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The Trends and Tides of Poultry Farm Building in Makurdi, Benue State, Nigeria

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ABSTRACT: *Adequate poultry housing is needed to protect birds from rain, direct sunlight, heat, cold, turbulent winds, dust etc. Birds are unlikely to perform satisfactorily if the housing is poor, therefore correct housing must be provided to meet the optimum environmental requirements for birds' performance either through growth or egg production. Moreso, poultry houses cannot function satisfactorily unless they are properly equipped and supplied with the needed appliances. In the light of this, nine farms where chosen from different parts of Makurdi (Wurukum, Welfare Quarters, Judges Quarters, Achusa and Lobi Quarters) and visited. Their housing structures and equipment were evaluated. Different aspects of their designs were compared with those found in the relevant literature. All the building accessed were naturally ventilated, open-sided houses. However, some aspects such as the stock density, orientation of buildings, space between buildings, roof designs needed improvement, while other aspects were almost non-existent such as bio-security and environment control. Typical house dimensions ranged from lengths (11m - 22m), widths (6m - 12m) and heights (3.0m - 4.7m). In Makurdi, there is need for an ideal poultry house which should be well ventilated, dry, clean and spacious.*

KEYWORDS: *Makurdi, Poultry, Farm buildings, Trends, Environment*

I. INTRODUCTION

Agriculture continues to be the most important sector of the Nigerian economy in terms of provision of employment in spite of its declining contribution to the nation's foreign exchange earnings. About 65% of Nigerians are estimated to depend on agriculture for their livelihood while 34.8% of the GDP and over 38% of non-oil foreign exchange earnings are contributed by the agricultural sector. The poultry sub-sector is the most commercialized of all the subsectors of Nigeria's agriculture (FAO, 2006).The term "poultry" covers a wide variety of birds of several species. The term is relevant whether the birds are alive or dressed. It includes chickens, turkeys, ducks, geese, swans, guineas, pigeons, peafowl, ostriches, pheasants and other game birds (Ekwue et al, 2003). The types of poultry that are commonly reared in Nigeria are chickens, ducks, guinea fowls, turkeys, pigeons and more recently ostriches. Those that are of commercial or economic importance given the trade in poultry, however, are chickens, guinea fowls and turkeys, amongst which chickens predominate (FAO, 2006).

According to FAO (2006), there are two distinct poultry production systems in Nigeria, as in most developing countries of Africa and Asia. The two systems are conventionally referred to as commercial poultry production and rural poultry production. The commercial system is industrial in nature and is therefore based on large, dense and uniform stocks of modern poultry hybrids. It is capital and labour intensive and demands a high level of inputs and technology. On the other hand, rural poultry production is by convention a subsistence system which comprises of stocks of non-standard breeds or mixed strains, types and ages. It is generally small-scale, associated with household or grass-root tenure and little or no veterinary inputs. Poultry houses are either naturally ventilated or mechanically-ventilated. Naturally ventilated houses are very common in developing regions of the world and in small to medium-size poultry operations. In such houses, it is important during hot weather to facilitate the flow of air into and out of the poultry house. Mechanically-ventilated systems are common in areas where climates are harsh and temperature extremes exist.

The majority of hot-weather mechanically -ventilated systems are negative-pressure systems, and these are of two types; inlet ventilation and tunnel ventilation. The latest technology available for housing of poultry to ensure that the optimum house temperature is maintained is by the use of tunnel-ventilated houses (Ernst, 1995). In tunnel-ventilated houses, the right air velocity and air humidity (which are important for hygienic condition) are carefully monitored and modified to maintain optimum conditions. In effect, the litter stays dry and the birds stay healthy and management required for these houses, the benefits are decreased mortality, increased bird weight and reduced feed conversion rates compared to the conventional naturally-ventilated, open-sided buildings. Mabbett (2011) has it that tunnel ventilation in combination with evaporative cooling will provide the necessary control of poultry house environments prevailing in tropical Africa. Indeed, proper use and control of such systems is the key to profitable poultry production in such areas. Hence, income generation is greater on tunnel ventilation farms than naturally ventilated farms.

Poultry as an important sector of agriculture which gives returns to the breeder on shorter generation interval. According to the Central Bank of Nigeria's report in 1999, Poultry eggs and meat contribution of the livestock share recorded improvement in Gross Domestic product (GDP) increasing from 26% in 1995 to 27% in 1999 which significantly sustained by availability and use of improved vaccines, curtailed mortality rates in birds, reduction in the tariff on imported day old chicks and parent stock. Furthermore, the relative ease of compounding efficient feed from available local feedstuffs, use of modern housing facilities that reduce mortality rate and enhance optimal performance of the birds are other factors that enhance the record (Ojo and Afolabi, 2000). Nigerians own many varieties of farm animals including poultry. Poultry ranks highest in number among the farm animals on the farm; mostly 80 – 90 % owned by small scale farmers (Idi, 2000). Poultry production is increasing very rapidly and the consumption is increasing faster than that of other kinds of meat beside beef (Bukar, 2003). The population of poultry in the country was estimated to be 104.3 million; chickens (72.4 million), pigeons (15.2 million), ducks (11.8 million), guinea fowl (4.7 million) and turkeys (0.2 million) (FDLPCS, 1992).

