

# STRUCTURAL AND ENVIRONMENTAL ASSESSMENT OF MODIBBO ADAMA UNIVERSITY POULTRY HOUSE YOLA, ADAMAWA STATE, NIGERIA

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## ABSTRACT

*Poultry farming is one of the lucrative businesses especially when done in a conducive environment. Some factors that can affect poultry production depend on the environment and structural materials used in the construction of the poultry houses. The assessment of Modibbo Adama University poultry Houses was carried out to see how the birds can be raised especially between the periods of March to May when the weather factors seems not to be too favourable for the birds. Both primary and secondary data were collected using thermometer, hygrometer, for room temperature and relative humidity measurements for eight weeks. The highest temperature recorded within the poultry houses was 32.93°C and the highest relative humidity was 71.67% between May to July, 2021. From correlation analysis the ambient temperature against relative humidity shows a negative correlation value of -0.87786 which indicates that a decrease in temperature led to an increase in relative humidity in the poultry houses. Other climate data recorded were the highest mean temperature of 35.95°C in the month of March while the lowest mean was 26.45°C in the month of September. The Highest relative humidity was 94.5% in the month of September while the lowest was 74.13% in the month of March. Materials of construction that were identified for the poultry houses included concrete floor, aluminum roof, no ceiling, walls were concrete, Pens were constructed for raising of the birds, windows were covered with nets. To improve the temperature within the poultry houses, planting of trees for aeration, construction of ceilings, increasing the window sizes for the entire houses so as to have sufficient space to allow the free flow of air.*

**Keywords:** Poultry, environmental, structural, birds, temperature, pens

## 1 INTRODUCTION

**P**oultry farming refers to the act and practice of raising birds (such as chicken, turkeys, geese etc.) for the production of meat or egg. However, several factors (such as ambient temperature, relative humidity, presence of ammonia, dust etc.) influence the microclimatic conditions in the poultry houses [1] and if these factors are not properly managed, it could reduce the level of meat and egg production, and sometimes, increase mortality among poultry birds. Poultry raised for meat production are called broilers while the poultry for table egg production are termed layers. Layers in Nigeria are reared under free range, deep litter system or battery cage system, with battery cage system being more prominent. Nigeria poultry production is dominated by small scale farming. This is in line with FAO [2] that Nigerian chicken population was 150.682 million of which 25% were commercially farmed, 15% semi-commercial, and 60% backyards. A reported by [3] asserted that Nigeria's egg production is largest in Africa and second largest in chicken production after South Africa's 200 million birds. Farm structures have contributed significantly to poultry farming by providing better housing, provision of modern conveniences and recreational facilities for good standard of living and working conditions of the farmers. According to [4], a structure is an object whose purpose is to carry loads or forces from one place to another. They can be shelters which provide accommodation for human beings, livestock, farm produce and farm machinery. An adequate

environment within poultry houses is a very important requirement for success in any poultry production. Poultry subjected to high environment temperatures exhibit many behavioral and physiological changes which allow them to re-establish heat balance with their surroundings. Lucas and [5] emphasized that under increasing temperature conditions, poultry birds change their behavior and physiological homeostasis seeking thermoregulation, thereby decreasing body temperature. A study by [6] showed that birds subjected to heat stress conditions spend less time feeding, more time drinking and panting, as well as more time with their wings elevated, less time moving or walking, and more time resting. Earlier, [7] noted that air sacs are very useful during panting, as they promote air circulation on surfaces contributing to increase gas exchange with the air, and consequently, the evaporative loss of heat. This process is very important in breeding and laying hens, as it affects egg shell quality [8]. Poultry farming activity taking place at Modibbo Adama University farm is on a small scale, therefore there is need to assess the structures and environmental conditions of the poultry farm. This will help us to know the quality of birds produced from the farm and also some factors affecting these birds. It will also help to improve production of both the poultry and its products. These can be possible if the structural and environmental conditions meet certain standards such as the type of houses, temperature, humidity, light intensity, ventilation and so on. This study is therefore, aimed at investigating the types of materials of construction of the poultry houses and the environmental requirements of Modibbo Adama University, Yola poultry farm.

