Growel
Commitment To Quality

# Basics of Layer Farming

## PRODUCTION

Poultry enterprises may vary from basic backyard poultry keeping to mechanized and automated production plants. Various types of poultry enterprises are illustrated in Table 1.

Table 1
**Types of poultry enterprises**

| | Backyard poultry | Farm flock | Commercial poultry farm | Specialized egg production | Integrated egg production |
|---|---|---|---|---|---|
| Subdivision of egg production | Pullet growing, feed production | Hatchery production separate from farming | Feed production separate from poultry farms | Chicken meat production becomes independent of egg production | Separate enterprises reintegrated as a business |
| Main management characteristics | Natural hatching | Artificial hatching and sexing | Feed mixing | Egg processing plant | Controlled-environment houses |
| Type of farming | Subsistence farming | Mixed farming | Joint egg and meat production | Eggs industry (single commodity) | Egg complex |
| Labour | Part-time | Part-time | Full-time | Division of management and labour | Separate daily work and random work |
| Building | Free range | Water feeder | Water feeder | Manure disposal equipment | Egg belt automatically controlled house |

*Backyard poultry* production is at the subsistence level of farming. Birds live free range and hatch their own eggs. Their diet is supplemented with crop waste or food leftovers. The labour involved in backyard poultry production is part-time.

*Farm flock* production is slightly more specialized. Eggs are hatched at a separate location where the hatch and the sexing of the birds are controlled.

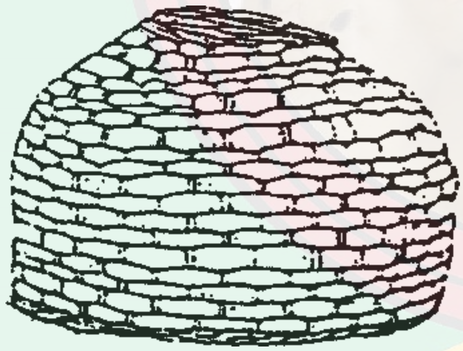
*Commercial poultry* farm production involves full-time labour and is geared toward producing on a sufficient scale for the sale of both eggs and poultry meat.

*Specialized egg production* consists of separating poultry for meat and egg production. In the egg producing plant, specialized employees oversee specific aspects of egg production.

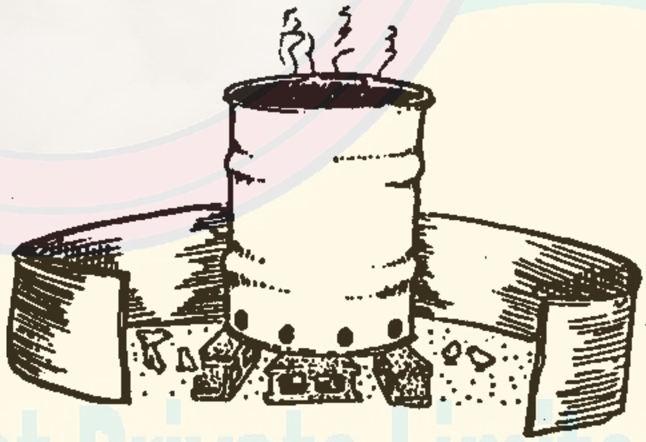
*Integrated egg production* is the most advanced enterprise and involves full mechanization and automation of the egg production cycle including battery egg laying, temperature controls, scientific feeding and mechanized egg collection methods.

**Types of brooders**

**Basket brooder**



**Oil barrel – charcoal**



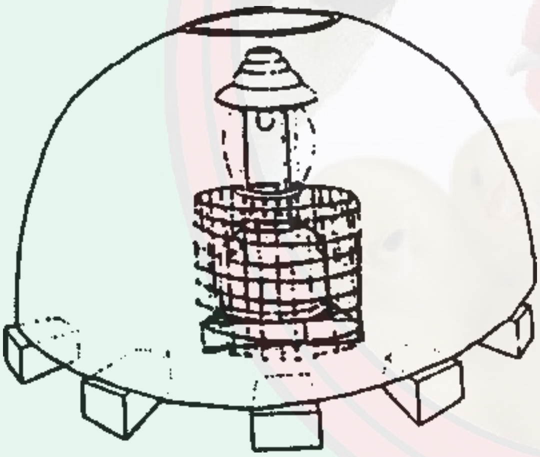
Source: Reid et al., 1990

All of the above poultry-keeping methods are used in the developing world, but the majority of the enterprises are backyard poultry and farm flock production. The poultry and egg sectors are highly fragmented. Most of the production is carried out by a large number of farmers, each with a very small flock. The greater part of produce is sold in markets close to the farms.

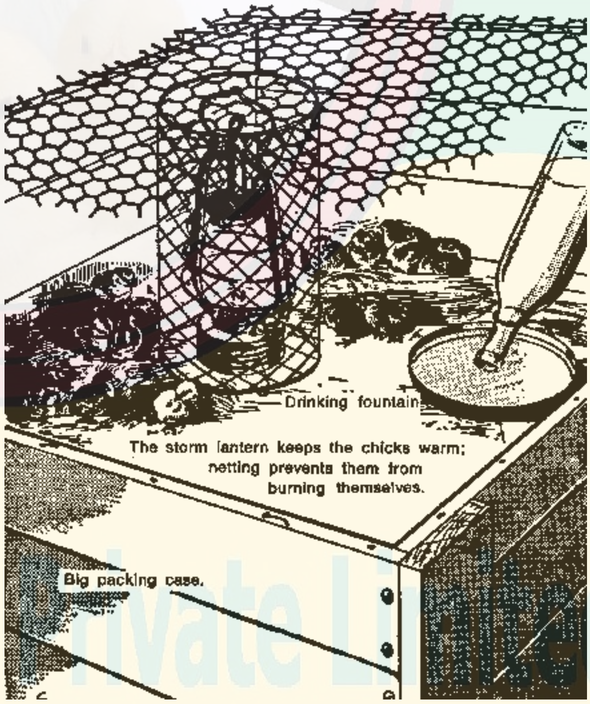
Day-old chicks are usually obtained from local hatcheries licensed by international hybrid breeding companies. Farmers or cooperatives of farmers may choose between varieties of chickens for egg production and meat production.

The small chicks can be either naturally or artificially brooded. If artificially brooded, small chicks must be placed in a separate house from laying chickens and it is necessary to protect the chicks from predators, diseases and catching colds. This stage of brooding lasts for eight weeks. In the first four weeks of life, small chicks need to be housed in a brooding box. Some typical types of brooders are shown below and on the previous page.

