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Litter and Ammonia Management in Nigerian Small Scale Poultry Industries: An Overveiw

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Abstract: The rapid development of the poultry industry in Nigeria has resulted in an increase in the demand for poultry litter materials. Wood shaving is the most common and effective litter material used by the poultry industry in Nigeria though sawdust is also used to some extent by small poultry producers. The management of the deep litter in a poultry house is of the greatest importance and seems to be one of the most neglected aspects of poultry husbandry in Nigeria. It is frightening to see broilers, layers and breeders maintained throughout the winter months on accumulation of their own droppings. Parasitic and bacterial infection are highly likely and the most serious consequences of all are in breeder houses where wet litter can have a calamitous effect on the feet of the cocks causing accumulations of infected litter on the feet and subsequently leading to a fall in the level of fertility. Farmers here in Nigeria tend to pay little attention to litter management and concentrate on nutrition and disease control. The adoption of an appropriate strategy for litter management aiming at optimizing both bird performance and cost of production largely depends on the availability and good quality bedding material at affordable cost. The economic significance of good litter management practices are hereby highlighted in this study.

Key words: Litter, ammonia, management, breeders, poultry industry, Nigeria

INTRODUCTION

The rapid development of the poultry industry in Nigeria has resulted in an increase in the demand for poultry litter material (Adene, 1989). It is becoming increasingly difficult to secure enough good quality litter that can help to control economic losses related to poor litter management (Sa'idu *et al*., 2008). Such losses can be due indirectly to poor performance and mortality or as a result of condemnation due to downgrading at the production level (Adene, 1989). Cost of litter is therefore becoming an increasingly important item in the cost of chicken production.

When planning a total management program for the production and marketing of chicken, all aspect of management such as ventilation, house temperature and bird density interrelate with litter managements. However, a good litter material must satisfy the following: insulate the bird from a cold and damp floor, help to conserve heat by insulating and provide supplemental heat through fermentation by feacal micro-organism, receive droppings and absorb moisture from feces and respiratory processes, provide a warm, soft and spongy surface for optimum comfort of the birds (Ruszler and Carson, 1974). Therefore, to be able to play its role efficiently the litter material should be dry, friable, absorbent, dust free, homogenous, disease free, non toxic and inexpensive (Shannaway, 1992). The litter should not become wet and caked. Litter should adhere slightly and breaks up when drop from the hand (Courtecuisse *et al*., 1990). When litter is too wet, it will ball up when squeezed in the hand when too dry it will not adhere. All old litter should be removed and the house should be completely cleaned and sanitized between crops. Start each crop with new litter to depth of 5-10 cm over the floor, equivalent to 500 kg/100 m^2 (Ritz *et al*., 2004). Farmers here in Nigeria tend to pay little attention to litter management and concentrate on nutrition and disease control. The adoption of an appropriate strategy for litter management aiming at optimizing both bird performance and cost of production largely depends on the availability and good quality bedding material at affordable cost. The economic significance of good litter management practices are explained.

SITUATION IN NIGERIA

Nigeria import day old parent-stock annually out of which 90% are of the broiler type. Parent stock and broilers are raised exclusively in a deep litter system

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(Durojaiye *et al*., 1991). In most cases, commercial layers are also raised on deep litter during the rearing period. This means that the annual requirement in terms of litter material is high. Wood shaving is the most common and effective litter material used by the poultry industry in Nigeria though sawdust is also used to some extent by small poultry producers. These materials are supplied mainly by the woodwork industries and furniture enterprise. However, with the rapid development of the poultry industry, there is a periodic shortage of wood shavings resulting in price increases. Indeed small poultry producers find it difficult to get wood shaving in sufficient amount and very often use less than the required amount. Now wood shaving is accessible mainly to big poultry producers that can afford to purchase in larger quantity.

TYPES OF LITTER MATERIALS USED IN NIGERIA

Litter will differ according to the nature of the materials and their constituent (Shannaway, 1992). In general any material that satisfies the criteria mentioned above can be used. Possible candidate include wood shaving, sawdust, shredded paper and paper chips, dry straw, rice bran and maize cobs and so on. These materials have been used successfully throughout the world though their ability to hold moisture, pH status and microbial count may vary dramatically. Apart from wood shaving, the only material that is relatively easily available locally is sow dust. It is widely used as flow litter in some part of the world (Ruszler and Carson, 1974).

LITTER MANAGEMENT

The management of the deep litter in a poultry house is of the greatest importance and seems to be one of the most neglected aspects of poultry husbandry in Nigeria (Ezeokoli *et al*., 1984). It is frightening to see broilers, layers and breeders maintained throughout the winter months on accumulation of their own droppings (Ruszler and Carson, 1974). Parasitic and bacterial infection are highly likely and the most serious consequences of all are in breeder houses where wet litter can have a calamitous effect on the feet of the cocks causing accumulations of infected litter on the feet and subsequently leading to a fall in the level of fertility (Ritz *et al*., 2004). Good litter need care: it is not achieved by accident. A start must be made with adequate material which can be wood shaving, sawdust or straw or mixture of these. Some poultry farmers use shredded paper. A depth of at least 150 mm (6 inches) is required and should be placed on a dry damp-free base (Moore *et al*., 1996). Studies have shown that litter on an earth base will contain on the average as much as 10% more moisture than a litter on a damp-proofed concrete floor so that under these circumstances. It may be more difficulty, although by no means impossible to manage (Terzich *et al*., 1998a). The ease with which the litter is maintained in a friable state is greatly influenced by the environmental conditions in the house, uniform temperatures and air movements are essential to good litter conditions and an even distribution of the air by diffusion of incoming air are capable of giving the best results (Terzich *et al*., 1998b).