## 2 MATERIALS AND METHODS

### 2.1 Description of Study Area

Modibbo Adama University, Yola in Girei local Government Area is located between latitude  $9^{\circ} 18' 00''\text{N}$  to  $9^{\circ} 21' 40''\text{N}$  of the Equator and longitude  $12^{\circ} 28' 30''\text{E}$  to  $12^{\circ} 30' 30''\text{E}$  of the Greenwich Meridian (Figure 1). Modibbo Adama University, Yola formally known as Federal University of Technology, Yola was established in 1981 by the Federal Government of Nigeria to provide the much needed technologically skilled manpower for the nation. The poultry farm house in Modibbo Adama University is adjacent to the new female hostel. It covers about a hectare of land where different livestock are raised.

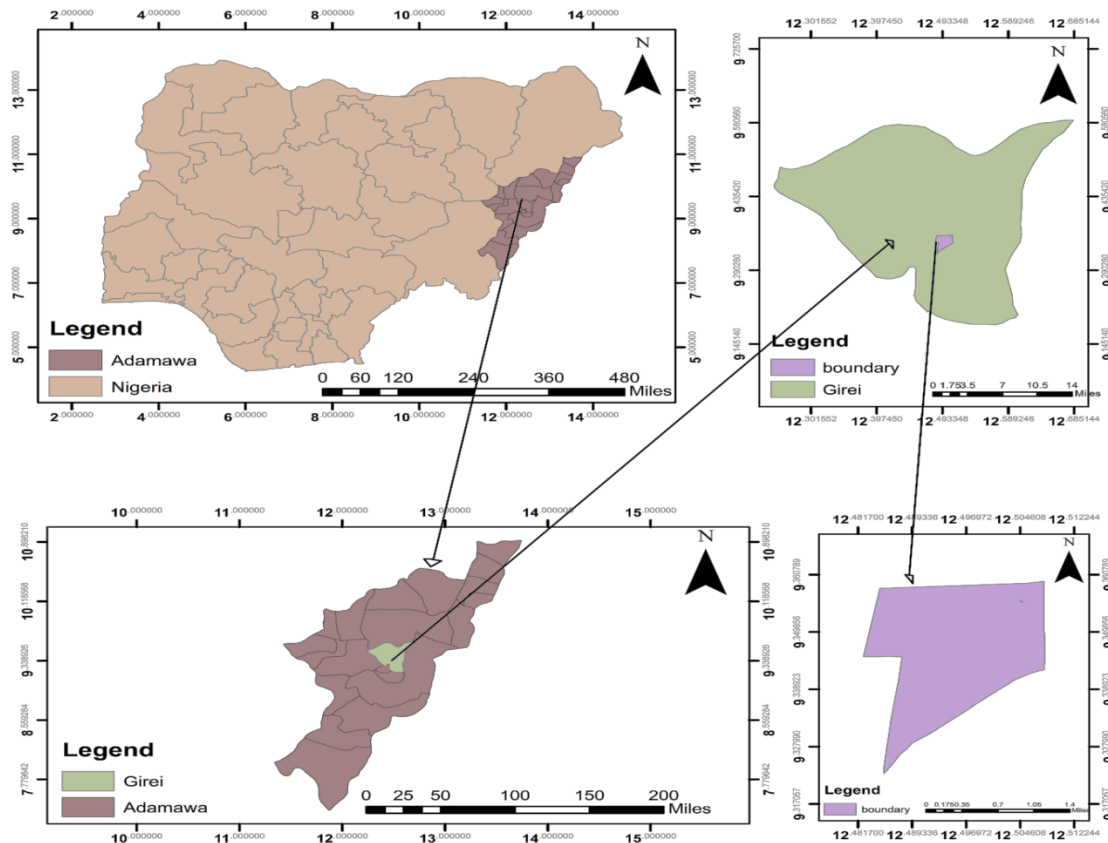


Figure 1. Map of study area at Modibbo Adama University, Yola Poultry House

The poultry products are raised in a pen house as shown in Plate 1 while others in a deep litter system in Plate 2.



Plate 1. Modibbo Adama University Poultry House



Plate 2. Deep Litter System

## **2.2 Method of Data Collection**

### **2.2.1 Survey Research and Interviews**

This was done to source out information through interviews. Survey data was obtained using interview through the following means:

Oral interviews: There was an interaction with those in charge of the poultry house. Issues raised included behaviors of poultry, lighting duration of the poultry birds, types and number of poultry birds raised in the poultry house, etc.

