Systems of poultry husbandry[1]

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ABSTRACT: There are many systems employed in poultry husbandry but each represents an economic method of poultry production under a given situation. The type, the area and the location of a farm partly determine the system to be adopted. The economic status, time and the understanding of the farmer also help to determine which system is used. For a poultry husbandry system to be considered as less intensive, or an 'alternative system', it should be: (1) less confining - birds kept in cages should have more room to get up and lie down fully; (2) less crowded - birds in pens should be kept in smaller groups and with more floor area per bird; and (3) better able to meet the bird's food and perching requirements. The systems which are most suited to small scale poultry husbandry are: (1) free range, in which the birds can roam at will over an extensive area; (2) intensive, in which the birds are wholly confined, such as the deep-litter system; and (3) semi-intensive, in which the birds are partially confined, but have at least occasional access to an outside run or scratching shed or straw yard. Among them, the extensive systems or the traditional systems are not only favoured by a small minority of farmers, but already have a place in many developing countries.

Key words: poultry husbandry, cages, barn system, free range

INTRODUCTION

There are many systems employed in poultry husbandry but each represents an economic method of poultry production under a given situation. The type, the area and the location of a farm partly determine the system to be adopted. The economic status, time and the understanding of the farmer also help to determine which system is used (Thear and Fraser, 1980; Kekeocha, 1984). Economically, many factors influence meat and egg production costs in different systems for chickens. These include housing system, area per bird, labor requirements, food intake, hygiene, mortality and bird performance. Undoubtedly, the simpler housing systems tend to be lower in production costs, while the more sophisticated, well insulated, controlled environment buildings containing intensive systems at higher stocking densities are much more expensive to run but also are more productive and overall, where energy is cheap, more economic (Appleby *et al*., 1992, Elson, 1992). This paper will review systems of poultry husbandry.

SYSTEMS OF POULTRY HUSBANDRY

In general, the system of management defines the extent to which birds are exposed to sunshine or ultraviolet rays and pasture and it also describes the housing pattern of poultry husbandry. The extensive system permits the fullest exposure to pasture and sunlight; the

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intensive system practically precludes or minimizes this exposure, while in between the two is the semi-intensive system (Oluyemi and Roberts, 1979). Richards (1987) also explained that the type of house required in poultry husbandry will depend on the system of management, which in turn will depend on the amount of space available. The systems which are most suited to small scale poultry husbandry are: (1) free range, in which the birds can roam at will over an extensive area; (2) intensive, in which the birds are wholly confined, such as the deep-litter system; and (3) semi-intensive, in which the birds are partially confined, but have at least occasional access to an outside run or scratching shed or straw yard. Among them, the extensive systems or the traditional systems are not only favored by a small minority of farmers, but already have a place in many developing countries (Aini, 1990; Sainsbury, 2000).

Ewbank (1981) defined the word 'intensive' as the husbandry system which is carried out within buildings and involves either the crowding of large groups of animals within restricted spaces (eg. fattening pigs kept on concrete floored pens and table birds reared in broiler houses), or the confining of one or more animals in small crates, stalls or cages (e.g. crate-reared veal calves and laying hens in wire cages). For a husbandry system to be considered as less intensive, or an 'alternative system', it should be: (1) less confining - birds kept in cages should have more room to get up and lie down fully; (2) less crowded - birds in pens should be kept in smaller groups and with more floor area per bird; and (3) better able to meet the bird's food and perching requirements (Figure 1).

