Lesson 4

LAYERS

Aim
Describe the management of domestic poultry for the production of eggs.

Laying hens are kept in flocks made up of only a few hens to many thousands. Because of this variation in the size of the units and the various preferences of the market, there are a number of systems for housing a flock. The various systems include:

- Extensive (free-range)
- Semi-Intensive
- Intensive

THE EXTENSIVE SYSTEM

The extensive system of poultry production (commonly known as "free-range") is based on the practice of allowing the bird access to foraging areas outside the poultry house. This system was widely practiced prior to the development of more productive strains of poultry and better management facilities (automated feeding and watering, better housing, environmental control) around the middle of the 20th century.

Nowadays, extensive poultry production is generally practiced by a specific range of growers, including:

- Organic farmers
- Village and community groups
- Hobbyists

Housing

In broad terms there are two basic forms of housing for extensive poultry production:

(a) A house or number of houses established in a permanent position

(b) A number of smaller houses fitted with skids or wheels which can be moved around (see figure 7 below).

With either of these methods, the house is used to protect the birds at night and to provide somewhere for the birds to lay their eggs. Whatever the size, the hen house should be fitted with perches to allow the birds to roost at night. There should also be sufficient nesting boxes to allow for laying.

Preventing predators from gaining access to the birds is a major consideration with free-range systems, and there are a number of ways of addressing this problem. One popular method is to fit the houses with a small hatch (pop-hole) which can be closed to keep the hens in at night to preclude predators and opened in the morning to allow the hens out. Another method gaining in popularity is to construct predator proof fencing around the forage areas, and place some form of guard animal (mareema dogs and wethered alpacas are both used for this purpose) to ensure the predators don't get near the birds.

