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Effect of high temperatures on the performance of growing-finishing pigs. The case of Alentejo

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SUMMARY - Ambient temperature is one of the main components of the physical environment, as it is a permanent factor and one of the most important affecting the physiology, behaviour and productivity of pigs. Thus, it is of particular interest to house these animals under conditions which permit maximize their zootechnical performances. Presently it is accepted that the optimum temperature for the performance of growing-finishing pigs is between 20°C and 25°C. Under higher environmental temperatures, i.e., near the upper critical temperature, the carcasses are lean, but the food ingestion is severely affected, leading to a slow growth rate. In Portugal, around 17% of the swine production is located in Alentejo. This region is characterized by very hot and dry summers, with the outside temperatures rising well above 25°C. The purpose of this paper is to describe, using the little information available, the effect of high temperatures on growing-finishing pigs. This will be followed by some solutions for management practices and environmental control that can be applied in regions similar to Alentejo, capable of offsetting this effect.

Key words: Pigs, thermal environment, growth performance.

RESUME - *"Effet des hautes températures sur les performances de porcins en croissance-finition. Le cas de l'Alentejo". La température ambiante est l'une des principales composantes de l'environnement physique, car il s'agit d'un facteur permanent et l'un des plus importants qui affectent la physiologie, le comportement et la productivité des porcins. Il est donc particulièrement intéressant de loger ces animaux dans des conditions permettant de maximiser leurs performances zootechniques. Il est actuellement admis que la température optimale pour les performances des porcins en croissance-finition est entre 20°C et 25°C. Sous de fortes températures environnementales, c'est-à-dire, près de la température supérieure critique, les carcasses sont maigres, mais l'ingestion alimentaire est sévèrement affectée, menant à un taux de croissance lent. Au Portugal, environ 17% de la production porcine est localisée dans l'Alentejo. Cette région se caractérise par des étés très chauds et secs, avec des températures extérieures qui s'élèvent bien au-dessus de 25°C. Le propos de cet article est de décrire, en utilisant le peu d'information disponible, l'effet des fortes températures sur les porcins en croissance-finition. Ceci sera suivi par quelques solutions pour la conduite pratique et le contrôle environnemental qui peuvent être appliquées dans des régions semblables à l'Alentejo, capables de contrebalancer cet effet.*

Mots-clés : *Porcins, environnemental thermal, performances de croissance.*

Introduction

The ambient temperature is one of the main components of the physical environment, as it is a permanent factor and one of the most important ones affecting swine physiology, behaviour and productivity. It is thus of great importance to house these animals under conditions that provide a temperature range that can maximize their zootechnical performances. Presently it is accepted that the optimum temperature for the performance of growing-finishing pigs is between 20°C and 25°C. (Rinaldo and Le Dividich, 1991; Le Dividich *et al.,* 1997). If the animals are housed under conditions of higher temperature, that is, near the upper critical temperature, the carcasses are lean (Nienaber *et al.,* 1983; Verstegen *et al.,* 1985; Campbell and Taverner, 1988; Fitas da Cruz and Le Dividich, 1998a), but the food ingestion is severely affected (Nienaber *et al.,* 1987; Massabie *et al.,* 1996,), leading to a slow growth rate (Stahly and Cromwell, 1979; Rinaldo and Le Dividich, 1991; Massabie *et al.,* 1996) specially in the finishing stage (Hsia and Lu, 1987; Fitas da Cruz and Le Dividich, 1998a).