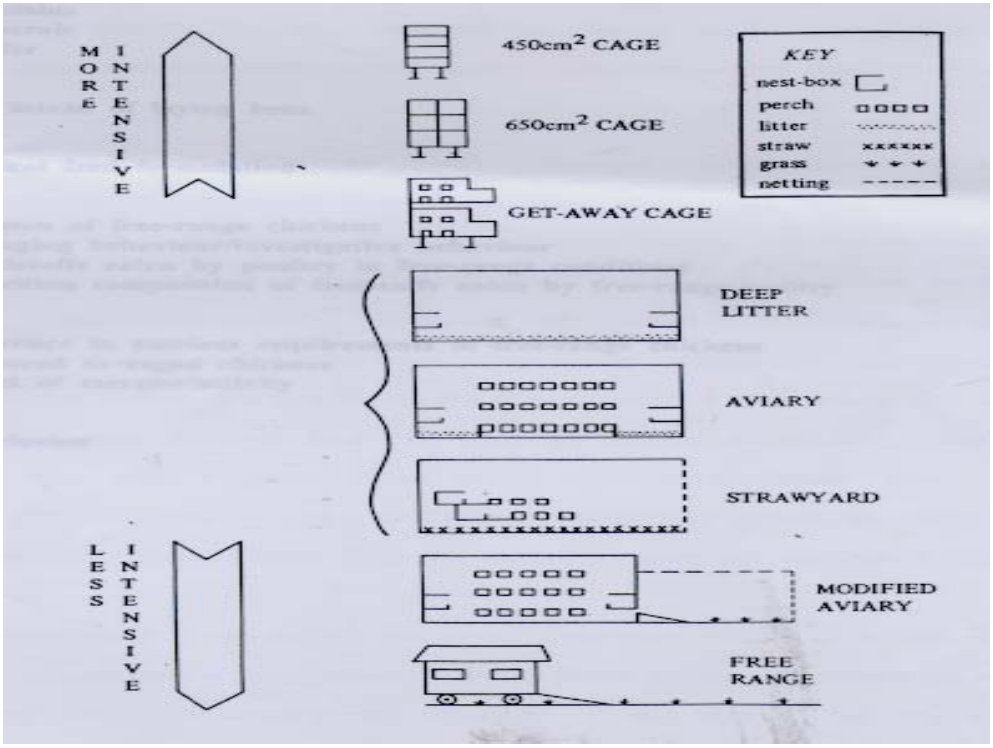

Figure 1. Housing systems for 'alternative systems' of poultry husbandry (from Ewbank, 1981).

Broadly speaking, choosing between different systems of poultry husbandry is particularly difficult, involving decisions about the balance between capital and running expenditure and judgments about trends in public opinion (and hence availability of premiums). Possibly changes in legislation on housing conditions must also be anticipated, because welfare legislation has a direct effect on production costs. Where eggs are produced in a particular system to meet market demand they can be expected to command a premium and therefore the extra costs of production should be more than covered (Appleby *et al*., 1992).

In the UK, for example, there is a trend away from cage systems due to the pressure from welfare interests, helped along by legislation. There are also signs in the USA that consumer and client sentiment is moving slowly towards a more perceived humane production and processing system for livestock, especially hogs and cattle. Within the poultry segment in the USA, commercial egg production is under more intense scrutiny than broilers, but there are aspects of live-bird production and processing that deserve evaluation (Shane, 2000).

Cages

Poultry industry practices, particularly the use of wire cages, are frequently subjects of criticism (Wegner, 1990). Historically, criticism of conventional caging systems are due to lack of opportunities for perching, lack of litter material and nesting areas (Craig and Swanson, 1994). Other criticisms of the cage systems are that cages impose a very restricted area for movement, leading to high proportions of birds with feather damage, overgrown claws, foot lesions and brittle bones. These welfare issues have attracted considerable attention in recent years regarding effects on the quality of life of laying hens (Barnett and Newman, 1997).

Conventional cages fail to provide the all welfare concerns of freedom of movement, freedom of fear, comfort and shelter, suitable flooring and freedom to display most normal patterns of behavior of laying hens (Sainsbury, 2000). Therefore, research on different systems of egg production has been prompted by public concern about the welfare of hens housed intensively in cages (Appleby *et al*., 1988). In Europe, for example, alternative laying systems are being forced on poultry producers in place of traditional cage systems in beginning the 1st of January, 2013 (Barnett, 2000; Sainsbury, 2000; Broom, 2001).

Barn System

Of the alternative systems available in Figure 1, the barn system (hen housed loose in sheds with litter, perches and nest boxes) is probably the most easily adopted in Australia and Indonesia. Indeed, some farmers produce barn eggs in Australia and promote this production system at point of sale (Barnett, 1998). Thomas *et al*. (2000) also suggested that barn egg production systems may provide a suitable alternative to intensive cage systems.