**Kerosene brooder**



**Storm lantern brooder**



After the first month, small chicks are removed from the brooder box and placed in the brooder house. At two months of age, the chicks enter the grower stage which lasts until they are five months (20 weeks) old. Growers may either be housed separately from small chicks or continue to be reared in brooder-cum-grower houses. It is important to properly manage the growers as their reproductive organs develop during this period and this will affect their egg production capacity in the future.

When the growers reach 18 weeks of age they are moved to laying houses and begin to lay eggs, which are, however, small and unmarketable. It is not until they are 21 weeks old that the growers reach their commercial laying stage. Layers may be placed in intensive, semi-intensive or free-range types of housing.

The choice of housing is determined by climate, type of production desired and the farmer's financial resources. Some examples of laying houses are shown on the next two pages.

Photographs 1 through 5 (see photograph section) are other examples of laying houses.

## Factors affecting egg production

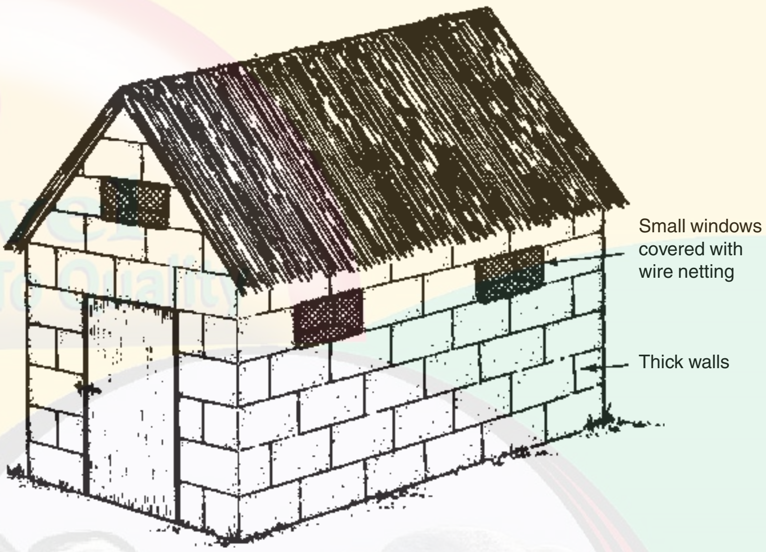
Typically, a layer's production cycle lasts just over a year (52-56 weeks). During the production cycle many factors influence egg production; therefore, the cycle must be managed effectively and efficiently in order to provide maximum output and profitability. The following factors influence egg production.

***Breed.*** The breed of the laying bird influences egg production. Management and feeding practices, however, are the key determining features for egg production.

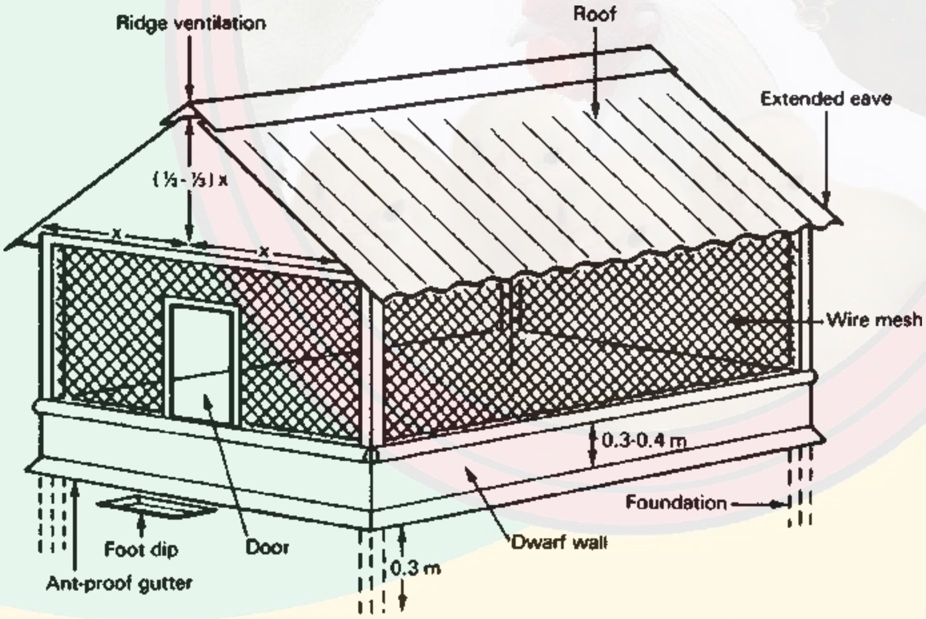
***Mortality rate.*** Mortality rate may rise due to disease, predation or high temperature. The mortality rate of small chicks (up to eight weeks of age) is about 4 percent; that of growers (between eight and 20 weeks of age) is about 15 percent; and that of layers (between 20 and 72 weeks of age) is about 12 percent. The average mortality rate of a flock is from 20 to 25 percent per year.