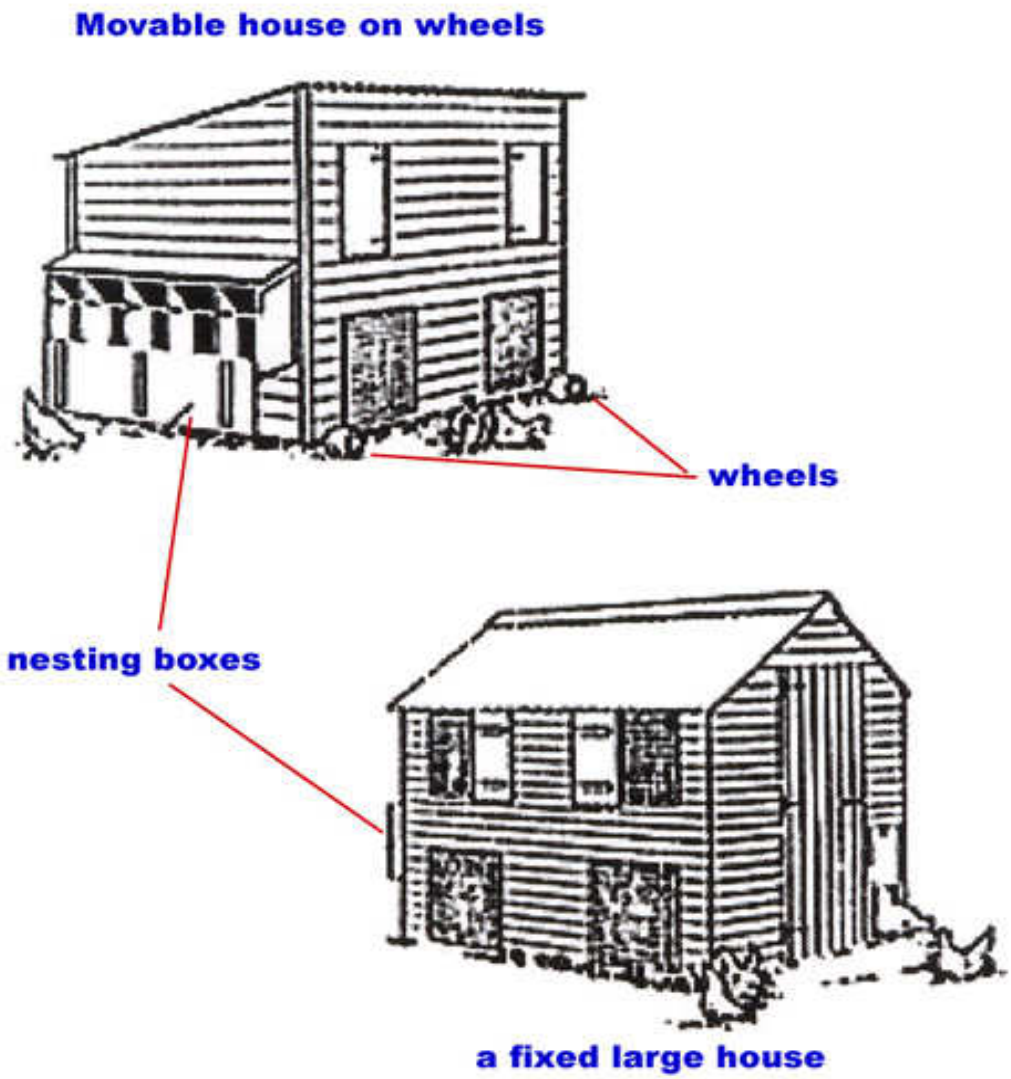


Figure 7: Housing for Free-range Birds

Management

The normal system is to move young pullets into a laying house about four weeks before they are due to start laying. This is done to allow them to become used to the new house and to give them time to settle in.

The pullets should be kept in the house and not allowed to range for the first two days after the move. After this time, they can be allowed out in the day. They will find their own way back to the house at nightfall - "putting themselves to bed" so to speak.

If any of the pullets roost on top of the house or in nearby branches at nightfall, they should be caught by hand and placed in the house. Birds that roost outside will almost certainly be taken by predators so it is worth trying to break this habit as soon as you notice it.

Hens on free-range are sometimes provided with food and water outside the house, however this practice is not recommended, particularly in those areas where there is a risk of avian influenza and other diseases being carried by wild birds. Regardless of whether the feed and water is presented inside or outside the house, it is important to ensure that adequate feed and water space is provided. As a general rule, allow 100mm (4”) of feed trough space and 50mm (2”) of water trough space per bird.

Management of the forage areas is an important consideration for free-range production systems. When any class of poultry is allowed access to natural forage in the form of grasses, herbs and

other green forage, they will invariably denude the area immediately adjacent to the house. This fact is one of the reasons that moveable houses have gained popularity, particularly in organic and Permaculture applications, where sustainability and effective use of resources are important. By regularly moving the house, the birds are presented with new forage areas on a regular basis, whilst the previously foraged areas get the opportunity to recover and rejuvenate. This process has the added bonus of preventing the build-up of harmful organisms, particularly internal parasites.

If permanent housing is to be used, careful planning is essential if the area immediately adjacent to the house is not to become denuded, overworked and "stale". The most effective means of achieving this goal is to divide the forage area around the house into small sections, using either fixed netting fences, or moveable electrified netting. This allows the birds to forage over a single small area at a time, and then move on to a fresh area, allowing the previously "worked" area to recover.

It is advisable to provide the birds with adequate shade away from the house. Not only does this provide for a more suitable environment during periods of hot weather and reduce the potential for certain forms of behavioural dysfunction (e.g. feather picking and cannibalism), it also encourages the birds to move away from the house, thus reducing the forage pressure on the pasture adjacent to the house.

Egg collection

Most extensive poultry operations rely on manual labour to collect the eggs. This is normally done once or twice per day. If only once a day, collection should not commence prior to 10.00am, by which time the majority of the eggs will be laid. All laying is generally finished by around 2.00pm. It is often necessary to wash some or all of the eggs from extensive systems due to the level of fouling with dirt, faeces and contaminants on the shells of the eggs.

