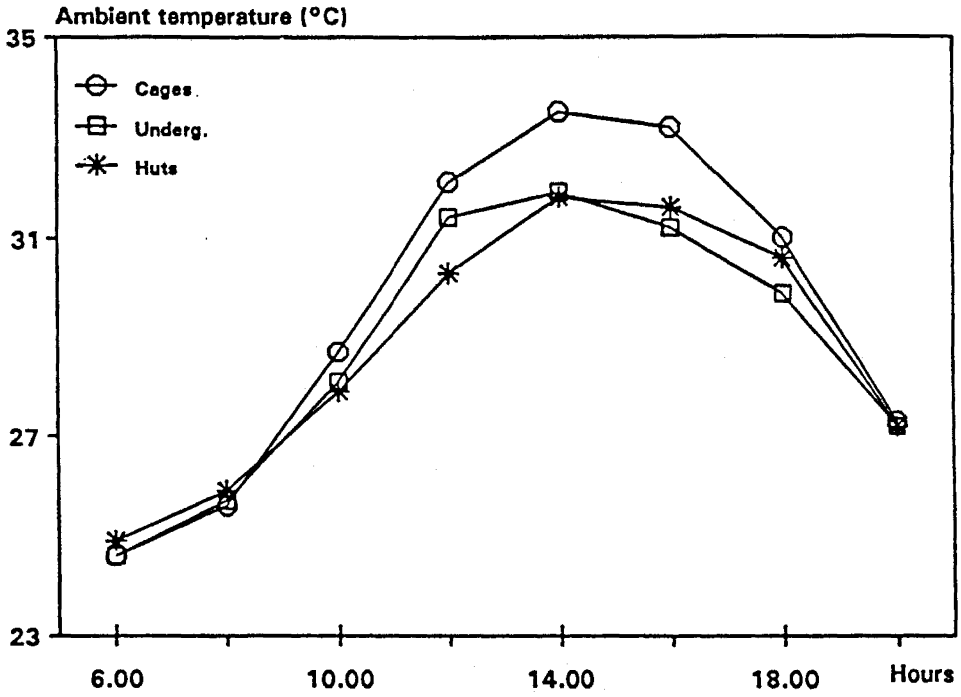

Fig. 1. Ambient temperature in the three different rabbit housing systems.