### **2.2.2 Observational Study**

Certain information on this study that could not be obtained through interviews were obtained through observation of the poultry house such as the type of poultry house, types of floor, wall, roofs, etc.

### 2.2.3 Weather Parameters and measurements

Data for weather parameters such as rainfall, temperature, wind speed, wind direction, and relative humidity were collected using secondary method at Geography Department, Modibbo Adama University, Yola [9]. In-situ measurements that were carried out in the poultry house were: temperature using non- contact infrared thermometer. Relative Humidity was recorded using digital hygrometer.

### 2.2.4 Thermometer

A Thermometer is a device that measures temperature or a temperature gradient (the degree of hotness or coldness of an object). The room temperature of the poultry house was measured using a non-contact infrared thermometer. The measurement within the Poultry house was taken and recorded for a period of eight weeks.

### 2.2.5 Hygrometer

A Hygrometer is an instrument used to measure the amount of water vapor in air, in soil, or in confined spaces. This instrument was used to measure the relative humidity of the poultry house for a period of eight weeks.

## 2.3 Method of Data Analysis

Methods of correlation and regression was used in order to analyze the extent and the nature of relationships between different variables. Correlation analysis was used to understand the nature of relationships between two individual variables of temperature and relative humidity that affect poultry production. Correlation coefficient ‘r’ was calculated using the formular provided by [10].

$$r = \frac{N(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}} \quad (1)$$

Where x and y are values of variables, and n is the size of the sample.

## 3 RESULTS AND DISCUSSIONS

### 3.1 Poultry house weather records and surroundings

The annual weather data on temperature, rainfall, relative humidity, wind speed and direction for the year 2021 were collected from Geography department Modibbo Adama University. The average mean result from the data obtained was summarized in the Table 1 [9].

Table 1. Average climatic data of Modibbo Adama University poultry house and surrounding

| Date      | Temperature (°C) |      |       | Relative Humidity (%) | Rainfall (mm) | Wind speed | Direction | Radiation |
|-----------|------------------|------|-------|-----------------------|---------------|------------|-----------|-----------|
|           | Tmax             | Tmin | Tmean |                       |               |            |           |           |
| January   | 37               | 25.3 | 31.15 | 74.7                  | 0             | 72.7       | N         | 17.14     |
| February  | 39.4             | 28.6 | 34    | 82.5                  | 0             | 77.4       | N         | 17.05     |
| March     | 44.4             | 27.5 | 35.95 | 74.13                 | 0             | 69.28      | N         | 17.16     |
| April     | 40               | 28.9 | 34.45 | 84.33                 | 10.3          | 74.45      | N/E       | 17.32     |
| May       | 38.3             | 26.5 | 32.4  | 88                    | 11.52         | 80.79      | N         | 17.04     |
| June      | 34.9             | 22.6 | 28.75 | 90.57                 | 19.21         | 76.59      | N         | 15.85     |
| July      | 35               | 23.7 | 29.35 | 91.3                  | 14.99         | 73.6       | N/W       | 15.4      |
| August    | 33.7             | 23.6 | 28.65 | 86.7                  | 31.15         | 104.4      | W         | 15.7      |
| September | 30.9             | 22   | 26.45 | 94.5                  | 10.3          | 69.3       | W         | 14.46     |
| October   | 31.9             | 23.2 | 27.55 | 89.97                 | 19.13         | 83.8       | W         | 14.16     |
| November  | 35               | 23.5 | 29.25 | 85.3                  | 0             | 82.32      | N/W       | 16.39     |
| December  | 35.4             | 24   | 29.7  | 79.68                 | 0             | 82.4       | N/W       | 15.81     |