Disease management

Effective prevention and management of disease is another important consideration for free-range systems, as there are a number of factors that expose birds in these systems to the risk of infection. These include:

- **Faecal/oral cycle:** This phrase describes the process whereby faecal material containing a potential disease causing agent is re-ingested by an animal. Due to the natural foraging behaviour of poultry, this situation occurs constantly in birds that have access to their own faeces.

- **Wild birds:** Unless the foraging area of free-range poultry is completely netted and bird proof, it is virtually impossible to prevent some contact with wild birds. This contact can lead to the transfer of disease, including internal and external parasites. The risk of exposure to exotic diseases such as Avian Influenza is a significant concern for both free-range producers and the poultry industry at large.

- **Internal and external parasites:** As noted in the points above, a combination of the faecal/oral cycle and potential exposure to wild birds makes control of internal parasites a significant problem for free-range poultry operations. External parasites can also be carried by wild birds, and once established on a site, can be very difficult to eradicate.

- **Behavioural dysfunction:** In free-range operations where modern egg laying hybrids have been used, a tendency toward certain negative or damaging behaviours has been observed. These include feather pecking, vent pecking and cannibalism. It is generally accepted that these behaviours are a result of a number of factors, such as genetics, environment and nutrition.

- **Inability to effectively control environment:** Due to the relatively simple nature of most houses used in free-range egg production systems, there is little capacity to protect the birds from extremes of climate, particularly heat. Birds have a tremendous capacity to tolerate cold conditions providing they are protected from wetness and drafts, but have few mechanisms to cope with extreme heat. Provision of adequate shade outside the house is a key welfare measure in areas prone to extreme temperatures.

- **Spotty liver:** This condition is the cause of loss of production and some mortality across free-range flocks. Whilst the causative agents have not been identified, it is known that the faecal/oral cycle is a factor.

- **Bacterial infections of the reproductive tract:** Unlike caged poultry, where the egg is deposited onto a relatively clean wire floor, laying birds run under extensive conditions can lay their eggs in a number of places, including the nest boxes provided, the floor of the house, or even the ground outside the house. When a bird lays an egg, there is a certain amount of eversion of the reproductive tract takes place. If the environment in which the bird is laying its egg is unhygienic, there is the potential for some contaminated material to attach to the everted reproductive tract, which is then taken back into the body, and an infection ensures.

Establishment costs and productive efficiency

It is generally believed that extensive poultry production systems are the cheapest to establish and maintain, however this is not necessarily the case. Whilst a simple house with some nests and perches is far cheaper to erect than a large, intensive facility with its automatic feeding and egg collection systems, what must be remembered is the relative cost per bird. This figure is calculated by simply dividing the total cost of the house and its furnishings by the number of birds it can effectively house. When this calculation is made, it soon becomes apparent that the establishment cost of a free-range operation on a “per bird” basis can be significantly more expensive than a large, intensive system.

The other factor that requires consideration is productive efficiency. This phrase refers to the relative cost of producing an egg and getting it to market. In a large, fully automated system, one or two staff members can effectively feed, water and collect the eggs of hundreds of thousands of birds; whilst in a free range system, where the feeding, watering and egg collection is all done manually, one or two staff member may only be able to manage a few thousand birds. Therefore, the cost of producing and packaging an egg becomes significant greater in an extensive production system.

THE SEMI-INTENSIVE SYSTEM

Under a semi-intensive system, the birds do not have access to the outdoors as they would in a free-range system. They are however, free to move around the chicken house, and are not confined to cages. The floor of the shed is covered with absorbent material (wood shavings, rice hulls, straw) to absorb the moisture from faeces and provide an appropriate environment for the birds.

Sometimes this material (known as “litter”) is replaced between different batches; however some growers leave the old litter in the shed between batches, allowing the litter to build to considerable depths. This is known as the “deep litter” system. There are arguments for and against both practices. Prior to the commercial use of individual cages for laying poultry in 1929, the semi-intensive system was the standard commercial production system.