## Types of laying houses

### Housing for hot – arid climates

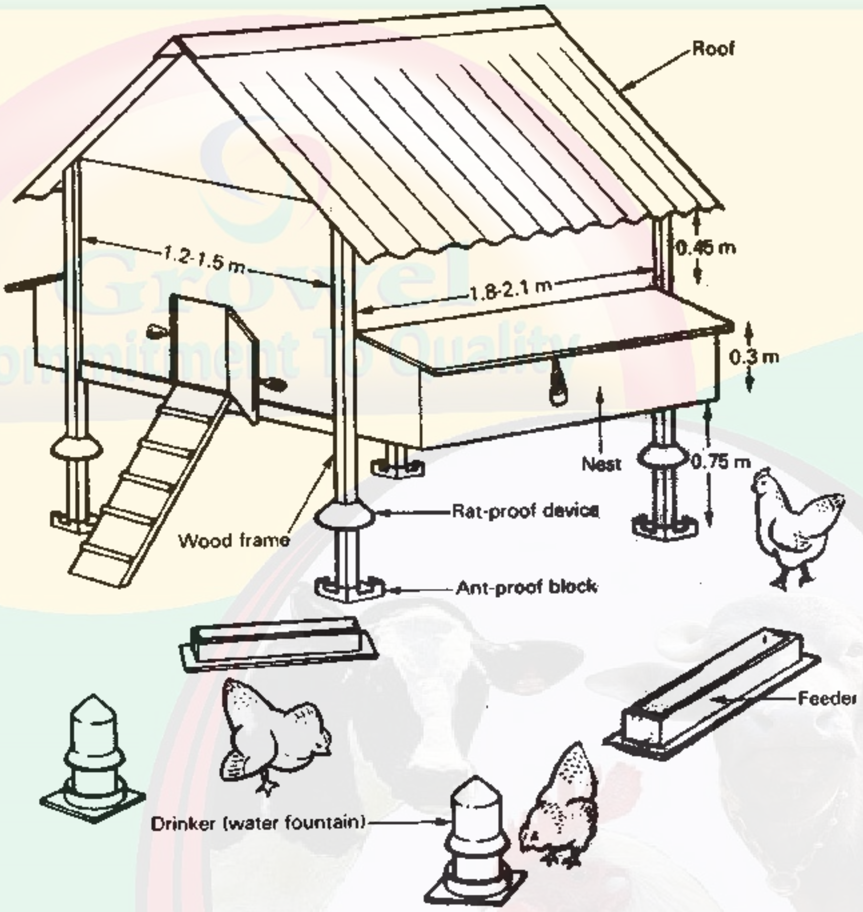



### Open-house type

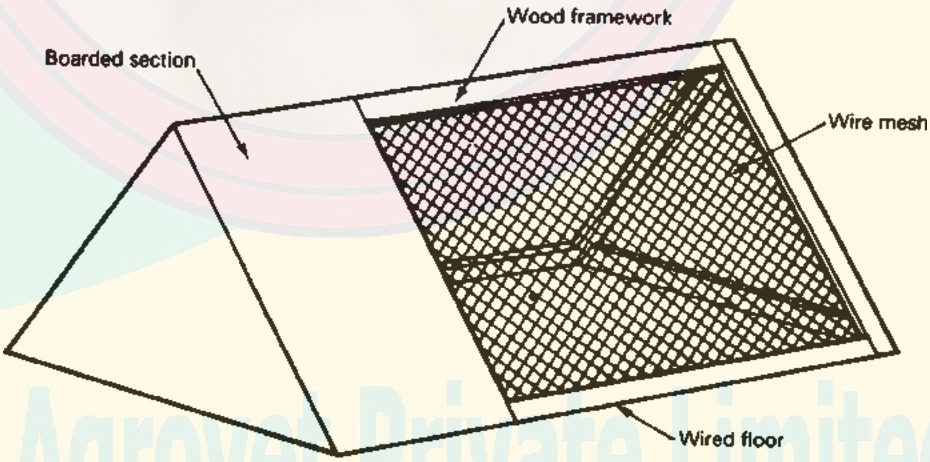



Sources: Kekeocha, 1985; Oluyemi and Roberts, 1979

**Types of laying houses,** continued




**Moveable type housing**



***Age.*** Birds typically begin producing eggs in their twentieth or twenty-first week and continue for slightly over a year. This is the best laying period and eggs tend to increase in size until the end of the egg production cycle.

***Body weight.*** In general, optimum body weight during the laying period should be around 1.5 kg, although this varies according to breed. Underweight as well as overweight birds lay eggs at a lower rate. Proper management and the correct amount of feed are necessary in order to achieve optimum body weight.

***Laying house.*** The laying house should be built according to local climatic conditions and the farmer's finances. A good house protects laying birds from theft, predation, direct sunlight, rain, excessive wind, heat and cold, as well as sudden changes in temperature and excessive dust. If the climate is hot and humid, for example, the use of an open house construction will enable ventilation. The inside of the house should be arranged so that it requires minimum labour and time to care for the birds.

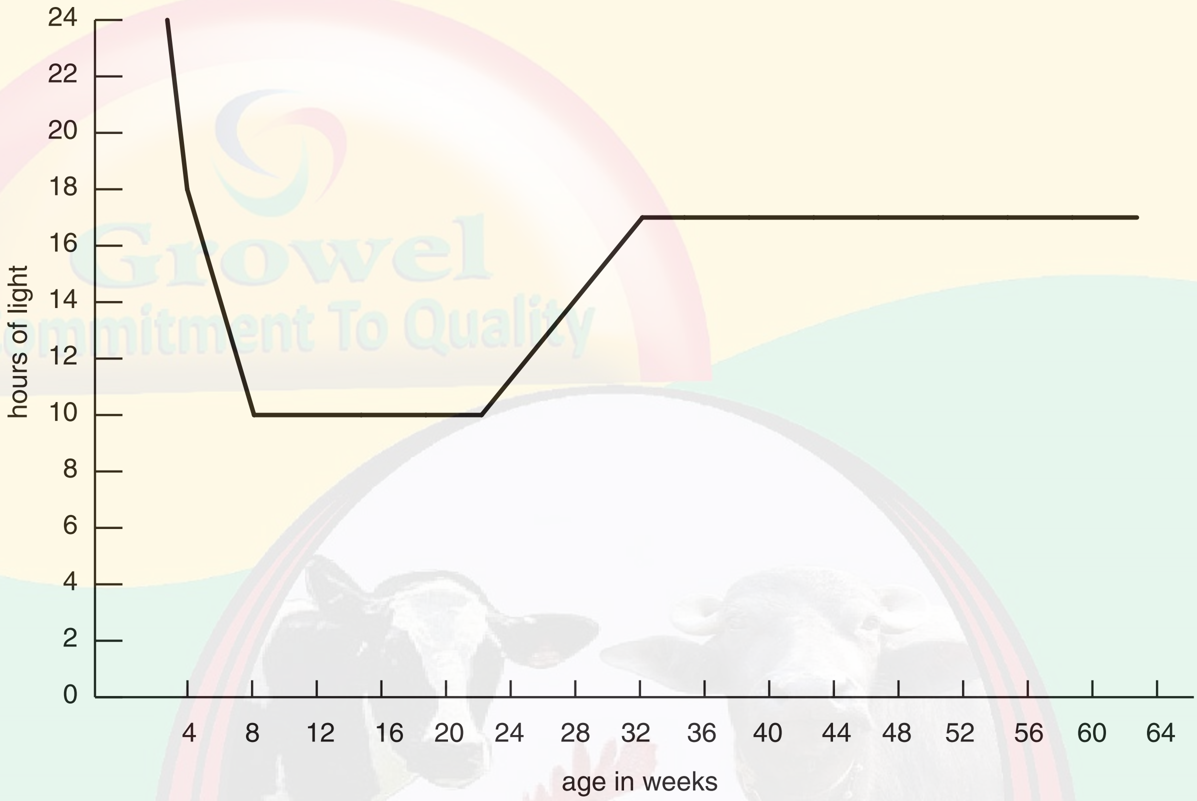
***Lighting schedule.*** Egg production is stimulated by daylight; therefore, as the days grow longer production increases. In open houses, found commonly in the tropics, artificial lighting may be used to increase the laying period. When darkness falls artificial lighting can be introduced for two to three hours, which may increase egg production by 20 to 30 percent.