Historically, the deep litter or built-up litter system came into vogue during the Second World War due to the shortage of labor for regular removal of litter from the poultry houses (Feltwell, 1954; Oluyemi and Roberts, 1979). The system is particularly suitable for farmers with little land, especially where land is expensive or in short supply like urban centers (Oluyemi and Roberts, 1979; Thear and Fraser, 1980). After many years of use it remains as a thoroughly satisfactory system of housing layers intensively, although of high capital cost (Sainsbury, 2000). It has also been used by laying poultry farmers in Indonesia (Sugandi *et a*l., 1975; Hatmono, 1999).

The deep litter system is an acceptable alternative to the public since it provides a better opportunity for movement and social interaction, and also answers other welfare concerns (Thomas *et al*., 2000). Thus, it is likely to fill an important niche in the community's requirements for non-cage eggs (Barnett and Parkinson, 1999). This system provides a number of welfare advantages. For example, there is freedom to move within the house area and an opportunity to stretch wings to the full extent and to exercise in a variety of different ways. There is also the opportunity to use nest boxes and achieve privacy when laying. There is also no exposure to predators in this system (SSCAW, 1990).

The deep litter system is said to be more humane than the cage system. The hens are free to walk around and peck in the litter, while the year-round protection from cold and rain, together with artificial lighting, ensures a high level of egg production (Thear and Fraser, 1980). In any litter-based system, birds defecate on the litter and the consequences of this are also important. Effects depend to a large extent on the behavior of the birds, which is an integral feature of the functioning of the system. Thus, faeces do not simply accumulate but are dispersed. They may then dry out and be broken down by bacterial action. Bacteria will then decay the droppings and litter into a mass of dry

and friable material which is odorless and comparatively hygienic (Kekeocha, 1984; Appleby *et al*., 1992).

Another advantages of the deep litter systems as compared to free range systems was illustrated by Feltwell (1954), who considered that egg collection may be difficult and time consuming in the free range system versus the deep litter system. Kekeocha (1984) also suggested that deep litter systems can make use of labor saving devices to provide better working conditions. Birds are continuously housed and therefore are protected from thieves and predators. This system can be used for both layers, breeders and broilers as well.

Deep litter house may vary in size, but one with a capacity of 2,000–3,000 birds, depending on the ages of the birds, is usually economical in the tropical areas. Large sizes may be used with skilled management (Oluyemi and Roberts, 1979). The UK Farm Animal Welfare Council (UK-FAWC) has suggested that flock sizes for barn systems be restricted to 2,000 hens, but most of the commercial developments in Europe are operating with a maximum flock size of 5,000–10,000 hens (Barnett and Parkinson, 1999). In other words, the deep litter system generally allows a moderate stocking density of about 7 birds/m^2 while still maintaining birds mainly at a single floor level on wood savings or other suitable litter material (Appleby *et al*., 1988; Sainsbury, 2000). The litter built-up is removed once a year, and provides valuable compost for vegetables (Thear and Fraser, 1980).

Free Range

Commercially, "free range" poultry farming is a system where birds are given free access to pasture and the accredited Code of Practice is that they must not be stocked above 1000 birds/hectare (Appleby *et al*., 1992; Dingle, 1998; Thear, 1999; Sainsbury, 2000). The system is also known as "traditional poultry husbandry" which is the system that has been known since time immemorial (IEMVPT, 1987). The term "free range" thus includes non-commercial village level free ranging native poultry production as occurs in South-East Asia (Aini, 1990, 1998, 1999), Africa (Kekeocha, 1984; Guéye, 1998), the Pacific islands and South America as well as commercial free range improved strain poultry production in developed countries (Appleby *et al*., 1992; Thear, 1999; Sonaiya *et al*., 1999).

It has been reported that 15% of commercial eggs in the UK are being produced in free-range systems and marketed at higher prices through regular supermarkets (Table 1). Of the total Australian hen production of 200 million dozen eggs each year, 5.5% are free-range eggs which sell on average of 1 Australian dollar more per dozen than cage eggs (Table 2). Because of the increasing demand for organic eggs in developed countries, most free-range egg producers in Europe, Australia and the USA are also accredited to sell their products as both "organic" and "free range" (Appleby *et al*., 1992; Thear, 1999; Sainsbury, 2000).