Housing

The most common types of semi-intensive poultry systems include:

- Barn – under this system birds are housed in houses, normally on litter, with access to feed, water and nest facilities. The birds do not have access to forage areas outside the house. This system lends itself to full automation.

- Aviary – increasing in popularity due to its relative cost effectiveness, the aviary system is very similar to the barn system, with the major difference being that some of the infrastructure, including feed, water and nesting facilities are constructed in the vertical plane, above the litter. This means that more birds can be housed under a single roof structure. Like the barn system, this system is best suited to full automation.

- Fold system – sometimes known as a the “chicken tractor”, this system is best suited to small scale operations, and makes use of small portable houses with a wire netting run attached and are designed to be moved every day (see figure 8 below).

With the exception of the fold system, most semi-intensive production systems are well suited to medium to large scale operations, particularly if some level of automation is employed.

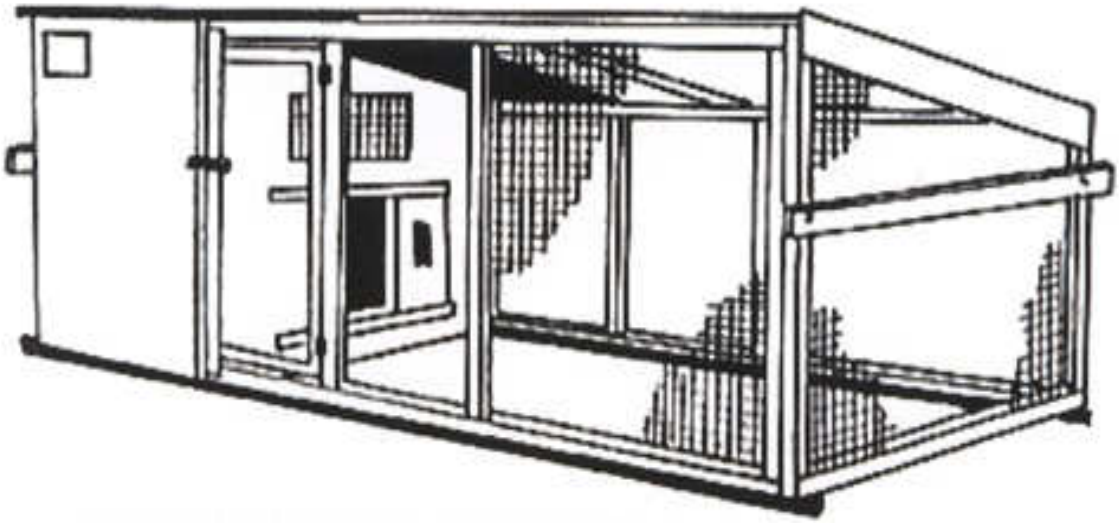


Figure 8: A fold-unit with a house and run

Management and Egg Collection

The management for birds in a semi-intensive system is very similar to that for birds in an extensive system. The exceptions include:

- Feed and water provided inside the house (often automatically)
- Pullets are sometimes reared in the house in which they will ultimately spend their productive lives
- Egg collection can be automated to varying degrees
- No forage areas to manage
- Reduced risk of predation

Disease Management

Poultry run in a semi-intensive system face almost all of the disease challenges of the free-range birds. The most notable exception is that birds in a semi-intensive environment should be protected from exposure to wild birds.

The semi-intensive poultry house also lends itself to certain forms of environmental control, which may include:

- Adjustable curtains
- Fans
- Foggers
- Tunnel ventilation (this form of environmental control is most common with modern intensive layer and broiler operations, and relies on evaporatively cooling huge quantities of air and drawing that cooled air through the house).

Establishment costs and productive efficiency

Given that there are generally more birds housed in a single structure, and that all infrastructure is basically centralised, the establishment costs for a semi-intensive operation, on a "per bird" basis is generally lower than that for extensive systems, and sometimes even intensive systems, depending on location and levels of automation.