In Makurdi, Benue State which is the study area, many poultry farms have sprung up due to the need for animal protein. This demand for poultry meat has increased remarkably over the past years due to increased population which gives rise to increased growth in the number of fast food restaurants featuring chicken in the state. Hence it is pertinent to access the housing conditions of the birds so as to ascertain whether they conform to the recommended standards.The objectives of this study include; to access the structures of the poultry farm building in the study area; to investigate the type and number of birds that are and can be accommodated in each building; to appraise the building materials for the construction of the building; and to describe the type and size of the facilities as well as the method of waste disposal and environmental control.

II. METHODOLOGY

Study Area : Makurdi is the capital of Benue State-Nigeria. Makurdi is located at the North Eastern part of Benue State and lies on latitude 7º30'N and longitude 8º35'E. It is located within the flood plain of lower River Benue valley. The physiographic characteristics span between 73-167 m above sea level. Due to the general low relief sizeable portions of Makurdi is water logged and flooded during heavy rainstorms. This is reflected in the general rise in the level of groundwater in wells during wet season. The drainage system is dominated by River Benue which traverses the town into Makurdi North and South banks. It shares boundaries with Gwer West and Guma Local Government Areas including Nassarawa State.The town is divided by the River Benue into the North and South banks, connected by two bridges: the railway bridge and the dual carriage bridge. Makurdi lies in the tropical guinea savanna zone of Central Nigeria, experiences a typical climate with two distinct seasons. The dry season lasts from late October to March and the rainy season which begins in April to October is the period of intensive agricultural activities by the inhabitants mostly Tivs, Idomas, Jukuns and Igedes.

Temperatures are generally high throughout the year due to constancy of isolation with the maximum of 32^{o}C and mean minimum of 26^{o}C. The hottest months are March and April. The rainfall here is convective, and occurs mostly between the months of April and October and is derived from the moist and unstable southwest trade wind from St. Helena Subtropical Anticyclones (STA). Mean annual rainfall total is 1190 mm and ranges from 775-1792 mm. Rainfall distribution is controlled by the annual movement and prevalence of Inter-Tropical Discontinuity (ITD).The mean monthly relative humidity varies from 43% in January to 81% in July-August period (Tyubee, 2009).The geology is of cretaceous sediments of fluvial-deltaic origin with well-bedded sandstones of hydrogeological significance in terms of groundwater yield and exploitation (Kogbe *et al.*, 1978). Makurdi town which started as a small river port in 1920 has grown to a population of 297,393 people (NPC, 2006).

Data Collection :A total of nine farms where chosen from different parts of Makurdi (Wurukum, Welfare Quarters, Judges Quarters, Achusa Old GRA, Lobi Quarters) were selected at random and visited as a part of the survey of the trends and tides of poultry farm buildings in the area of study. The survey assessed the layout (arrangement) of the poultry structures and their facilities, investigated the type and number of birds that are and can be accommodated in each building, and appraised the building materials for construction. The size and materials for the construction of the structural elements (columns, beams, roofs, walls and floors) were also noted. The type and sizes of the facilities such as waterer and feeders as well as methods of waste disposal and environmental control are described. The summary of the farms visited is shown in table 1 and 2 below.

Table 1 Details of some poultry farms in Makurdi.

S/No	Name of Farm/Farmer	Location	Number of Poultry Birds	Type of Poultry Birds
1	Sam Poultry Farms	Wurukum	400	Broiler
2	Martytex Animal Care Services	Wurukum	2000	1800 Broilers 200 Layers
3	Rose Farms	Welfare Quarters	300	Broilers
4	Sophie Farms	Old GRA	500	Broilers
5	Adura Baba Integrated Farms	Achusa	1000	Broilers
6	Valliepride Farms	Achusa	1500	Broilers
7	Averd Farms	Judges Quarters	1800	1000 Broilers 500 layers 200 Geese 100 Turkeys
8	Ashaver Farms	Judges Quarters	1500	1000 Broilers 500 Layers
9	Shihel Farms	Lobi Quarters	2000	Broilers