Table 1. Yield and percentage distribution of laying fowl in the UK by system of management (from Dingle and Henuk, 2001)

	Free range		Conventional cages		Deep litter and barn		All systems	
Year	NOE	POD	NOE	POD	NOE	POD	NOE	POD
1960-61	166	30.9	206	19.3	187	49.8	185	100.0
1971-72	190	-	235	-	209	-	230	100.0
1972-73	-	4.5	-	88.1	-	7.4	-	100.0
1976-77	192	-	245	-	224	-	243	-
1979-84	-	1.9	-	96.1	-	2.0	-	100.0
1989-90	220	-	290	-	250	-	253	-
1988-92	-	13	-	85	-	2.0	-	100.0
1997-98	276	-	311	-	287	-	-	-
1998-99	-	15.5	-	80.1	-	4.4	-	100.0
Space	1000 birds/hectare		450 cm^2/bird		7-10 birds/m^2			
Cost (%)	150		100		118			

NOE = Number of eggs/bird (eggs per annum - September to August);
POD = Percentage of distribution; - = data not available.

Table 2. Prices of 700 g packs of eggs at Coles supermarkets in Sydney and the annual distribution of eggs in Australia (Dingle and Henuk, 2001).

Type of eggs	Prices, A$	Annual distribution, %
Normal, caged eggs	2.90	89
Barn-laid	3.59	2.5
Omega-3	3.80	2
Free-range	4.03	5.5
V-eggs, vegetarian eggs	4.15	1

All free range poultry eat more feed and generally produce fewer eggs, and therefore their feed conversion is less efficient, than caged birds (Lu and Dingle, 1999). Decreases in egg production by free ranging commercial poultry appear to be partly due to the use of some nutrients to supply the needs of body warmth and locomotion (Schmidt-Nielsen, 1997; Alexander, 1999) and possibly the greater demand for nutrients by the immune system due to greater exposure of free range birds to immunizing agents (Hamilton, 1998; Glick, 2000).

However, there may be nutritional and cost savings to be made by using qualitatively and quantitatively different feed formulas for free range rations. For example, free range poultry may ingest minerals and vitamins from their environment and so can tolerate deficient or marginal diets (Tolan *et al*., 1974; Feltwell, 1992). There is a risk however that birds may access the easily obtained deficient diets and not seek the required nutrients from the environment (Dingle and Henuk, 2001).

Within the commercial poultry industry, a change to free range from cages has resulted ini a lower incidence of some diseases such as bone fragility and fatty liver disease, but the re-emergence of some old disease problems such as heavy parasitic burdens in laying flocks (Hafez, cited by Anonymous, 2000). Thus, in both village poultry and commercial free range, death and disease problems are often greater than in completely housed poultry. These losses have to be offset against the cost of providing housing, protection and vaccination, and the cost of educating farmers in the management of housing, equipment and disease control. On the other hand, there is evidence that allowing animals more contact with the natural environment is beneficial for the normal development of the immune system (Hamilton, 1998; Glick, 2000). Free range might be a more economic way of providing protection for poultry than medication and vaccination (Dingle and Henuk, 2001).

There are no nutrient recommendations published specifically for barn or free range poultry. This is a new area of research which will require the same careful assessment of nutrient allowances as has been conducted on cage birds. The first questions that have to be addressed are: why do floor birds eat more feeds than cage birds? Can the consequent increase in cost of feed be decreased by reformulation of diets? Do floor birds obtain some nutrients such as vitamins and minerals from the floor and recycling of excreta? Do either floor or free range birds develop better immunity?

CONCLUSIONS

Based on discussion of the paper, it could be concluded as follows:

There are many systems employed in poultry husbandry but each represents an economic method of poultry production under a given situation. The type, the area and the location of a farm partly determine the system to be adopted. The economic status, time and the understanding of the farmer also help to determine which system is used.

The systems which are most suited to small scale poultry husbandry are: (a) free range, in which the birds can roam at will over an extensive area; (b) intensive, in which the birds are wholly confined, such as the deep-litter system; and (c) semi-intensive, in which the birds are partially confined, but have at least occasional access to an outside run or scratching shed or straw yard. Among them, the extensive systems or the traditional systems are not only favoured by a small minority of farmers, but already have a place in many developing countries.

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