Keeping Village Poultry

A technical manual on small-scale poultry production

Network for Smallholder Poultry Development

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Need for a manual on small-scale village poultry

There is a growing attention and interest in using poultry as a tool in poverty alleviation in villages throughout the world. However, the existing literature either gives advice on industrial or semi-industrial production systems using exotic (imported) breeds under highly controlled conditions, or very simple field guides giving little useful advice on how to rear poultry at village level. The present manual tries to gather existing knowledge on how to improve village poultry production systems with relatively few inputs. ***The manual will deal with improved free-range systems consisting of small flocks of 5- 50 local or cross-bred chickens.*** Small-scale confined poultry rearing, sometimes also called small-scale industrial poultry production will not be dealt with in the present manual. The main reason behind this choice is the fact that many excellent practical handbooks and guidelines dealing with such systems already exists. Please consult Annex A for titles on manuals and books relating to small-scale industrial poultry production, as well as references for relevant training manuals dealing with improved free-range systems. In Annex B, you may find a short introduction to the three major international networks on small-scale village poultry development.

The primary target group of the manual is extension workers in the government and private sector involved with smallholder poultry development at village level. A secondary target group is literate small-scale poultry farmers. It is the intention that extension workers and literate farmers should themselves be able to extract the material they need from the manual and reuse it in their specific contexts.

Need for a participatory approach

When instructing villagers in improving poultry management and production, it is important that the training takes place in a participatory manner. Involvement and learning are enhanced when the participants contribute to the discussion. It is therefore essential that the participants are encouraged to come forward with their own experiences, and that the discussions take their point of departure in records of local practices and problems. Likewise, practical instruction, where the participants prepare equipment out of local materials, mix local feeds etc., highly increases their ability to remember what they have learned. The participatory method and learning-by-doing will create a direct connection between the training and the challenges the farmers encounter when implementing new methods. Please consult the separate Poultry Network manual on Farmer Field Schools for more advice and ideas on how to use the technical advice in practical training at farm level.

Introduction to technical chapters

The manual has been divided into six chapters dealing with 1) Poultry Management, 2) Housing, 3) Feeding, (4) Diseases and Health Management, 5) Profitability and Marketing of products, and 6) Animal and breed selection. Each chapter will present background information and possible solutions to practical problems in the every day management of small-scale poultry production under village conditions in the tropics.

Acknowledgements

The authors would like to acknowledge the support and ideas given by resource people involved in rural poultry development Worldwide. A first draft of the manual has been tested in several countries supported by Danida through Agricultural Sector Programme Support (ASPS) or NGO supported agricultural development activities. In Vietnam, Dr. Jens Peter Tang Dalsgaard, ASPS livestock advisor, his colleagues and local technical advisors have given fruitful feedback on techniques and training issues. In Benin, Dr. Christophe Chrysostome, FSA-UAB and his colleagues have tested several techniques and approaches and given us valuable feedback. In Bangladesh, Burkina Faso and Senegal rural development efforts supported by Danida under different development programmes and projects have provided us with useful information on technical as well as training issues. In Denmark, the Danish Poultry Network has received important critique from poultry development experts Mr. Hans Askov Jensen, Mr. Peder Lund, Mr. Peter Wollesen and Dr. Hans Ranvig. Finally, Dr. Emmanuelle GuerneBleich, Dr. Manuel Sanchez and Dr. Simon Mack from AGAP/FAO gave important feedback and advice on the first draft and supported us in terms of access to previous training material and drawings published through the UN system.

If you find that certain paragraphs or chapters should be changed or new issues added, please do not hesitate to contact the Network for Smallholder Poultry Development on our e-mail: poultry@kvl.dk.

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September 2004

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Village-based poultry production systems

Nearly all rural and peri-urban families keep a small flock of poultry. These are mostly owned by women and managed by women and children. Profits are usually low and products are used for home consumption, as gifts and for religious purposes. Village-based poultry production systems may be divided into at least three different categories (Table 1.1) i.e., A: traditional free-range, B: improved free-range and C: small-scale confined rearing systems. The aim of this manual is to suggest different interventions which may help the farmer to move from A to B, that is, to improve the traditional free range system into what is often called a "semi-scavenging system" .The small-scale confined systems, also called small-scale industrial poultry production, has been dealt with in several other handbooks and manuals, and will not be dealt with in this manual. Annex A gives references to a number of valuable publications relating to small-scale confined systems.

Table 1.1 Village-based poultry production systems.