III. RESULTS AND DISCUSSION

All the poultry farms utilize naturally ventilated buildings with similar and in some cases different design specifications. Some of which are detailed in table 1 and 2 below. However, the following are

S/ No	Name of Farm/Farmer	No. of buildings	Typical building Dimensions in meters (Length, Width, Height)	Stock density (birds/m^2)	Building orientation	Space between buildings (metres)	Roof Design
1	Sam Poultry	1	11, 6, 4.0	5–7	North- South	-	Flat
2	Martytex Animal Care services	4 1	9, 8, 3.5 6, 11, 3.0	5–7 3-4	North- South	2 -	Gable Flat
3	Rose Farms	1	9, 6, 3.0	5–7	East - West	-	Gable
4	Sophie Farms	1	22, 8, 3.5	3-4	North- South	-	Flat
5	Adura Baba Integrated Farms	4	7, 6, 3.7	3-4	North- South	2	Flat
6	Valliepride Farms	5	11, 6, 3.9	5–7	East - West	2.5	Flat
7	Averd Farms	4	22, 10, 4.0	3-4	East - West	4	Gable
8	Ashaver Farms	3	15, 9, 4.7	5–7	North- South	3	Semi - monitor
9	Shihel Farms	2	22, 12, 4.5	3-4	East - West	5	Gable

Table 2. Features of the farms in Makurdi.

summarized during the field visits which were conducted between November 2013 and February 2014. Some pictures from the field visits are also presented.

Access and Services : All farms were easy to access as they were either near the main road or had good roads leading to them. Most the farms do not have processing plants and feed mill exception of Adura Baba Integrated Farms which have a processing plant and a feed mill. Averd farms has its own feed mill. Hence, the other farmers purchase feeds from feed dealers (Hybrid feeds, Vital feeds, Top feeds, etc). None of the farm were with hatcheries or breeding farms. All farms had water and electricity supply.

Stocking Density : The average stocking density (floor space) was 5 – 7 birds/m^2 and most farms were not producing at their maximum capacity (e.g. Rose farms and Sophie farms). Hence, the farmers productive potentials were not actually realized since birds grow better with enough space. The recommended stocking density by FAO (2011) is 3 - 4 bird/m^2.

Farm Houses : The number of houses on the farm varied significantly (Table 2). The houses were basically north-south or east-west-oriented. East-west orientation is preferred in the tropics (Makurdi inclusive) as it helps to minimize exposure to direct sunlight. Typical house dimensions ranged from lengths (11m - 22m), widths

(6m - 12m) and heights (3.0m - 4.7m). Today, a height of 3.9m - 5.3m is preferred for greater ventilation in order to reduce heat stress on birds (Ernst, 1995). Similar sizes and types of materials were used for elements of building construction. These elements are discussed below.

1. **Foundation :** The foundation of all the farms are made of poured concrete. It is the best foundation materials because it is hard, durable and strong in compression. Concrete blocks were used for the foundation wall.

2. **Floors :** All farms visited had the deep litter arrangement in place The floors of the building consisted dirt with sawdust, wood shavings or rice hulls 5 – 10cm deep. For a deep litter arrangement, FAO (2011) recommends that concrete floors of 80 –100mm thickness obtained from a stiff 1:2:4 or 1: 3:5 (cement: sand: gravel) mix laid on a firm base of at least 150mm ground level. This was however difficult to ascertain whether this was followed in constructing the floors. The floors were disinfected between grow-outs using commercial disinfectants.

3. **Walls :** Most of the walls of the farms visited were open-sided walls were by masonry blocks were raised to about 1m or their walls were mainly one to three rows of concrete blocks with a hexagonal wire mesh (1.25cm) completing the upper part of the walls. Lengths of timber were used alongside the wire mesh as a means of securing the wire mesh to the block.

4. **Doors :** The doors were usually made of similar materials as the walls (wire mesh and timber or wood/ wood and zinc sheets). Most of the main entrance doors were made of zinc metal sheets.

5. **Roof Shapes and Covering (Roofing system) :** Most of the farms made use of the flat roofing design except Averd farms and Ashaver, farms; and Shihel farms used the double-pitched(gable) roof design. Gabled roofs reduce solar heat loading. All the farms used zinc roofing sheets as roof cover. Zinc is a good covering material since it is impervious to rain and keeps out radiation (Ekwue et al, 2003). It is however, a good absorber and emitter of radiant heat. For better environmental control using zinc, roofs should be insulated and/or have heights of 4m to 5m (Lindley and Whitaker, 1996).

6. **Windows :** Shutters or curtains made from feed sacks or jute materials were used to cover the buildings that had window openings. All window frames were covered by wire mesh.