On mainland Portugal, animal production accounts for more than half of total agricultural production (Antunes Correia, 1995). Pig production is the most important in the animal sector, creating more than 14% of the total income in the agricultural sector. The distribution of pigs in

Portugal is irregular (Fig. 1), with greater concentration in the Lisbon, Tejo Valley, Centre-Coastal and Alentejo regions. However, problems with land use and sanitation have contributed to the transfer of some production to Alentejo, and thus the total number of animals in this region has increased by 14% in the past few years (Anuário Pecuário, 1997). On the other hand, and as far as the climate is concerned, this region is located in a particularly unfavourable type of Mediterranean climate (Fig. 2) with very hot summers and the rains concentrated in the cold season (Feio, 1991). In fact, during the hot weather, the project temperatures are very different (Table 1) from the recommended range (20°C to 25°C) and from the upper critical temperature (28.5°C, according to Verstegen and Close, 1994), for finishing pigs. Thus it becomes apparent that the outside climatic conditions in this region can limit the performance since the animals are subject to conditions of heat stress. In order to curtail this effect, it is necessary that the swine facilities be well planned and that the management practices be well adapted to the limitations imposed by the climatic conditions.

Thus, will be presented the results of some experiments carried out in the experimental facilities of the University of Évora, regarding both management practices as well as environmental control. The use of which can be of interest in decreasing the effect of high temperatures. These experiments involved a total of 240 animals subject to average housing temperatures between 28°C and 35°C, with live weights of 50 to 93 kg, housed in pens with concrete floors and fed *"ad libitum"*.

Fig. 1. Geographical distribution of pig production in Portugal (AERA, 1996).

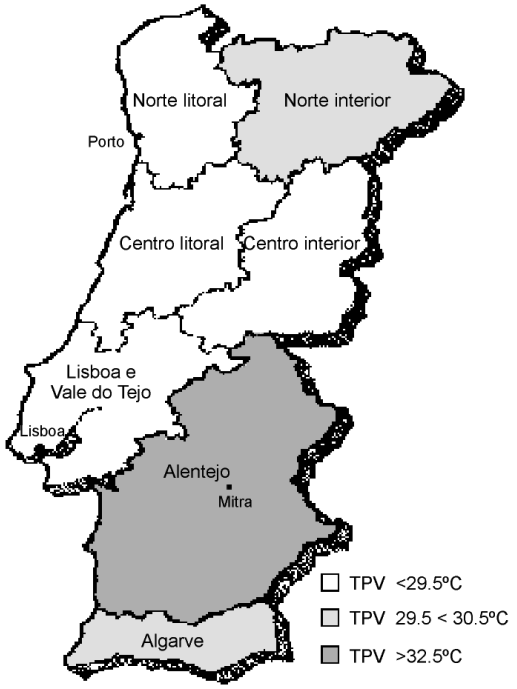

Fig. 2. Summer project temperatures verified in Portugal (Fitas da Cruz, 1996).

Intervention on management practices

Through animal density

In one of the experiments carried out, it was observed that an increase in the available space per animal from 0.75 m^2 to 1.5m^2 was responsible for a significant increase (P<0.001) in the feed intake (FI/kg and day) and the growth rate (ADG, kg/day), without any effect on the feed conversion ratio (FCR), (Fig. 3) or on carcasses characteristics.

Table 1. Relationship between recommendations, upper critical temperature (UCT) and Summer project temperatures for Portugal zones. (Fitas da Cruz, 1996)

Zone	Temp. Proj. (°C) (TPV)	Δ UCT† (°C)	Δ V†† recomend. (°C)
Interior North	30.1	+1.6	+5.1
Coastal North	28.7	+0.2	+3.7
Interior Central Zone	28.4	–0.1	+3.4
Coastal Centre	29.3	+0.8	+4.3
Lisboa and Tejo Valley	28.9	+0.4	+3.9
Alentejo	33.0	+4.5	+8.0
Algarve	29.8	+1.3	+4.8

†Δ UCT: TPV - UCT
††Δ V: TPV - 25.0°C

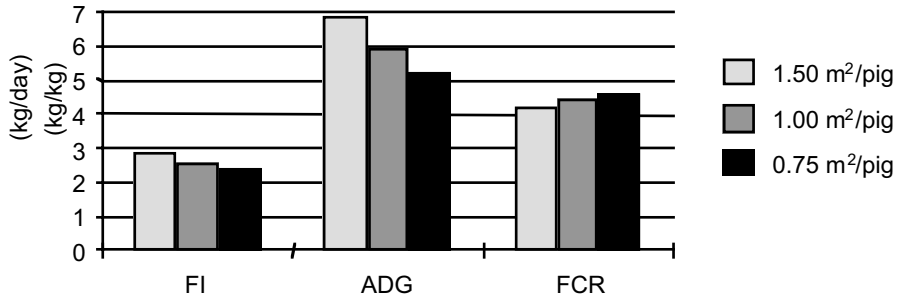

Fig. 3. Effect of stocking density on the growth performance (Fitas da Cruz, 1996).