Danger areas in litter management are drinker points due to splashing or leaking and feeding areas due to concentration of birds. It is essential to turn the litter frequently and it is often desirable to turn it all from time to time, especially if it is working properly. There is no denying that this is a very laborious task but mechanical implement can help enormously. The important thing to appreciate is that once the litter is working the activity of the birds themselves will keep most of it, if not all in a good condition. The activity benefits the birds, they obtain some nutrient from the litter and the whole atmosphere and environment in the house can be pleasant. Working litter is warm and adds warmth to the house but wet litter is invariably colder and takes heat from the house in an attempt to dry out (Ruszler and Carson, 1974). High ammonia levels for all ages of poultry are potentially dangerous and also most pleasant for the operator, levels up to 15-20 part per million (ppm) are acceptable. If levels go over 40 ppm there may be reductions in food intake but if level go >50 ppm, the delicate membranes lining the respiratory tract are affected and respiratory disease is much more likely, possibly even resulting in blindness. By and large, it is possible to estimate the levels of ammonia fairly accurately by using ones sense of smell. If it is definitely in the ave then it is really too high but there are more accurate ways of getting an estimate either by using a litmus paper color or more accurately by using a dragger gas detector. The latter can detect levels of a large number of gases by pumping samples of the air with hand bellows through indicator tubes that enable an immediate reading to be obtained.

AMMONIA TREATMENT

Various strategies are employed to manage litter so as to minimize the exposure of birds to high ammonia concentrations. Controlling the litter moisture content and pH are the major avenues for reducing ammonia volatilization (Kristensen and Wathes, 2000). Litter

moisture is managed by minimizing water leaks and ingress while maintaining adequate ventilation to remove moisture from the building. Maintaining the litter pH <7 has been shown to minimize ammonia volatilization. Ammonia release is maximized when the litter pH is 8 or above. However, control of litter pH over the life of the flock has proven to be a difficult task, in part because it is not commonly measured (Carlile, 1984). In poultry litter, the decomposition of uric acid has been shown to be brought about almost exclusively by aerobic bacteria (Schefferle, 1965). It was reported that in the litter uric acid was converted to ammonia by some of the organisms but to urea by the majority. The use of urease inhibitors such as Phenylphosphorodiamidate (PPD) and N (n-butyl) Thriophosphorictriamide (NBPT) to disrupt the transformation of urea to ammonia has been demonstrated by Varel (1997).

It has been shown that the uricase enzyme can be inhibited by the addition of certain minerals to poultry manure (Kim and Patterson, 2003). The use of the urease inhibitor is likely to substantially reduce the amount of ammonia released from the litter however it's effect last for only (7-14 days) which would require reapplication for continued effect. Using a urease inhibitor may reduce ammonia emissions whilst improving the fertilizer value of the poultry litter through increased nitrogen content (Kim and Patterson, 2003). The production and volatilization of ammonia is inhibited by low pH levels because pH directly affects the equilibrium between NH_4^+ and NH_3. Thus, a clear strategy for ammonia emissions reduction is to maintain a relatively low litter pH. One method of doing this is to apply phosphoric acid (H_3PO_4) to the litter (Moore *et al*., 1996).

The quality of the litter as plant fertilizer would be improved by the increased nitrogen level. However, this treatment greatly increased the water soluble phosphorous levels and this increases the potential for environmental damage through the offsite movement of phosphorous. One very widely used method of suppressing ammonia loss from poultry litter is the application of alum [Al_2 (SO_4) $318H_2O$]. Researchers have demonstrated that this treatment significantly reduces ammonia loss from the litter resulting in higher nitrogen concentration in the litter when land-applied as a fertilizer (Moore *et al*., 1996).

It has also been shown that this treatment reduces water soluble phosphorous levels in the final litter, reducing the potential for offsite export of this nutrient (Moore *et al*., 1996). Another widely used method of suppressing ammonia loss from poultry litter is the application of sodium bisulphate ($NaHSO_4$). Some research however has failed to demonstrate a difference in ammonia emissions from litter treated with $NaHSO_4$ and untreated litter. Sodium bisulphate is commonly used in Kentucky and Pennsylvania broiler operations and was used as part of the standard operating procedures (Ritz *et al*., 2004).

CONCLUSION

Litter management in poultry house is an important and neglected aspect of poultry husbandry in Nigeria. However, ammonia can have detrimental effects on poultry production performance, health, welfare and on the environment. Bird performance and health can be affected by both respiratory disease challenge and physical damage due to high ammonia concentration. Research is needed to develop methods of reducing nitrogen excreted by poultry to develop methods of manure management and treatment that will retain nitrogen in environmentally benign forms and to develop methods and technologies to accurately quantify ammonia release from agricultural facilities.

The old litter should be removed completely and the house should be cleaned and sanitized between crops. Start each crop with new litter to depth of 5-10 cm over the floor which is equivalent to 500 kg/100 m^2 because bird performance, carcass quality and profitability are affected by litter management used.

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