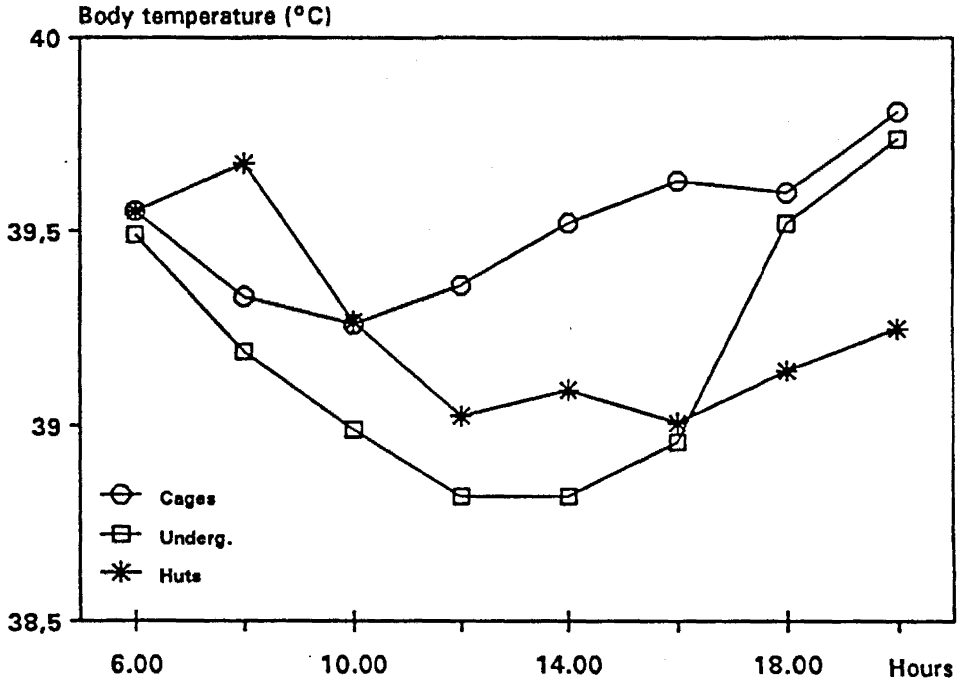

Fig. 2. Body (rectal) temperature in the rabbits housed in the three different systems.

the intensity of and the length of exposure to heat stress on the part of the animals. Traditional or newly developed systems looks more efficient on this purpose than breeding in cages.

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REFERENCES

Arrington L.R. and K.C. Kelly. 1976. Domestic Rabbit Biology and Production - University Press of Florida.

Blocher F. and P.F. Koehl. 1990. Elevage de plain air et de semi plain air. 5émes Journ. Recherche Cunicole en France, Paris.

Camps J., J.M. Cereza and V. Rosell. 1985. Efectos del calor y frio excepcionales en la producción de los conejares. Actas X Simp. Mund. Cunicultura, Barcelona, 237-248.

Casady R.E., W.C. Rollins. and D.B. Sittman. 1962. Effect of season and age of dam on individual weaning weight, number of weaned and total litter weight of hutch raised domestic rabbits. Small Stock Magazine, 64 (11), 7, 23.

Eberhart S. 1980. The influence of environmental temperature on meat rabbits of different breeds. Actas II Cong. Mund. Cunicultura. Barcelona, I, 399-409.

Finzi A. 1987. Technical support to agricultural development and settlements in West Noubaria, Egypt. Tech. Report F.A.O., Project EGY/85/001.

Finzi A., L. Gualterio and A. Valentini. 1986. Allevamento del coniglio all'aperto, Riv. Coniglicoltura, 23 (2),47-49.

Finzi A., A. Scappini and A. Tani. 1988. Les élevages cunicoles dans la région du Nefzaoua en Tunisie, Riv. Agricol. Subtropicale e Tropicale, 82, 435-462.

Gonzales R.R., M.J. Kluger and J.D. Hardy 1971. Partitional calorimetry of the N.Z.W. rabbit at temperatures 5-35°C. J. Appl. Physiol., 31, 728-734.

Gonzales R.R., M.J. Kluger and J.A. Stolwijk. 1974. Thermoregulatory responses to thermal transients in the rabbit. Am. J. Physiol., 277 (6), 1292-1298.

Kadlecik O. 1983. The effect of season and inbreeding on semen quality in rabbits. Acta Zootechnica Nitra, 39, 303-309.

Matheron G. and J.P. Martial. 1981. L'élevage du lapin en ambiance chaude et humide: étude de quelques reponses zootecniques et physiologiques. E.N.S.A., Rennes.

Nichelmann M. 1971. Besonderheiten der physikalischen Temperaturregulation beim Kaninchen. Archiv für Exp. Veterinärmed. 27, 782-789.

Nichelmann M., H. Rohling. and M. Rott. 1973. Der Einfluß der Ungebumgstemperatur auf die Höhe des Energieumsatzes erwachsener Kaninchen. Archiv für Exp. Veterinärmed. 27, 499-505.

Prud'hon M. 1976. Comportament alimentaire du lapin soumis aux temperatures de +10, +20, +30 °C. I Congr. Int. Cunicole, Dijon. Comunication n.14.

Roca T. 1991. Cuniexpo '91 7.a Mostra-Mercat Cunícola de Catalunya, Bol. Cunicultura, 54, 31-33.

Whaley R.V. 1983. A visit to a rabbitry in western Samoa. J. Appl. Rabbit Res. 6, 54-55.