In closed houses, where layers are not exposed to natural light, the length of the artificial day should be increased either in one step, or in a number of steps until the artificial day reaches 16 to 17 hours, which will ensure constant and maximized egg production. Effective day length should never decrease during the laying period. An ideal artificial light schedule is shown in Figure 1.

***Feed.*** Free-range hens will produce more meat and eggs with supplemental feed, but only if they are improved breeds or crossbreeds. The selection of local hens is done on the basis of resistance and other criteria rather than feed utilisation for production.

Fresh and clean water should always be provided, as a layer can consume up to one-quarter of a litre a day.

Figure 1
**Lighting schedule**




Source: Smith, 1990

***Culling.*** Culling is the removal of undesirable (sick and/or unproductive) birds, from the flock. There are two methods of culling:

- mass culling, when the entire flock is removed and replaced at the end of the laying cycle; and
- selective culling, when the farmer removes individual unproductive or sick birds.

Culling enables a high level of egg production to be maintained, prevents feed waste on unproductive birds and may avert the spreading of diseases.

***Climate.*** The optimal laying temperature is between 11° and 26° C. A humidity level above 75 percent will cause a reduction in egg laying. Figure 2 indicates the effect temperature has on egg production.

Figure 2
**Temperature and its effects on egg production**

| Temperature (°C) | Effects |
|---|---|
| 11 – 26 | Good production. |
| 26 – 28 | Some reduction in feed intake. |
| 28 – 32 | Feed consumption reduced and water intake increased; eggs of reduced size and thin shell. |
| 32 – 35 | Slight panting. |
| 35 – 40 | Heat prostration sets in, measures to cool the house must be taken. |
| 40 and above | Mortality due to heat stress. |

Source: Kekeocha, 1985.

When the temperature rises above 28° C the production and quality of eggs decrease. Seasonal temperature increases can reduce egg production by about 10 percent.

***Management factors.*** Effective and efficient management techniques are necessary to increase the productivity of the birds and consequently increase income. This entails not only proper housing and feeding, but also careful rearing and good treatment of the birds.

***Vaccination and disease control.*** Diseases and parasites can cause losses in egg production.

Some of the diseases are as follows:

- bacterial: tuberculosis, fowl typhoid
- viral: Newcastle, fowl plague
- fungal: aspergillosis
- protozoan: coccidiosis
- nutritional: rickets, perosis

Some of the parasites are:

- external: lice, mites
- internal: roundworms, tapeworms

Vaccinations are administered to birds by injection, water intake, eye drops and spraying. Clean and hygienic living quarters and surroundings may eliminate up to 90 percent of all disease occurrences.

### Collection of eggs

Frequent egg collection will prevent hens from brooding eggs or trying to eat them and will also prevent the eggs from becoming damaged or dirty.

## EGG PRODUCTION CYCLE

Birds usually start to lay at around five months (20-21 weeks) of age and continue to lay for 12 months (52 weeks) on average, laying fewer eggs as they near the moulting period.

The typical production cycle lasts about 17 months (72 weeks) and involves three distinct phases, as follows.

- ***Phase 1: Small chicks or brooders.*** This phase lasts from 0 to 2 months (0-8 weeks) during which time small chicks are kept in facilities (brooder houses) separate from laying birds.
- ***Phase 2: Growers*.** This phase lasts about 3 months, from the ninth to the twentieth week of age. Growers may be either housed separately from small chicks or continue to be reared in brooder-cum-grower houses. It is

important to provide appropriate care to the growers particularly between their seventeenth and twentieth week of age as their reproductive organs develop during this period.

- ***Phase 3: Layers.*** Growers are transferred from the grower house to the layer house when they are 18 weeks old to prepare for the laying cycle. Birds typically lay for a twelve-month period starting when they are about 21 weeks old and lasting until they are about 72 weeks old.

## Production planning

On average a bird produces one egg per day. Furthermore, not all birds start to lay exactly when they are 21 weeks old. Planning is therefore required for egg production to be constant so as to meet market demand. A schedule similar to the one shown in Table 2, which indicates on average satisfactory levels of production for a flock of birds, can be used.

In areas where the climate is hot and humid, commercial hybrid laying birds produce on average between 180 and 200 eggs per year. In more temperate climates birds can produce on average between 250 and 300 eggs per year. The table below illustrates a typical production schedule in a hot and humid climate.

In Table 2 the age of the flock is shown in the first column and the percentage of birds that actually lay during that week of age is shown in the second column. Usually at 21 weeks of age only 5 percent of the flock lay.

As shown in the third column, for 100 birds at 21 weeks of age only five would actually be laying. In the fourth column the actual number of eggs produced is shown. On average a bird produces 208 eggs over a twelve-month period, which is a weekly production rate of four eggs per bird. At 21 weeks of age 20 eggs are produced (five birds produce four eggs each) and at 22 weeks 40 eggs are produced, etc.

The graph in Figure 3 shows the actual percentage of productive laying flock over a period of time, and the graph in Figure 4 shows the number of eggs produced over a period of time for 100 birds. Egg production rises rapidly and then starts to fall after 31 weeks of age. When less than 65 percent of the flock are laying eggs (71 weeks of age), it may become uneconomical to retain birds. Feed costs and sales of culled birds for meat must be considered as well

Table 2
**Production schedule in temperate climate (100 birds)**

| Age of flock (in weeks) | % of flock laying | No. of birds laying | No. of eggs produced per week |
|---|---|---|---|
| 21 | 5 | 5 | 20 |
| 22 | 10 | 10 | 40 |
| 23 | 18 | 18 | 72 |
| 24 | 34 | 34 | 136 |
| 25 | 52 | 52 | 208 |
| 26 | 65 | 65 | 260 |
| 27 | 74 | 74 | 296 |
| 28 | 84 | 84 | 336 |
| 29 | 88 | 88 | 352 |
| 30 | 92 | 92 | 368 |
| 31 | 94 | 94 | 376 |
| 32 - 39 | 88 | 88 | 352 |
| 40 - 47 | 83 | 83 | 332 |
| 48 - 59 | 77 | 77 | 308 |
| 60 - 64 | 73 | 73 | 292 |
| 65 - 70 | 70 | 70 | 280 |
| 71 - 76 | 65 | 65 | 260 |

as prices for eggs. In some instances when egg prices are high it may be viable to delay culling birds until only 45 percent of the flock is still laying eggs (78 weeks of age).