The level of productive efficiency depends largely on the level of automation employed; however it will be significantly better than that of extensive systems.

THE INTENSIVE SYSTEM

Under the intensive system, birds are confined inside a cage throughout their lives. The development of the intensive system of poultry management is the product of a series of events that took place around the 1930's. These were:

- An increase in the size of commercial chicken flocks
- Replacement of dual purpose breeds with specialised, high producing light breeds
- Perfection of chicken sexing techniques, allowing the removal of males at day old, and the sale of pullets only to layer operations
- Massive improvements in productivity, brought about by advances in breeding, feeding, disease control and management

Housing

Today's modern intensive egg laying facility is a clean, highly sophisticated operation, employing a range of technologies to optimise production and animal welfare outcomes.

There has been considerable debate and increasing public awareness of potential animal welfare issues associated with the use of cages, to the extent that the practice is banned in some countries. However, productivity and liveability of birds housed in these systems exceeds those from either the free-range or the semi-intensive systems, and research into the long-term suitability of poultry cages is ongoing.

As a result of this research, a new generation of "environmentally enriched" or furnished cages has been developed to better meet the perceived needs of the birds (see image below).

These new cages have a range of new features, including:

- Perches
- Separate nest boxes
- Provision of litter for scratching and dust-bathing
- Claw shortening devices (often abrasive strips)

There is still conflicting views about the suitability of these new systems, both from within the industry and from animal welfare groups.

Management

Housing birds in cages has simplified many of the management tasks involved in the cost effective production of table eggs. For example, feed and water can be brought directly to the bird via automatic means, and eggs can likewise be collected automatically. The risk of predation is virtually nil. However, the birds are completely reliant on the farm manager to provide all their needs, including nutrition, water and an appropriate living environment. For this reason, most modern intensive facilities employ some form of environmental control system to optimise the living environment of the birds and maintain maximum productivity.

The standard of management in an intensive facility must be high, as the farm manager must control every aspect of the operation. Data collection and analysis is often another key responsibility of the farm manager, and provides a useful tool for monitoring bird health and overall well being.

Egg collection

As mentioned earlier, egg collection in modern facilities is often automatic, with the eggs being carried along long conveyors (sometimes known as “anacondas” to a centralised egg packaging facility. Even without automation, egg collection in a cage facility is much easier than in any other system, as the eggs all roll out to the front of the cage, and there are no eggs laid on the floor or outside the shed.

Disease management

One of the reasons that cages became popular for egg production was the fact that the poultry producer had a means of breaking the faecal/oral cycle. This meant that persistent disease problems of extensive and semi-intensive production systems such as internal parasites and coccidiosis were overcome without the need for chemicals or medication. Many behavioural problems were also overcome, although feather picking remains a problem in certain styles of cages under specific conditions.

However, with so many birds living in close proximity to each other, it soon became apparent that any airborne disease could quickly spread throughout the entire flock, causing significant losses. For this reason caged birds are subject to carefully developed vaccination programmes to minimise the risk of disease. Most modern intensive facilities also have high levels of biosecurity, including mandatory showering for all those entering the facility.

As mentioned earlier, management of the environment in an intensive poultry operation is a constant process, as any unfavourable conditions within the facility could have a significant impact on productivity.

Establishment costs and productive efficiency

As most intensive poultry operations are of a large to very large scale, the establishment costs are extremely high. Not only do large, environmentally controlled sheds with concrete floors need to be constructed, they then need to be fitted with cages, lighting and all the infrastructure to support the automatic feeding, watering and egg collections systems. However, when calculated on a "per bird" basis, even the most elaborate intensive system compares very favourably with a small, extensive system as far as establishment costs are concerned. With regard to productive efficiency, no other system can compare with an intensive facility. High levels of automation ensure that minimal staff levels are required to maintain production.

Comparison of production systems

The following table has been prepared to compare the relative strengths and weaknesses of each of the production systems.