Through nutrition

In a different experiment, the feed intake of animals with 60 to 70 kg live weight was measured and it was observed that during the Summer months around 59% of the daily feed intake was done during the night period, that is between 7:00 pm and 7:00 am. In the winter months the feed ingestion was evenly divided (50%) between the night and day periods (Fig. 4).

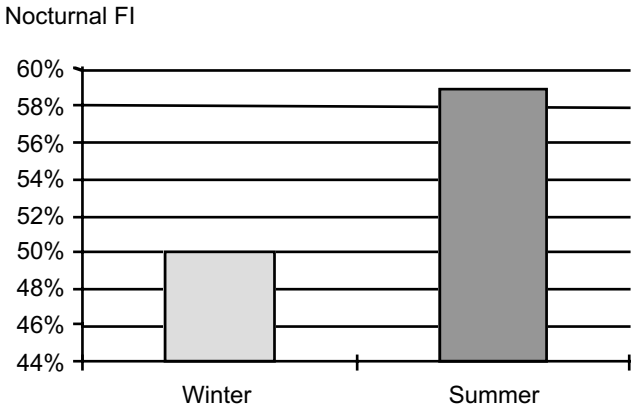

Fig. 4. Effect of season on nocturnal feed intake (Fitas da Cruz, 1996).

In other experiment, was also observed that the increase in the energetic concentration of the diet from 11.9MJ ED/kg to 13.4MJ ED/kg could be beneficial for growth performance as it was responsible for a significant increase in the growth rate (P<0.05) and a decrease in the feed conversion ratio (P<0.01) (Fig. 5).

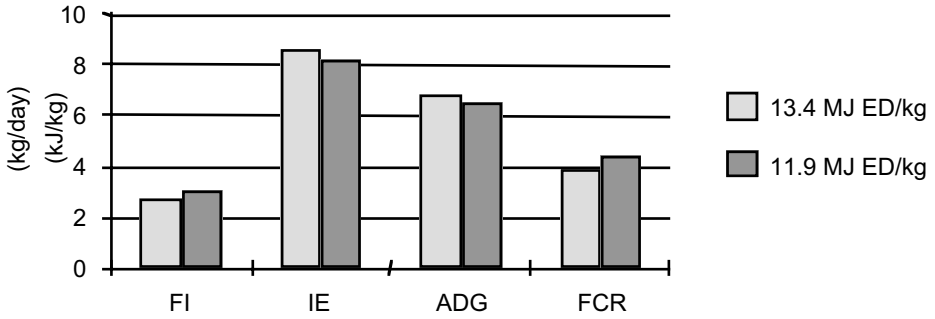

Fig. 5. Effect of energy density of diet on growth performances (Fitas da Cruz, 1996).

Intervention on environmental control

Based on the principle that the environmental control techniques used in facilities for animals should, among others, obey the following two requirements: (i) be of low cost, in order not to affect the farm profitability and (ii) provide good labour efficiency wherever they are used, a set of experiments were carried out using evaporative cooling techniques. One of the analysed alternatives was nebulization which presented undeniable advantages in terms of growth rate (Fig. 6) without affecting the feed conversion index. On the other hand, the use of evaporative panels provided lower indoor temperatures (Fig. 7) which led to higher performances, while using smaller ventilation rates when compared to natural ventilation.