Figure 3

**Percentage of productive laying flock over a period of time**

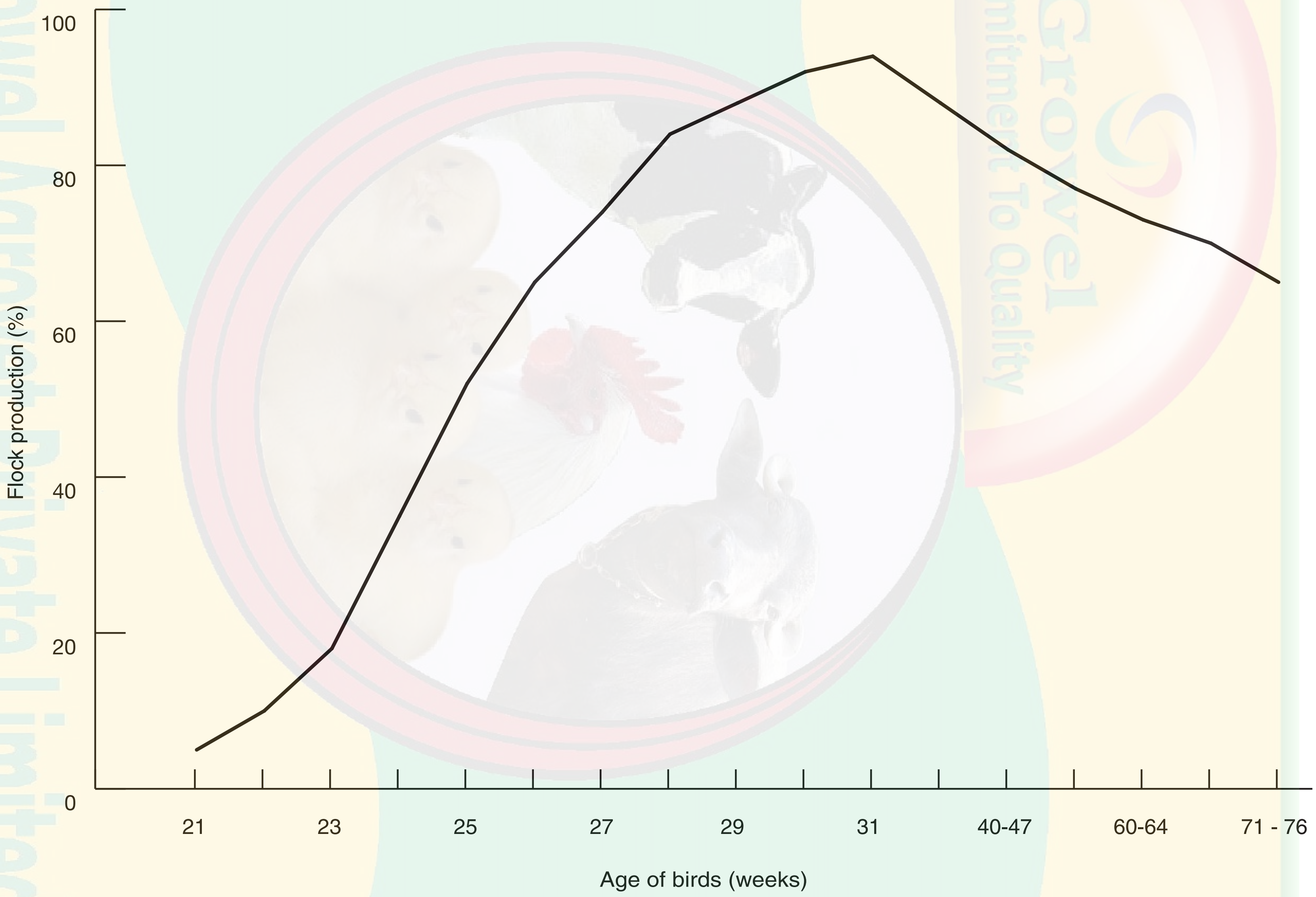
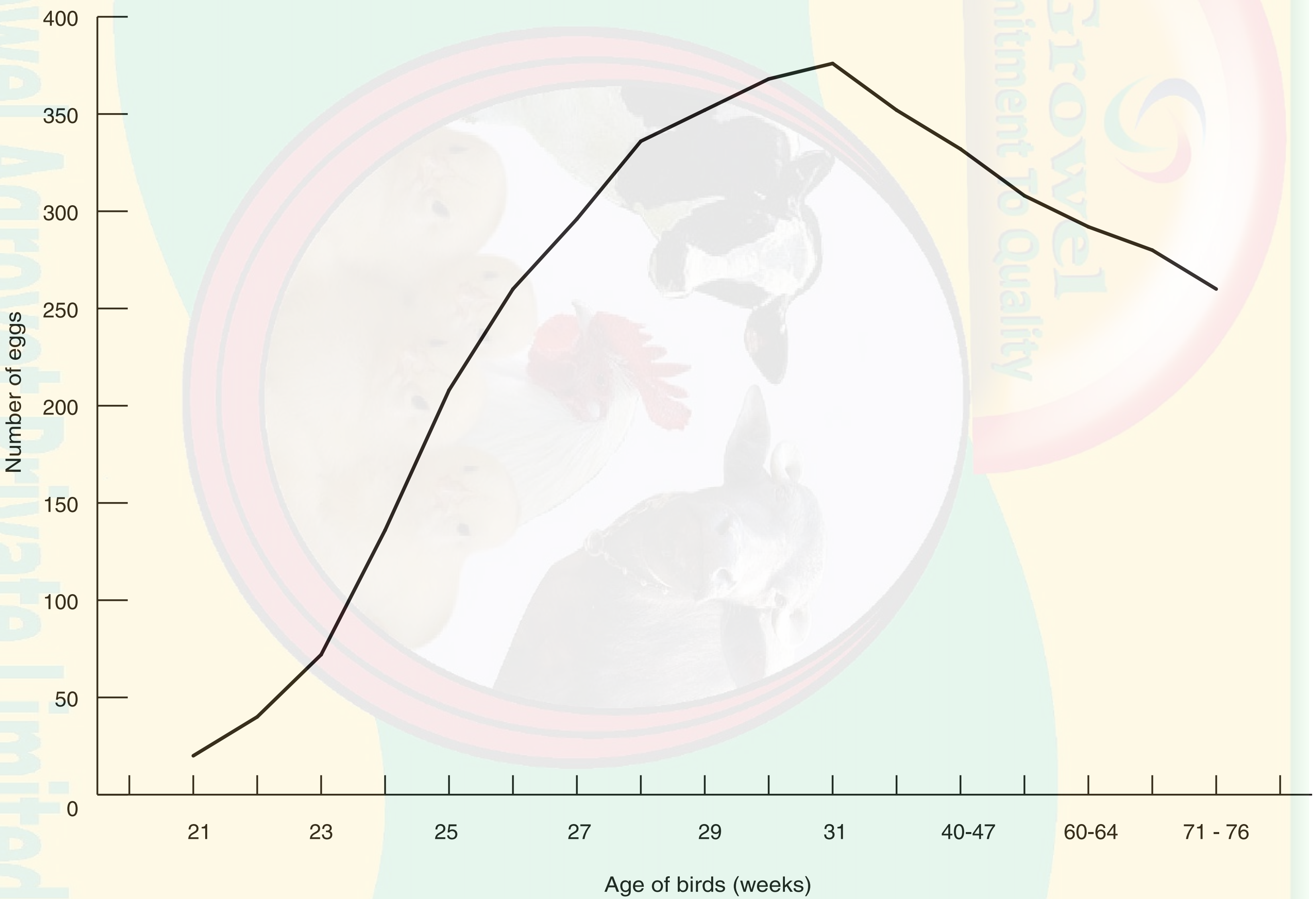