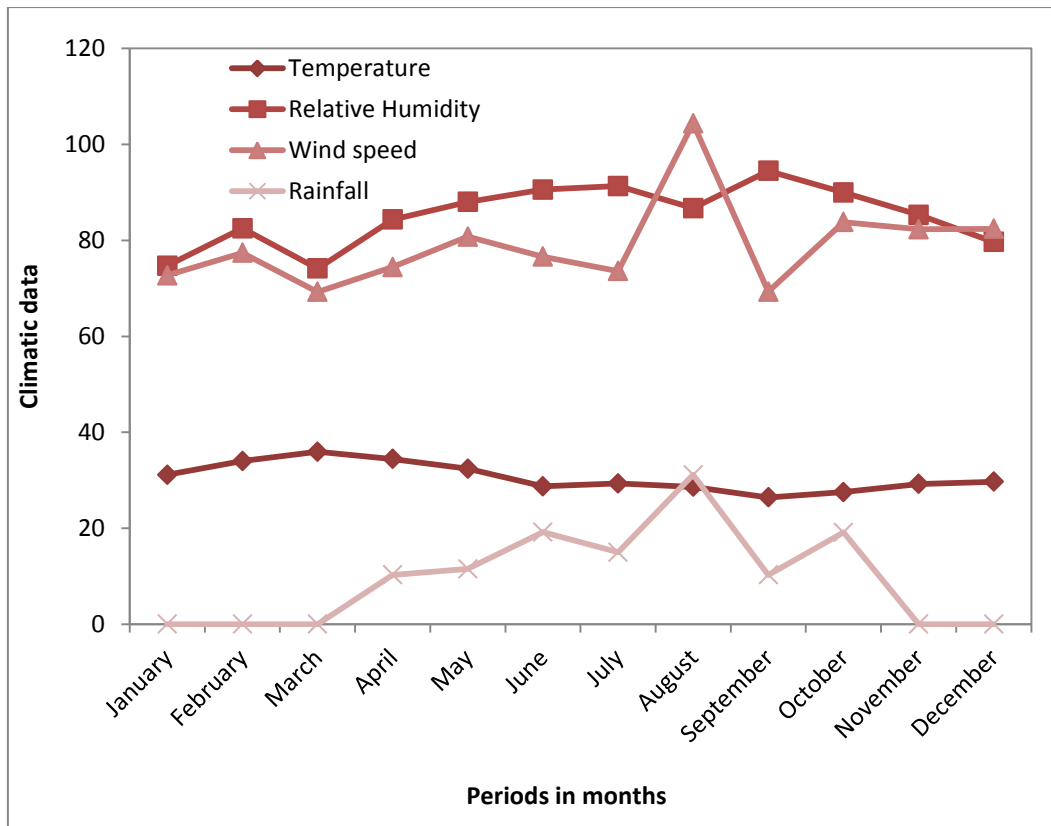


Figure 2. Annual climatic data against periods in months

These climatic elements were selected due to their effects on poultry production. While temperature is indicative of thermal stress, relative humidity affects breathing, food intake and utilization. Rainfall affects both the quality and quantity of feed while wind speed has an impact on outbreak of diseases. The annual weather records collected from Geography Department Modibbo Adama University, Yola is presented in Table 1. Temperature of month that had the highest mean was 35.95°C in the month of March while the lowest mean was 26.45°C in the month of September. This had implication of reduction in poultry feed intake which is in line with [11] that says temperature between 21°C and 38°C decrease feed intake and utilization. Temperature range of 32.4°C to 33.25°C as observed can affect the quality as well as the quantity of egg being produced. The highest relative humidity was 94.5% in the month of September while the lowest was 74.13% in the month of March. This high relative humidity induced the outbreak of disease in poultry through the creation of conducive breeding environment for disease pathogens. High rainfall and wind speed could also affect the poultry structures especially where the foundation and the material of construction is not strong enough to withstand it. Results of in-situ measurements of climate data were presented in Figure 2. Some of the records exceeded the standard requirements.

### 3.2 Modibbo Adama University Poultry Housing

The Poultry house in Modibbo Adama University was constructed in such a way to meet the environmental condition of the birds. A good housing system was provided for the birds in order to obtain maximum output. The poultry house consists of the following dimensions:

Table 2. Structural description of Modibbo Adama University poultry farm

|                          |  |
|--------------------------|--|
| Dimensions of the house. | Dimension of poultry house = 27.3m x 12.4m, Window size= 19.7m x 1.13m, Dwarf wall= 1.36m, Door size= 1.92m x0.97m, Foot dip= 0.6m x 1.1m                                |
| Roof                     | The roof was made of aluminum and the shape of roof was gable roof.  |
| Building orientation     | The orientation of the poultry house was East-West.  |
| Types of system          | The birds were raised in deep litter system.   |
| Floor                    | The floor type was of concrete   |
| Wall                     | The walls were constructed 1.3m high on the sides for good ventilation and the remaining was covered with nets to prevent the entrance of insects, rabbits, lizards, etc |
| Slope                    | The house was constructed on a flat land to avoid erosion and excessive sunlight.  |
| Insulator                | Nylons were attached at side of the walls and door for control of moisture during brooding.  |
| Ventilation              | Cross ventilation existed there and there was also a provision of fan in the poultry house for air circulation during hot seasons  |
| Ceiling                  | There was no Ceiling constructed   |
| Foot dip                 | Foot dip at the entrance of the poultry house was provided which contained disinfectants.  |
| Pens                     | Pens were constructed for raising of the birds   |
| Sunshine hours           | The sunshine hours were between 11-13 hours. There was no provision for light in the night for the birds as the source of the light was faulty.                          |

#### 4.2 Data obtained from the poultry farm

Measurement of the room temperature and the relative humidity were recorded between the periods of May to July 2021 as presented in Table 3.

Table 3. Daily room temperature of Modibbo Adama University Poultry House in (°C)

| No of weeks | Day1 | Day2 | Day3 | Day4 | Day5 | Day6 | Total | Mean  |
|-------------|------|------|------|------|------|------|-------|-------|
| 1           | 34.4 | 32.9 | 34.2 | 31.1 | 32.6 | 32.4 | 197.6 | 32.93 |
| 2           | 34.7 | 32.1 | 32.1 | 32.0 | 33.8 | 30.0 | 161.7 | 26.95 |
| 3           | 30.0 | 31.7 | 30.2 | 30.8 | 31.6 | 30.0 | 184.3 | 30.72 |
| 4           | 27.1 | 30.9 | 34.1 | 34.7 | 31.9 | 32.0 | 190.7 | 31.78 |
| 5           | 28.1 | 31.0 | 27.0 | 33.0 | 31.9 | 29.6 | 180.6 | 30.10 |
| 6           | 28.9 | 30.3 | 29.4 | 33.9 | 30.9 | 28.7 | 182.1 | 33.35 |
| 7           | 27.6 | 28.5 | 29.0 | 30.1 | 28.7 | 29.5 | 173.4 | 28.90 |
| 8           | 30.0 | 27.2 | 27.9 | 29.1 | 31.3 | 31.1 | 176.6 | 29.43 |

As observed in Table 3, the highest temperature recorded within the poultry house for the first week was 34.4°C while the lowest was 31.1°C. For the second week the temperature increased to 34.7°C while the lowest temperature was 30.0°C. For the third week the highest temperature was 31.8°C while the lowest was 30.0°C. For the four, fifth, sixth, seventh, and eighth week the highest temperature recorded was 34.7°C, 31.9°C, 33.9°C, 30.1°C, and 31.1°C respectively while the lowest temperature for the four, fifth, sixth, seventh, and eighth week recorded was 27.1°C, 27.0°C, 28.7°C, 27.6°C, 27.2°C respectively. These increase and decrease in temperature was as a result of rainfall, wind speed and sunshine. According to [12] the temperature of the poultry house should be 16 to 24°C. If the room temperature decreases, the bird's body temperature will decrease. Likewise, if room temperature increases, the bird's body temperature will increase and may lead to death.



Table 4. Daily relative Humidity of Modibbo Adama University Poultry House in (%)

| No of weeks | Day1 | Day2 | Day3 | Day4 | Day5 | Day6 | Total | Mean  |
|-------------|------|------|------|------|------|------|-------|-------|
| 1           | 63   | 59   | 62   | 58   | 60   | 62   | 364   | 60.66 |
| 2           | 65   | 69   | 69   | 75   | 73   | 79   | 430   | 71.67 |
| 3           | 58   | 61   | 56   | 57   | 62   | 58   | 352   | 58.67 |
| 4           | 71   | 65   | 62   | 53   | 57   | 55   | 363   | 60.00 |
| 5           | 70   | 63   | 71   | 55   | 54   | 60   | 373   | 62.10 |
| 6           | 65   | 62   | 60   | 63   | 52   | 69   | 371   | 61.83 |
| 7           | 73   | 72   | 70   | 56   | 71   | 60   | 402   | 67.00 |
| 8           | 59   | 77   | 73   | 70   | 59   | 57   | 395   | 65.83 |