	Free-range	**Semi-intensive**	**Intensive**
Access to pasture	Yes	No	No
Control of environment	Limited to nil	Limited	Absolute
Control over egg quality	Potential for floor eggs, soiled eggs and broodies on nests	Potential for floor eggs, soiled eggs and broodies on nests	Yes
Disease control	Difficult, particularly with issues relating to the faecal/oral cycle. Exotic diseases and external parasites can be a problem due to exposure to wild birds	Difficult, particularly with issues relating to the faecal/oral cycle.	Faecal/oral cycle broken. Little risk from wild birds
Establishment costs	Relatively low, depending on scale and complexity of operation	Low to moderate, depending on level of automation	Moderate to high, depending on level of automation
Labour input per bird	High	Variable, depending on level of automation	Low
Level of automation	Limited to nil	Variable	High
Marketing potential	Potential to tap into alternative markets to achieve a premium price	Some potential for market differentiation	Limited, normally obliged to accept current market price
Nutrition	Some potential for the birds to harvest nutrients from the forage area	Limited to foraging in deep litter	Completely dependant on feed supplied
Protection from predators	Variable	Yes	Yes
Size of enterprise	Small to medium	All	Large
Welfare issues	Improved public image of non-intensive production systems, however issues such as predation, extremes of climate and behavioural dysfunction (cannibalism) remain	Better public image than intensive systems, issues with behavioural dysfunction	Poor public image, currently enjoys the best production and liveability figures of all three production systems

HOUSING

All poultry require housing of some sort regardless of whether they free-range or are kept intensively. The more intensive the system the better the standard of housing required. This is particularly so when birds are caged. Housing provides shelter from sun, rain and wind and also from predators.

Birds that free-range for most or part of the day can get by with a simple house that provides a sound roof, perches, nest boxes and a dry, bedded or slatted floor. However, when birds are housed permanently within the house, more care is needed to provide an optimal production environment.

The optimum temperature for egg production is 21^{O} Celsius, with any change in temperature either side of this ideal having some impact on productivity. However, birds are much better able to tolerate cold than hot conditions, and most environmental control systems are geared towards the lowering of temperatures in laying houses. Cold conditions have the greatest impact on laying fowl when they are associated with wetness and drafts.

The range of building types, construction techniques and building materials for the housing of poultry is as varied as the environments in which they are run; from simple open sided houses constructed of locally harvested poles and thatched roof to state-of-the-art sandwich panel buildings complete with concrete floors, artificial lighting and computer operated environment control.

In determining the most appropriate type of housing for any particular egg laying operation, the following important factors require careful consideration:

- Scale of operation
- Level of capital expenditure
- Location
- Climate
- Topography
- Target market
- Genetics
- Sustainability

Given the range of variables, and the potential to invest significant amounts of capital, professional advice should be sought prior to the establishment of a commercial egg laying enterprise to ensure the best possible outcomes for the business.

Nest Boxes

When considering appropriate nesting for laying fowl, an understanding of nesting behaviour is necessary. In the wild, the jungle fowl actively searches for a quiet, dark and secluded place to make a nest to lay her clutch of eggs. The nest has to serve two purposes; first, it must hide the eggs from predators during the two to three weeks it can take to lay a clutch of up to twelve eggs (remembering that the hen may only lay one egg every two days, and she leaves the eggs unattended whilst the clutch is being accumulated). Secondly, the nest must conceal the hen and her eggs during the three weeks of incubation.

Having an understanding of these behaviours provides some insight into the nesting habits of the domestic chicken, even though some would argue that much of this instinctive behaviour has been “bred out” of modern commercial strains.

Whether the birds are housed in free-range, aviary or barn situations, the nesting requirements are the same, and need to be considered from the perspective of both the laying hen and the producer. The laying hen, like her jungle fowl ancestor, requires a place that is removed from the

rest of the flock. Ideally this place should also be out of sight of the other birds, and provide a sense of security and seclusion. The producers on the other hand, requires nests that ensure that all eggs are recovered in a clean and marketable condition, are easy to keep clean, encourages all birds to lay in the nest rather than on the floor and are easy to collect eggs from.

