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A brief review on the hand-in-hand relationship between animal agriculture and basic environmental factors

Aristidis Matsoukis[1*]

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[1]Agricultural School of Agricultural Production, Infrastructure and Environment, Agricultural University of Athens, Greece.
*Corresponding email: armatsoukis@aua.gr

Livestock farming activity is a viable option for increasing the livelihood status of a large number of farmers around the world. This activity impacts on the environment and the other way round. In this regard, this brief review highlights the vital role of basic environmental factors, that is to say air temperature and relative humidity on the development and productivity of domesticated animals, shedding also light on the need for suitable barn environment which leads to increased farm animal productivity and profitability.

Keywords: Air temperature, Animal agriculture, Barn, Relative humidity, Thermoregulation.

1. Introduction

Nowadays, for many people, life is closely bound up with domesticated animal species from different perspectives, for example, companion animals. Apart from this role for animals, a large number of domesticated animal species is an important part of animal agriculture and an efficient way of improving income, especially for the farmers of developing countries [1].

It is well known that the growth and consequently the productivity of animals is a function of their genetic potential and of all the factors that make up their environment [2]. However, from a general point of view, some environmental factors seem to be more important than others and maintaining their values within the proper range should be a one-way street. Air temperature is one such factor.

2. Air temperature, relative humidity and animal thermoregulation

Air temperature is an environmental parameter that greatly affects the normal functions of animals [3 -5]. The daily thermometric range in areas of the equator is about 6^{o}C while in desert areas it lies between 16^{o}C and 20^{o}C. Nevertheless, the changes of the mean daily temperature between different seasons in some areas can be quite large. For the overwhelming majority of the domesticated animals, values of mean daily temperature between 10^{o}C and 20^{o}C, referred to as their "comfort zone" [3], do not create problems in their development.

The vast majority of domesticated animals belongs to the category of warm-blooded animals, which means the existence of a mechanism called thermoregulation. The purpose of this mechanism is to maintain body temperature within a very narrow range of values where life can be maintained [6]. To achieve the purpose above, the heat loss should be equal to the heat uptake by the animal body [7]. Specifically, the net amount

of heat that the animal gains from its normal functions (difference of the heat consumed for the various functions of the body from the heat derived from the metabolism) must be approximately equal to the sum of the amounts of heat that come from radiation (direct and indirect from the sun, clouds, soil, adjacent facilities, etc.) convection and conduction (internally through blood and externally through air layer around the body) as well as evaporation [8].

Thus, the impact of air temperature on the body temperature of animals and, by extension, on their productivity is of primary importance. In addition, it is well known that air temperature is closely related to relative humidity, which, apart from its role on animal body thermoregulation through water evaporation and sweat produced [8], affects the health of animals [9], especially when they are at an early age [10].

3. Barns, necessity and suitable environment

The performance and the hygiene of the animals are greatly affected by the environmental conditions of the barns in which they spend a long time or their whole life. Of course, the degree of protection of animals does not always indicate their comfortable living in barns, which mainly depends on the combination of air temperature, relative humidity and ventilation, from an environmental point of view.

The air composition and pollution inside the barns also play an important role [11]. The air temperature and to a greater extent the relative humidity take higher values in the barns than in the countryside. This is largely explained by the presence of animals that emit heat and water vapor in the surrounding area [12]. The prolonged exposure of animals to increased air temperature and relative humidity values in barns, above a certain limit, can cause major problems in their comfortable and healthy living with a negative impact on their productivity. Care must therefore be taken to remove excess heat and moisture and an effective way to achieve this is ventilation. Ventilation can be natural or artificial. In natural ventilation, air enters and leaves the barn in a natural way through roof openings and side walls. Artificial ventilation presupposes the existence of ventilators that force the air in the barn to come out and be replaced by outdoor air [13, 14].

The open barns are preferable to the closed ones only in the case that the air temperature and relative humidity values in open space are close to the optimal growth values for the domesticated animals throughout the year. Animals thus have access to food and water according to their needs and can move freely. So, on the one hand, they are protected from the undesirable conditions of radiation, rainfall, etc., on the other, they can enjoy the environmental conditions of the local climate, with positive effects on their performance. Animal welfare should be a priority in all cases of maintaining the appropriate microclimatic conditions for animal normal development and productivity, in relation to the cost of employment staff [12].

4. Conclusions

To sum up, the role of air temperature and relative humidity in the development and productivity of domesticated animal species is nonnegotiable and should be taken seriously into account towards a more careful design of barns and suitability of their sites. Domesticated animal care and well-being helps animal agriculture to better proceed, both qualitatively and quantitatively.

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