Figure 4

**Number of eggs produced over a period of time (100 birds)**



Clearly, egg production requires planning for costs as well as for profit generation and for meeting market demand. Planning involves not only the number of eggs laid by the flock over a period of time, but also when to hatch chicks to replace birds with diminishing laying capacity.

If production is to be kept constant, a simple chart as shown in Table 3, for example, will be needed to plan when new chicks must be hatched so that they can be introduced to laying in time to pick up on diminishing egg production.

Table 3
**Production planning**

| Layer flocks | 0 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 |
|---|---|---|---|---|---|---|---|---|---|
| | (........................ time in weeks ........................) | | | | | | | | |
| 1st layers | Born | | Lay | | | | | | |
| 2nd layers | | | Born | | Lay | | | | |
| 3rd layers | | | | Born | | Lay | | | |

As indicated on the chart, the first layer flock was hatched at 0 weeks to become productive after 21 weeks. The second flock of layers was hatched at the 21st week to be ready to lay after the 41st week, as the first layer flock starts to diminish production. This type of production entails having flocks of birds of different age groups.

Clean and hygienic living quarters and surroundings are essential to control disease. There should be no more than three or four different flock age groups present at one time. The mortality rate on average is between 20 and 25 percent. This means that if one wants 100 birds to lay, it may be necessary to buy between 120 and 125 small chicks.

## PRODUCTION COSTS AND PROFITS

Records should be kept of costs incurred during the operation and of proceeds from the sale of eggs. Costs must be covered by the sales of eggs. The difference between the proceeds from the sales and costs incurred represents profit.

### Brooder-grower stage

The costs to be considered are not only those concerned with the birds during the laying period, but also those incurred in the brooder and grower stage during which time no eggs are being produced. The brooder-cum-grower stage lasts about five months (0-20 weeks). The main costs to consider during this stage can be seen in Table 4.

### Laying birds

Once the costs for the brooder-cum-grower stage have been calculated, it will be possible to calculate costs for the laying birds. Calculations may be made on a daily, weekly or monthly basis. However, the most useful calculations are made at the end of the laying cycle. Daily, weekly or monthly calculations give approximate indications of costs and relative profits or losses. The main concern for farmers during this period is probably whether or not the proceeds from the sale of eggs cover feed and rearing costs. Feed cost is generally estimated to be about 75 percent of the production cost of eggs.

Comparing feed and rearing costs and egg proceeds for a week or a month may give an indication of profitability or loss. A farmer would have to subtract the cost of feed for a week from the proceeds for the total number of eggs sold that week. Furthermore, the rearing costs (expenses incurred before the birds start laying) should be amortized. This can be calculated by dividing the total rearing costs by the laying period. If rearing costs are US$ 10 and the laying period is 52 weeks, cost per week for rearing is US$ 0.19. Table 5 shows a simple record of weekly costs and sales.

### Costs and income for the laying cycle

Calculations for the laying cycle (52 weeks) are more accurate and enable the farmer to determine whether the egg laying enterprise is running at a profit or a loss.

Table 4
**Expenses for rearing**

| Costs | US$ |
|---|---|
| Chicks (total number of chicks multiplied by price per chick) | |
| Feed (total kg of feed multiplied by price per kg) | |
| Housing | |
| Equipment | |
| Labour | |
| Vaccinations | |
| Mortality | |
| Loan | |
| Various | |
| Total costs | |

Table 5
**Weekly costs and sales**

| | US$ |
|---|---|
| a) Eggs sold | |
| b) Feed used | |
| c) Rearing costs | |
| a minus b and c = | |

***Costs.*** When calculating costs for the laying cycle, the main expenditures to consider are:

- rearing – rearing brooders until they become layers;
- housing – building or maintaining laying house and brooder house;
- equipment – the cost of miscellaneous items such as feeders, buckets, etc.;
- feed – total feed used during the year;
- labour – labour costs incurred to manage birds;
- vaccinations – medicines and veterinary visits;
- mortality – loss of laying birds due to disease, etc.; and
- various expenses – lighting, water, etc.

***Income.*** When calculating income for the laying cycle, the earnings to consider derive from:

- the sale of eggs;
- the sale of culled birds after the first cycle of production; and
- where applicable, manure sold as fertilizer.

Table 6 shows an example of record keeping for yearly production costs and income.

Initially, capital is required to start an enterprise; proceeds from the sales of eggs should, however, provide funds to continue with the business before the end of the first laying cycle. Indeed, three months after point of lay (30 - 31 weeks of age), when the birds should normally have reached peak production, the proceeds from the sale of eggs should be sufficient to operate the business on a revolving fund basis. The three-month period is sufficiently long even for the low producing birds or those that peak late.

Figure 5 shows the various factors that affect the profitability of an egg enterprise.

