ENGINEERING FACTORS TO DEVELOP A SUSTAINABLE ENVIRONEMENTAL CONTROL SYSTEM FOR RABBIT PRODUCTION

By

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B. Sc. Agric. Sc. (Agric. Engineering), Ain Shams University, 2008

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ABSTRACT

Shaimaa Mohamed Mostafa Baraka: Engineering Factors to Develop a Sustainable Environmental Control System for Rabbit Production, Unpublished M. Sc. Thesis, Department of Agricultural Engineering, Faculty of Agriculture, Ain Shams University, 2015.

This research aims to study the effect of using Modified Trombe-Wall (MTW) in natural ventilation system to decrease thermal load in rabbit house. A Modified Trombe-Wall is a south-facing concrete blackened wall and covered on the exterior by glazing. Sunlight passes through the glass and is absorbed and stored by the wall. The glass and airspace keep the heat from irradiating to the outside. The experimental model was set up at Shoubra El-Kheima, Egypt. Results of the experimental work show that the (MTW) actually decreases temperature inside the model by seven-degrees Celsius. The technique achieved the largest ventilation rate (0.014 m^3/s) at time 2 pm (September).

The results of theoretical Study for Trombe Wall system at rabbit house indicated that ventilation with TW decrease the heat stress by average thermal efficiency 20.7 %. The system of natural ventilation causing possible absence of stress conditions was detected (THI<27.8).

Keywords: Trombe Wall, Comfort zone, Ventilation, Animal environment

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I. INTRODUCTION

Generally, climate control is of great importance for agricultural production in order to achieve high yield, good quality crops and develop production of animals. The quality of the environment in agricultural buildings is governed by such factors as temperature, moisture and air quality. The effects of temperature and humidity are often limiting the development production and reproduction of animals. Thermal stress acts as a limiting factor for maximum efficiency production and may interfere with reproductive rates and the production of meat and milk and increases rates of mortality. Effective temperature is particularly useful when the air temperature is below or above the thermal comfort zone. Ventilation is very important to provide fresh air necessary to maintain acceptable air-quality levels, where air is driven in/out of the closed area because of pressure differences across the openings. Using passive ventilation by what is called a "Trombe Wall" uses solar energy because the energy is too expensive and may not be available. There are problems in providing a healthy environment and reproductive systems for small animals to give higher productivity, under controlled environmental conditions, using available natural resources and sustainable economy under Egyptian environmental conditions.

The aim of this research is to study engineering factors for a natural ventilation system, depending on roles warming to provide the appropriate conditions for rabbit housing.

II. REVIEW OF LITERATURE

The impacts of climate on animal production include the effect of extreme climates as well as the effect of global climatic changes.

In arid and semi-arid regions, high ambient temperature accompanied with scarcity of water affects significantly animal production to be about 2-4% of world meat, milk and egg production. In semi-arid regions, and that additional heat stress will damage crops and especially livestock **(Lacetera, 2003)**.In humid tropical regions, **Valtorta** (**2002)** has discussed the direct and indirect impacts of climate on animal production.

According to climatic change scenarios, milk production in hot/hot-humid southern regions of United States might decline by 5-14%; conception rate will be reduced by 36% and short-term extreme events (e.g. summer heat wave and winter storms) can result in the death of vulnerable animals **(IPCC, 2001)**.

2-1 Climatic factors affecting livestock

Climatic factors affecting livestock climatic regions can be classified according to its effect on animals to: hot, cold and altitude (Table 1-3).

Hahn et al. (2003) demonstrated that the main natural physical environmental factors affecting livestock are: air temperature, relative humidity, radiant heat, precipitation, atmospheric pressure, ultraviolet light, wind velocity and dust. Impacts of climatic factors on farm animal production, reproduction, morbidity and mortality are illustrated in Tables (2-4-5). It is worth noting that the effect climate on farm animals depends greatly on the severity and duration of climatic factor and animal adaptive mechanism. Chronic heat stress for example affects animal morbidity, production and reproduction, while it has a slight effect on animal mortality.