Feeders and Drinkers : None of the farms visited used automatic feeders or drinkers. The common feeders were of galvanized steel and wooden trough types (0.6m – 1.6m length, base width of 5 – 8cm for 8 weeks old birds and 20 – 25 cm for adult birds) and common drinkers of plastics with the capacity range of 2 – 8 litres.

Ventilation : The buildings of the farm visited were open-sided. They relied on natural airflow through the buildings (natural ventilation) commonly found in the topics. Chickens tolerate cold weather better than wet sticky foul-smelling litter resulting from inadequate ventilation.

Brooding : Chicks were normally brooded in the entire house by placing waste feed bags and polyethene bags around the entire floor structure and providing heat using electric bulbs. FAO (2011) recommends that the brooding building should be isolated from other buildings by 30m or more and should be self-contained in terms of field supplies and storage equipments. Most of the farms visited were using the same building for brooding (Rose farms, Sam poultry farms, Sophie farms) and the ones using different building for brooding did not use the specified distance for isolation. Full-sided wall poultry house is recommended for brooding day-old chicks; this was not observed in any of the farms.

Water Supply : All farms got their water either from the private wells or drilled boreholes as it is difficult to gain access to portable water from public supply in Makurdi metropolis.

Bio-Security : The only means of bio-security seemed to be chlorination of the water for birds. No farms had any footbaths at the doors to the buildings, though the floor was regularly disinfected. In all the farms visited, protective clothing or footwear were not provided for service personnel or visitors who entered these facilities. Moreso, quarantined periods were not established for new animals to be introduced into a group or facilities.

Waste Disposal/Management : Waste litter generated from these farms was given to other farmers to be used as fertilizers, packaged in bags and sold or disposed using the public disposal system. Averd farms packaged litter from layers and sells to interested persons, but dispose litter from broilers using public disposal. Dead birds were either burned or given to the dogs.

IV. CONCLUSION

Generally speaking, the intensification of poultry farming in Makurdi and Benue State at large has been towards large commercial flock production. With this trend has come an increase in confinement housing for poultry, hence the investment needs in terms of buildings and equipment. Poultry buildings or constructions entail providing sheds or environment for accommodating birds and store rooms (feeds and equipment). The extent to which these birds are exposed to the environment (sunshine, rain, wind) is determined partly by the system of management and this includes the design of the housing used for birds.This work presents the trends and tides of poultry house building in Makurdi, Benue State. The essentials of poultry buildings as they relate to housing of birds and equipment have been delve into and the different types of houses and equipment for operational activities in a poultry production management system were compared with current standards. However, it is pertinent to state that there is great need for improvement in the areas of stock density, orientation of buildings, space between buildings, roof designs and bio-security.

The recommended stocking density by FAO (2011) is 3 - 4 bird/m^2. The stocking density used by farmer in Makurdi is 5-7 bird/m^2 which gives less space for the birds. Less space creates stressed social behaviour, allowing disease vulnerability and cannibalism and leaving weaker birds deprived of feed. Getting the stocking density right is important to the farmer to ensure proper return on his investment.The orientation of some of the buildings in Makurdi are in North - south. According to Czarick and Fairchild (2008) in Daghir (2008), naturally ventilated houses should always be orientated in an east–west direction. The reason for this is to minimize the possibility of direct sunlight entering the house. Direct sunlight striking upon a bird can dramatically increase the effective temperature a bird is experiencing. Direct sunlight can increase the surface temperature of a bird to well above 38°C, creating a heat stress situation at air temperatures that would not normally be thought of as problematic.

In terms of the space between buildings as a group or for brooding buildings, more attention is needed since none of the buildings accessed attained such recommendations. FAO (2011) recommends that If there are several poultry buildings in a group, it is desirable to have them separated by 10–15 metres in order to minimize the possibility of spreading disease. Brooding buildings should be isolated from other poultry buildings by 30 metres or more, and be self contained in terms of feed supplies and storage of equipment. The most used roof design in Makurdi is the flat roof design and Zinc metal sheets were used as their roof cover. The roof should be double-monitor type and be made with alu-zinc, Compared to the gable roof, this design, although more expensive to construct, allows considerable light in the centre of the building which improves ventilation considerably.

The only bio-security measure practiced in the Makurdi is the chlorination of water for the birds. More attention should be given to other bio-security measures such as providing footbath at the doors to the buildings, protective clothing or footwear should be provided for service personnel or visitors who enter these facilities and specific quarantined periods should be established for new animals to be introduced into a group or facilities.

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APPENDIX

Some pictures taken from field visit.

Picture 1: Pictures from Averd farms

Picture 2: Pictures from Rose farms

Picture 3: Pictures from Martytex animal services farms

Picture 4: Pictures from Ashaver farms.