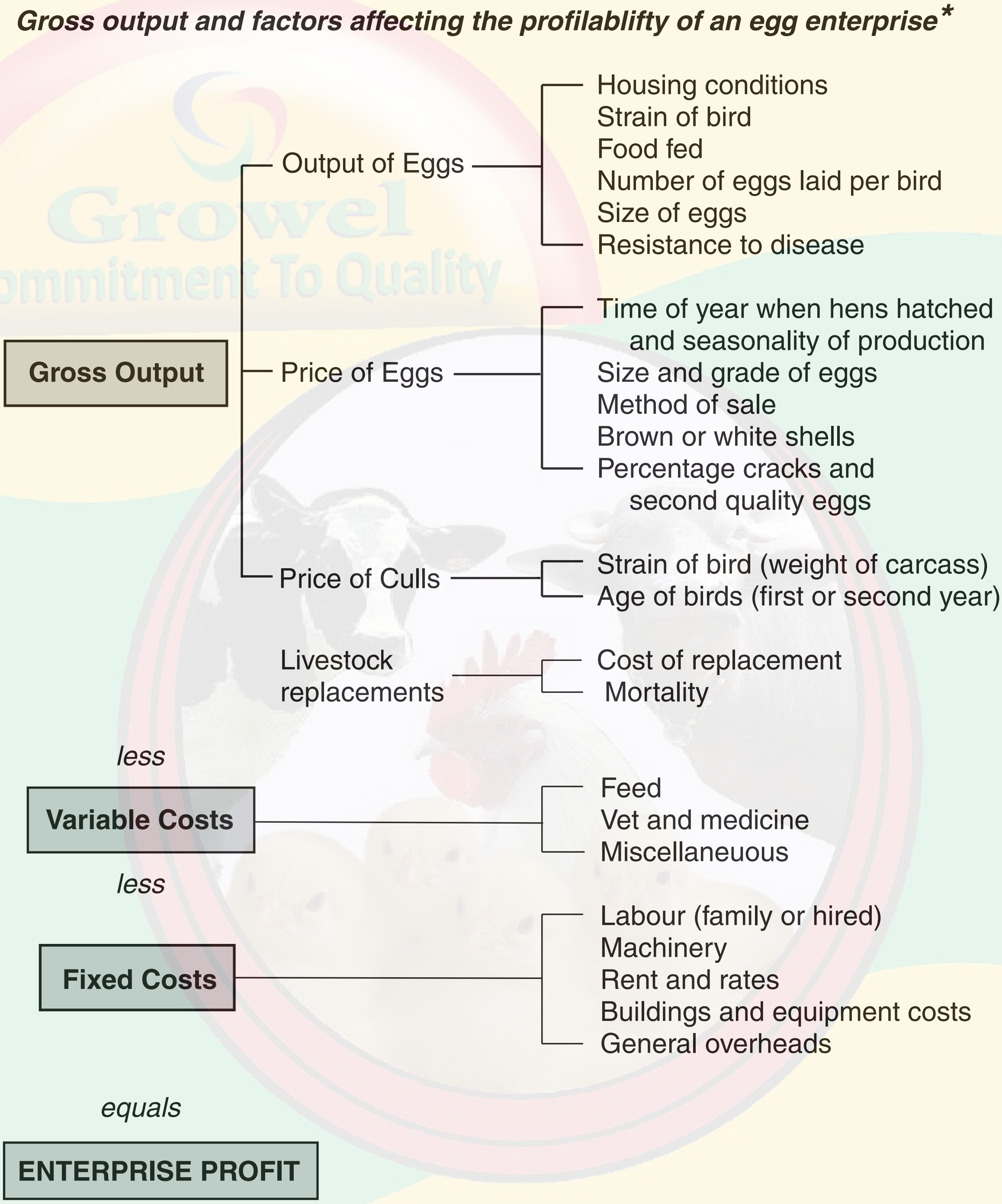
Table 6
**Costs and income for a production cycle***

| **Costs** | US$ |
|---|---|
| Rearing (carried forward from table 4) | |
| Houses | |
| Equipment | |
| Feed | |
| Labour | |
| Vaccinations | |
| Mortality | |
| Various expenses | |
| Total costs | |
| **Income** | |
| Sale of eggs | |
| Sale of culled birds | |
| (Sale of manure) | |
| Total income | |
| Profit | |

*This table does not include marketing costs (see Chapter 5, Pricing and sales policy).

Figure 5

**Gross output and factors affecting the profitability of an egg enterprise***




*Draft FarmManagement Training Manual, AGSF, Rome, 2002.

The following guidelines have been selected from the FAO Special Programme for Food Security (SPFS) Diversification Component, May 1997.

### Guidelines for improved household poultry production

**Constraints.** The main limitation to improved household poultry production is the extremely high loss of birds before they reach maturity caused by inadequate nutrition and disease. This loss means that a high proportion of all the eggs laid have to be kept for replacement stock leaving little, if any, surplus for sale or consumption.

The main causes of loss are:

- **Poor nutrition** is the major cause of loss and predisposes birds to disease, poor immune response to vaccines and predation.
- **Disease,** especially the highly infectious viral Newcastle Disease (ND), which is believed to be endemic in most rural flocks. Clinically the disease is cyclic and occurs at times of climatic and nutritional stress. The virulent (velogenic) strain common in Africa and Asia can, but not always, cause up to 80 percent mortality in unvaccinated chickens. Fowl cholera (pasteurellosis), coccidiosis, Gumboro disease (infectious Bursal disease) and fowl pox can also, to a lesser extent, cause problems in rural flocks.

Poor, or non-existent housing, is also a major cause of high losses. Without being able to confine birds at night, it is almost impossible to catch and vaccinate them, although new types of ND vaccine can be administered in the feed. Shelter can also provide protection for young birds against predators and can ensure that all the eggs are laid in the proper place and not lost.

The majority of indigenous breeds or strains of chicken/fowl have evolved to survive under harsh conditions where they largely have to fend for themselves. Such hardiness, however, is at the expense of higher levels of productivity and they are less able to exploit the advantages of improved management, nutrition, etc., than breeds with a greater genetic potential for egg production and feed conversion (growth).

**Potential.** Improved management and disease control can have a substantial impact on household economies. Under traditional management the majority of eggs are hatched to ensure sufficient replacements with only the male birds being sold or consumed. Reduced losses will ensure that more birds could be successfully reared and, assuming the extra birds can be properly fed, this will allow more eggs to be collected and consumed or sold as a regular source of income.

**Potential interventions**

The basis for any improvement programme will be improved husbandry, notably housing, nutrition and disease control, primarily Newcastle Disease. Subsequent interventions would concentrate on further improving nutrition and the introduction of improved breeds/strains.

**Improved feeding.** Most household flocks rely on scavenging and household scraps and, depending on conditions, this is usually adequate for survival and a low level of production. However, inadequate nutrition, exacerbated by marked seasonal fluctuations, is a major predisposing factor to disease and high mortality. As investments are made in improved animal health, housing and, especially if improved birds are to be introduced, then attention must be given to diet supplementation or feeding a complete diet in the case of totally confined birds.

Conventional feed materials such as maize, wheat, barley, oilcakes, fishmeal, etc., are rarely available to the back-yard producer. In many developing countries these are in short supply and even compounded feeds may be of dubious quality. For household production systems, however, there are usually a wide range of locally available feedstuffs that can be used in addition to household scraps. These include: surplus/broken or second grade grains (cereals, maize, sorghum and millet); roots and tubers (sweet potatoes, cassava, etc.), green material (legumes and leaf meals, sweet potato vines, etc.), residues and agro-industrial by-products (bran, rice polishings, oilseed cakes, etc.). Unless a complete balanced ration is available, the ability to free range is important to allow the birds to feed on insects and worms, green material, etc., so that they can balance their essential amino acids, mineral, vitamin, as well as energy requirements. Where appropriate, improved feeding systems (troughs, etc.) should be supplied to reduce wastage. Access to clean water is always essential and a source of calcium (ideally ground oyster shell) is highly recommended.

