

**OPTIMIZATION OF THERMAL COMFORT IN A NATURALLY VENTILATED  
LIVESTOCK BUILDING**

**BY**

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## **ABSTRACT**

This work investigated the effect of building vent and orientation on the thermal comfort of rabbits under a naturally ventilated livestock building. This was with a view to optimizing the productivity of the animals.

Mathematical equations were used to estimate heat and moisture production by the animals, airflow rate and the Temperature-Humidity Index (THI) of the building. The experiment was conducted using two model buildings oriented at 45° and 90° to the northeast wind. Two inlet vents of 30% and 50% on the windward side and an outlet opening of 20% on the leeward side of the model buildings were used. The experiment was carried out using a 3 x 2 x 2 factorial arrangement with two replicates. The factors were inlet opening, orientation and sex of the animal. A rabbitry without wall on all sides was used as the control building. Data on temperature and relative humidity within and outside the buildings were collected twice daily (7.00 a.m. and 1.00 p.m) and used to calculate the THI. Rabbit weight gain and feed consumption were collected while feed utilization efficiency was calculated on weekly basis. Physiological parameters of pulse rate, rectal temperature and respiration rate were also collected twice a week. The data were analysed using inferential statistics.

The results showed that the amount of building opening (difference in the height to length) and orientation significantly ( $P < 0.01$ ) affected the thermal comfort level of a livestock building. The average THI values were 33.16°C °C, 34.80 °C and 34.33 °C respectively for 50%, 30% and the control (100% opening) buildings, respectively. The building orientation also had significant effect ( $P < 0.01$ ) on the productivity characteristics of the rabbits. Also, THI were 33.35 °C and 34.61 °C for the 90° and 45° building orientations, respectively. This was attributed to the variations in heat and moisture removal from the buildings. The weight gain and feed efficiency of rabbits in the 90° orientation building were respectively 7.53 g and 0.03 higher than those for 45° orientation building.

However, the pulse rate, rectal temperature and respiration rate were 6.95 bpm, 0.84 °C and 6.54 rpm lower in the 90° orientation building than the 45° orientation respectively. Female rabbits also responded better than male rabbits ( $P < 0.01$ ) with average of 0.61 g and 0.01 higher values of weight gain and feed efficiency, respectively.

In conclusion, the study showed that both building orientation with respect to the direction of the prevailing wind and size of ventilating opening affected the Thermal Comfort Indicator (THI). The combination of 50% opening and 90° orientation of the buildings gave the best THI value of 32.49 °C. Under all conditions, the female rabbits responded better than the male in the production characteristics.