There are a number of commercially available nesting systems that meet the criteria mentioned above, and fall into two general types, the individual nest and the colony nest. In many cases these systems utilise synthetic materials instead of shavings or hay as they are easy to manage and keep clean.

Small scale producers can utilise locally available materials to construct nest boxes, or even use recycled packing boxes or plastic drums, the latter being easy to clean between batches. It is important to line the nest with hay or other soft, absorbent material to make the nest comfortable and to reduce the incidence of faecal contamination of the egg shell.

Drinker systems

The provision of clean, cool drinking water is the single most important consideration for any egg laying operation. Laying fowl require clean, uncontaminated drinking water that is neither too hot nor too cold. If water supply and/or consumption is interrupted for any reason (equipment failure, contamination, overheating) there will be a subsequent drop in egg production until the problem is resolved. This situation is exacerbated during extremely hot conditions, when water consumption can double from 250ml up to 500 ml.

For most small scale producers, simple troughs or other receptacles are satisfactory, provided that they are cleaned regularly (see Figure 9). There are also many commercially available drinker systems that assist in ensuring a constant supply of clean water.

For larger producers, the most effective and reliable drinker system is the “nipple” system; the standard drinker system of the commercial industry worldwide, providing water to literally billions of chickens, laying hens, broilers, turkeys and other poultry species. This system provides drinking water to the bird when they activate a captive “nipple”, releasing a flow of water directly into the bird’s beak.

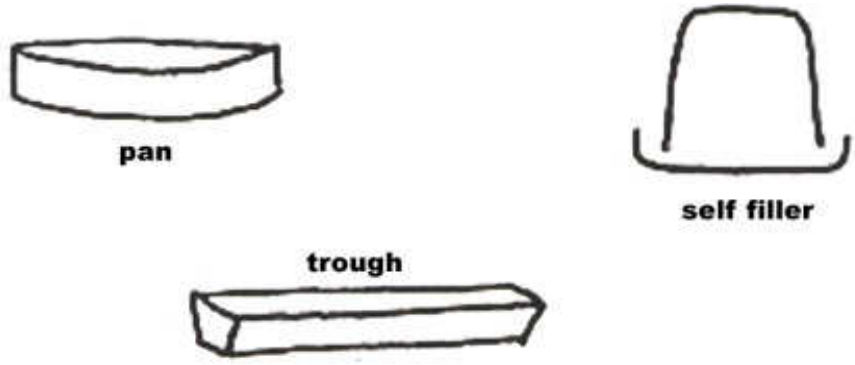


Figure 9: Different types of water troughs

Feeders

Food is expensive and represents at least 60% of the cost of keeping laying hens. No farmer or poultry-man can afford to waste food. Feeders for laying poultry fall into two general categories, manual and automatic.

As the name suggests, a manual feeder requires regular filling, and presents a constant supply of feed to the birds whilst minimising wastage (see Figure 10). Manual feeders are best suited to small-scale and extensive production systems, as they require significant labour input to maintain.

Most modern semi-intensive and intensive systems utilise some form of automated system, the most common systems being either the pan or chain.