**Control of Newcastle Disease (ND) and other health constraints.** Effective vaccines have been available against most strains of ND for a long time. However, there are a number of issues that need to be addressed:

1. Until recently, the potency of vaccines was highly sensitive to temperature which meant that the provision of an effective vaccine at village level required a 'cold chain' of refrigerators, cool boxes, etc., from the manufacturing laboratory through to the farm. The majority of vaccines are still highly sensitive to temperature and fall within this class.
2. Conventional vaccines are sold in large dose vials, usually 1 000 doses, aimed at the commercial producer but unsuitable for use at the village or household level.

3. Village flocks are usually small, scattered and multi-aged which makes them difficult to target by mass vaccination campaigns. Catching free range, often semi-feral chickens to vaccinate them individually has always proved difficult.

4. Vaccination of a multi-age flock has to be undertaken on a continuous basis (monthly) to be effective.

A new 'heat stable' oral vaccine has been developed and widely tested in Asia and Africa. The primary advantage is that it no longer requires a complete cold chain to maintain its potency. Queensland University in Australia has made available free to laboratories in developing countries a seed virus, designated $I_2$, to those who wish to explore the possibilities of vaccine production. This opens the door for producing with intermediate levels of technology, the fresh (not freeze-dried) vaccine at regional laboratories for use within a few weeks of production. In addition, a commercial V4 vaccine is also available, but not in large quantities and it remains expensive.

Potentially these vaccines offer the possibility of overcoming the problems of transport, storage and the difficulty of catching individual chickens. They are not, however, available everywhere, and applying the vaccine to feeds is not without problems. The question of who produces the vaccine remains an issue and experience has shown that projects may be able to introduce the technology but often production ceases once external inputs are removed.

Conventional vaccines remain a viable option if there is a reliable 'cold chain', if housing is provided that allows the birds to be caught easily and if sufficient numbers of owners participate, making the use of large vials economic. There is often little difference, however, in cost between 200- and 1 000-dose vials. A major problem with the larger vials is to find and catch 1 000 village chickens within the two hours or so that these 'old' heat sensitive vaccines remain viable.

Almost all birds in rural flocks are infected with a variety of internal parasites which cause reduced growth rate, weight loss and lower egg production. Strategically timed treatment(s) with inexpensive anthelmintics (e.g. fenbendazole and other benzimidazoles) given in the feed can easily eliminate the majority of these parasites.

**Improved housing.** The basic aim should be to provide simple (using local materials wherever possible) yet secure housing for the birds at night. Approximately 0.1m$^2$ (1ft$^2$) should be adequate per bird. Housing should provide: perches for birds to roost on; access to clean water; a creep feed for chicks; and, nest boxes for laying and brooding. Location should be close to the house to deter theft and preferably raised off the ground to provide protection from predators and to reduce dampness. The shelter should have easy access to allow for catching the birds with the minimum of disturbance. Such housing can usually be provided cheaply using local materials (timber, mud, thatch, etc.); however, more complex designs may require more expensive sawn timber and wire netting.

**Improved breeds.** Once standard levels of husbandry (housing, feeding and disease control) have been achieved, improving the genetic potential of the birds offers the next step in increasing productivity. One strategy is to use local birds to incubate and rear higher egg-producing breeds.

Two choices are available. The introduction of pure-bred, dual-purpose breeds (e.g. the Rhode Island Red or Australorp) or the commercial hybrids, which are usually selected either for meat (broiler) or egg production. Traditionally, the dual-purpose breeds have been the exotic breeds of choice, the exception has been the White Leghorn, a laying breed that has proved unsatisfactory in adapting to village conditions. Obtaining grandparent stock of these breeds is becoming increasingly difficult and expensive. Some commercial companies now offer a more hardy, dual-purpose type of hybrid bird that could be used in certain situations.

Securing a regular source of healthy birds from well managed hatcheries can be problematic. Traditionally, government services have maintained poultry farms with imported parent stock and have supplied day-old-chicks (DOCs) or point-of-lay (POLs) birds to farmers. However, as with so many state run operations, there are real problems in managing such enterprises efficiently. Lack of working capital and staff incentives have resulted in most of them operating at a very low level of productivity and at a financial loss. The alternative of placing such activities in the private sector should be encouraged. Initially this may involve a phased approach through increasing cost-recovery to full privatization of government services. Non-governmental organizations can have a role in providing skills, start-up loans, etc., to assist private entrepreneurs in establishing themselves. Wherever possible the incubation, brooding, rearing and production of hatching eggs can be undertaken by separate specialized producers within the village.

In many developing countries improved birds have to be imported. There are a number of options that can be considered:

- *Importing grandparent stock to produce parent stock in the country.* This requires high levels of management, a regular supply of quality inputs, and a sufficient demand for parent stock.
- *Importing parent stock as either fertile eggs or day-old chicks to supply commercial birds for distribution.* This is usually the most economic option if acceptable levels of production can be maintained.
- *Importing commercial fertile eggs or day-old chicks for direct supply to farmers.* This option might be feasible in establishing a programme but it is costly. Although the full costs involved in producing DOCs locally from parent stock may exceed the cost of importing commercial DOCs if management and performance is low. With full cost recovery, these costs will have implications for the financial viability of the enterprise that must be understood.

There are other issues that also need to be considered. The indiscriminate distribution of imported breeds could have long-term adverse effects in diluting the advantageous traits in the indigenous breeds, especially broodiness in local hens.

There is potential for improving locally adapted breeds by selection. Virtually all the indigenous breeds have not been subjected to any selection process, other than natural selection. The consequence is that there is a large variation in production traits (i.e. number of eggs laid, etc.) between individuals in the overall population. By identifying and selecting the top performers for a given trait, and given the chicken's short generation interval, it would be possible to make substantial gains in genetic potential within the existing production environment. However, care must be taken since some traits are genetically negatively correlated i.e. broodiness and egg production. The logistical constraints in successfully implementing such a programme are formidable.

**Institution support.** The promotion and development of producer groups as the basis for self-sufficiency should be supported through training (technical and business management) and start-up capital in the form of goods or services. Involvement and support for the private sector in the provision of goods and services should be encouraged and, initially, this would involve the introduction of cost recovery for government goods and services that provide a 'private' rather than a 'public' benefit.

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