As presented in Table 4, the highest relative humidity recorded within the poultry house for the first week was 63% while the lowest was 60%. For the second week the relative humidity increased to 79% while the lowest relative humidity was 65%. For the third week the highest relative humidity was 62% while the lowest is 58%. For the four, fifth, sixth, seventh, and eight week the highest relative humidity recorded were 71%, 71%, 69%, 73%, and 77% respectively. The lowest relative humidity for the four, fifth, sixth, seventh, and eight week recorded were 55%, 54%, 52%, 56%, and 57% respectively. The relative humidity falls within the range as recommended by [13] however high humidifies at high temperatures create undesirable conditions for the hens and result in excessive condensation in the buildings. It also results in favorable conditions for microbial pollution growth in poultry litter, which increases the generation of ammonia (NH<sub>3</sub>) and CO<sub>2</sub>.

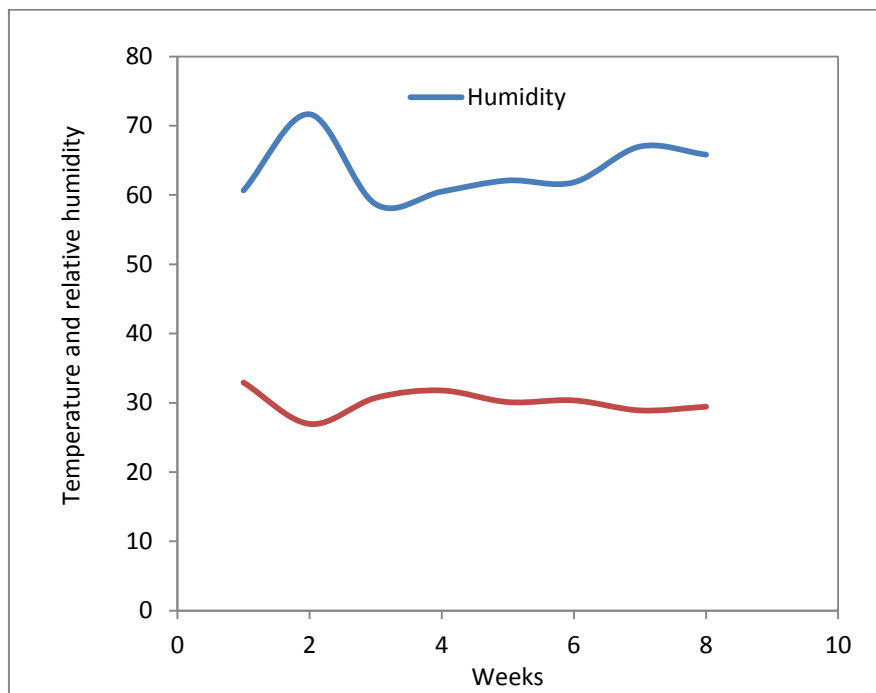


Figure 3. Average weekly room temperature and relative humidity against periods in weeks

From correlation analysis the ambient temperature against relative humidity shows a negative correlative value of -0.87786 which indicates a decrease in temperature will lead to an increase in relative humidity in the poultry farm. The highest temperature as seen in Figure 3 was 32.39°C while that of the relative humidity was 71.67%.

#### 4 CONCLUSIONS

In concluding this study, the highest temperature of 32.93°C was recorded in the poultry house as against the threshold value of 16 to 24°C for birds. Materials of construction that were identified for the poultry house included concrete floor, roofs made of aluminum, no ceiling, walls were concrete, Pens, nets. There might be need for expansion as the pen within the house does not

allow free flow of air and also to accommodate more birds. The highest relative humidity was 94.5% in September while the lowest was 74.13% in March; this can induce disease outbreak. There is therefore the need to improve the temperature by planting of trees, construction of ceilings, increasing the window size for ventilation system. The following recommendations can be considered for further research. Periodic monitoring of the poultry temperature, relative humidity, ventilation and other factors is very essential so as to improve the quality of birds being raised. Roof openings and other ventilation inducing techniques should be incorporated into the designs to generate ventilation by wind. Cutting down of trees should be discouraged; planting of trees around the poultry house should be encouraged to reduce the negative effects of solar radiation on comfort. Expansion of the poultry to have sufficient space for the birds.

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