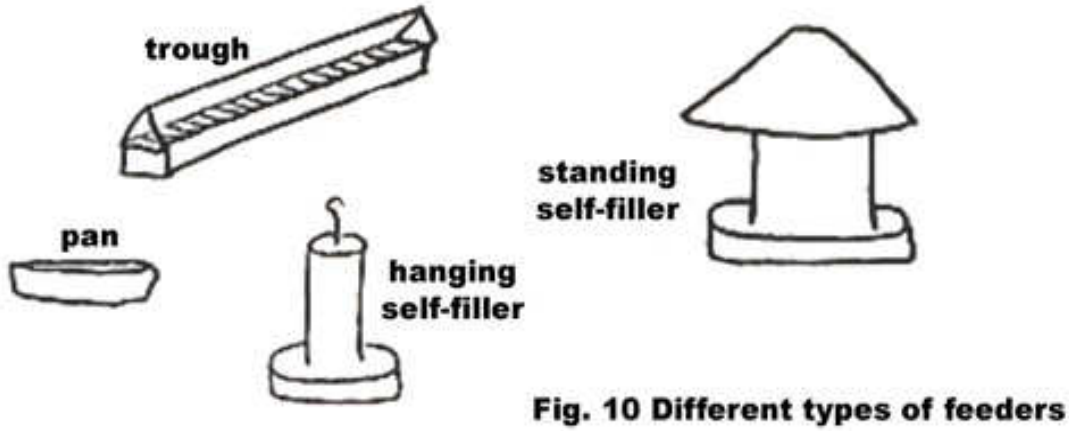


Fig. 10 Different types of feeders

Battery Units

There are a number of systems of battery cages but the main ones are:

- Single deck (where one row of cages is suspended from the roof of the building
- Double Decker (two rows are suspended)
- Pyramid system
- "Enriched" or "furnished"

Size of Cages

There are two sizes of cage.

- The single cage: This cage holds one bird. Bullying is avoided and accurate individual records can be kept. However, if the bird dies in the cage, it cannot be replaced until all the cages are refilled with pullets.
- The communal cage: This cage holds four to five birds so the cost per bird is less than the single cage. However, the birds can peck and bully each other.

All battery cages have wire netting floors to allow the manure to pass out of the cage. The floor is set at an angle to allow the eggs to roll down the front of the cage into a trough out of reach of the birds.

Collecting eggs

In systems where eggs are collected manually, collection normally takes place twice a day. This figure varies with automatic collection systems, depending on the capacity of the egg belts and the work practices of the operation. Regular egg collection is necessary for a number of reasons, including:

(a) Eggs are less stained - they require less cleaning;

(b) The hens are prevented from becoming broody and wanting to sit on the eggs; and

(c) The number of broken eggs is reduced. This reduces the risk of hens wanting to eat their eggs.

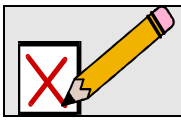
Eggs can then be sold wholesale to an egg processor who is responsible for cleaning, sizing, grading (candling) and packaging the product alternatively this work can also be done by the egg farmer.

FEEDING THE LAYING HEN

Once the hens commence laying the biggest cost will be feed. In general, it requires 1 and a half to two kilograms of feed for each dozen eggs produced. Each layer will require about 120 grams of complete ration per day. The nutrient requirements for modern commercial laying strains are quite specific, and careful attention is required in preparing rations. All the modern breeding companies provide detailed nutritional information for the different stages of growth and production of their birds.

REPLACING THE FLOCK

Periodic replacement of flocks is imperative in order to have a balanced flock relative to egg size, egg quality and productivity. In most cases this requires at least four different flocks of varying ages on the farm at any time. Such flocks should be maintained separate from one another for health reasons. Due to the differing ages the size, quality and production rate of the eggs will vary for each flock. Flocks are usually kept for one year of lay (to 18 months of age) or recycled (moulted) at 65 weeks of age and kept for an additional 35 to 40 weeks before they are replaced. A typical flock will lay between 21 and 26 dozen eggs per hen per year. Farms that only keep chickens of one age usually have fewer disease problems, but from a marketing aspect the lack of eggs of different sizes and quality to meet the needs of customers make this a less feasible form of management.



SELF ASSESSMENT
Perform Self Assessment Test 4.1
If you answer incorrectly, review the notes and try the test again.

SET TASK

Talk to several poultry growers who specialise in layers. What sort of poultry raising system do they use? What sort of housing do they use? Why do they prefer this way to others? How are eggs collected?

If access to farms is a problem - use the internet to find different types of "Virtual Farms" that you can use as examples; or you may research journals and reference books to find relevant information.

ASSIGNMENT
Complete Lesson 4 Assignment