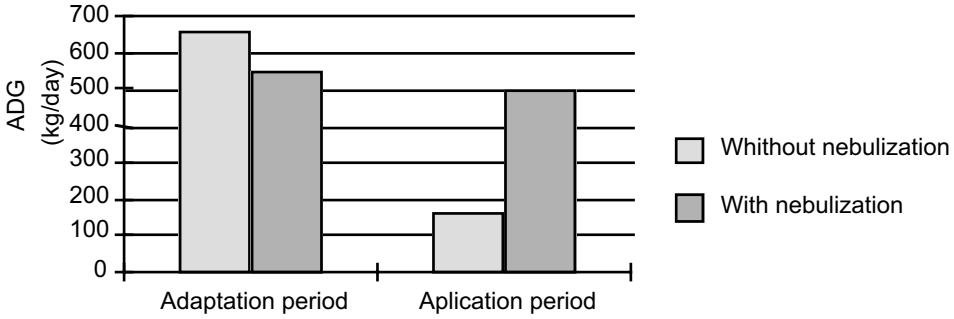

Fig. 6. Effect of nebulization on growth rate (Baccari *et al.,* 1993).

Final considerations

The presented results indicate that in the Alentejo, Summer condition markedly affect growth performance of pig. Also demonstrate that through small changes in management practices it is possible to offset the negative effect of high temperatures. Nevertheless these practices also present some inconveniences, such as the fact that a decrease in animal density implies an increase in building costs per animal, and an increase in the energetic density causes an increase in the fat content of the carcasses (Fig. 8). So their application may not lead to a general increase in growing-finishing pig performance.

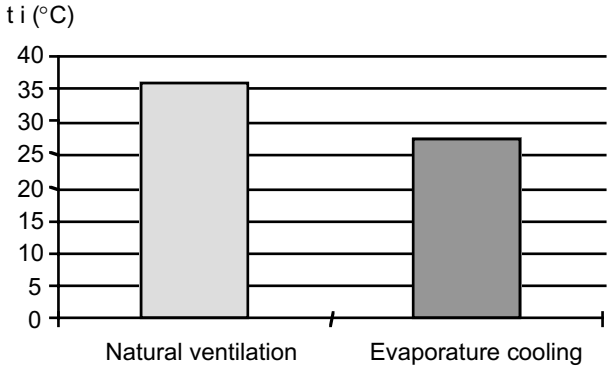

Fig. 7. Effect of ventilation system on the inside temperature for the same ventilation rate of 20m^3/s and outside temperature of 35°C (Fitas da Cruz and Le Dividich, 1998b).

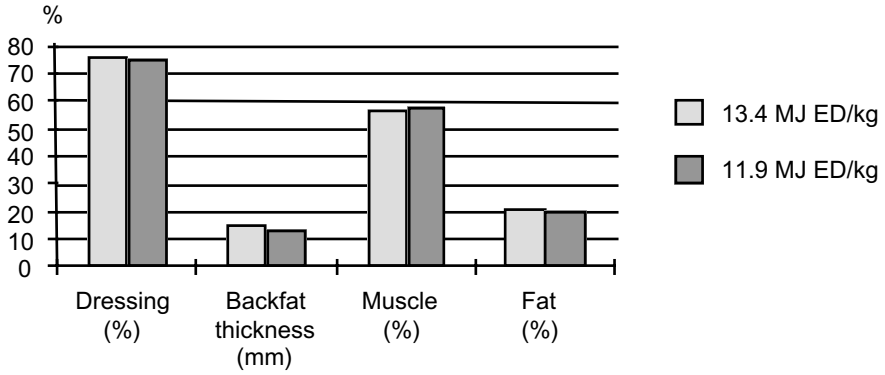

Fig. 8. Effect of energetic density on carcass characteristics (Fitas da Cruz, 1996).

Evaporative cooling seems to be able to provide indoor thermal conditions close to the recommended. Its use in a region like Alentejo seems to be encouraging, although a cost-benefit analysis, comparing the costs of building and operating such a system with the increase in animal production should always be present in the decision making process.

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