A: Traditional free-range (1-10 birds) Low input/low output	**B: Improved free-range (5 - 50 birds) Low input/low output**	**C: Small-scale confined (50 - 200 birds) High input/high output**
Majority of rural families	Moderate number of rural families	Few rural families
Owned mostly by women	Owned by women & family	Businessmen
Home consumption	Home consumption and sale on local markets	
Small cash income	Family income	Business income
Social & cultural importance	Social importance	Little social importance
(gifts, religious)	Micro-credit	Credit based on assets
Indigenous breeds	Indigenous/ improved breeds	Hybrids (broilers or layers)
High mortality	Moderate mortality	Low mortality
No feeding (scavenging)	Local feeds (semi-scavenging)	Balanced feeds
No vaccination	Newcastle Disease vaccination	Several vaccination schemes
No medication	Little medication/local remedies	Full medication
No housing	Simple housing	Houses with cages or deep litter
Egg production: 30-50 eggs/y/hen	Egg production: 50-150 eggs/y/hen	Egg production: 250-300 eggs/y/hen
Long broody periods	Short broody periods	No broodiness
Growth rate = 5-10 g/day	Growth rate = 10-20 g/day	Growth rate = 50-55 g/day

Due to the complexity of the systems, there are many ways of improving poultry production of which the most important are reflected in the titles of the chapters of this manual, i.e. management, housing, feeding, disease and health management, marketing and breed and animal selection.

A. Traditional free-range poultry production

The present situation in many villages is that poultry is left with little or no care. This causes severe fall in productivity. The birds find their feed by scavenging among the houses in the village, and in addition they might get leftovers from the harvest and from the kitchen. As a result, feed is rarely adjusted to the needs of the birds. Young chicks are left scavenging together with adult birds, having to compete for feeds and becoming easy prey for predators and spread of diseases.

Very often birds do not get enough water, or they get dirty water, which may transfer diseases. Birds are seldom put in an enclosure or a shelter to protect them from wind and rain, or to keep them safe from predators and thieves. Nests for hens are rarely provided, causing the birds to lay their eggs on the ground. Furthermore, the system is usually based on hens with an ability to go broody and rear their own chicks. This has many advantages, but the long broody periods reduce egg production. Birds are seldom vaccinated or given medicine against diseases or parasites, as this is not seen as being profitable. Different poultry species are kept together and animals bought in the market or other villages are mixed with the flocks.

Consequently many birds die very young, due to predators, diseases, starvation, adverse weather conditions, and accidents. Often eight out of ten chicks die within the first few months.

Fig. 1.1 Poorly managed poultry farm

Many birds may get ill and grow slowly, producing fewer eggs and less meat. Birds that roam everywhere may easily catch and spread diseases. When one bird has a contagious disease, there is a greater risk that all birds in the village will get it. If there is a general lack of essential nutrients, resistance against diseases is low.

Village poultry production often encounters problems related to lack of organisation, which implies that local inputs, such as feed, medication, veterinary services, and training, are rarely available locally. Without organisation and knowledge about the potentials of village poultry, the abscense of an enabling environment, the farmers, mostly women, receive very little support and advice from each other or from extension workers. As a consequence village-based small-scale poultry production remains rudimentary in most places.

Poultry behaviour

Normally village poultry form small groups consisting of 5-10 hens with one cock, but flocks may vary from one up to around 30 adults and young growers, depending on the feed resource base and disease level in the area. Up to this number they will still be able to recognise each other, which will help diminishing conflicts among the birds. Each cock or hen in the flock enjoys his or her special status in relation to the others, implying that some have priority over others when choosing places for

nesting, for resting, for scavenging, etc. High-ranking animals will have nice feathers and combs, and their posture will show their dominant position. If a low-ranking hen comes too close to the territory of a hen of higher rank, the latter will indicate this by stretching her neck and turning her bill towards the intruder. Normally this will suffice for the other to retire. The ranking may change according to age, brooding, and other factors. The system of more or less stable dominance is very practical, since the animals can be free to concentrate on finding food and watch out for enemies.

Poultry have a very constant rhythm day in and day out. In the early morning and late afternoon they scavenge for food. Later in the morning the hens will often lay eggs, and after midday they will rest. When they sleep at night, they prefer to sit high in order not to be easy preys for predators.

Fig 1.2 Dust bathing is important for poultry to keep clean.

To protect against very high or low temperatures and to be fit to escape predators, it is important for birds to have good feathers. They therefore spend much time cleaning and preening their feathers with their beaks. In order to protect themselves against external parasites, they dust bathe several times each day (Fig. 1.2).

B. Improved free-range poultry rearing

A village hen often weighs no more than 1.2 – 1.5 kg at the point of lay. A village cock weighs maybe 1.4 – 2.0 kg at age of maturity. Poultry need a good supply of varied feed and of clean water. Depending on the time of the year they will be able to find part of their feed by scavenging in the surroundings of the household. But often they will need an extra supply of nutrients in order to gain weight and for hens to lay a good quantity of eggs. Especially the small chicks need good protein-rich feeds such as balanced feeds or from simple supplementary sources such as maggots, snails, termites etc. (see chapter 3 for more advice on feeds and feeding).

Often a free-range hen will lay the first eggs at the age of 22-28 weeks and lay 3-4 clutches of 10-15 eggs a year, depending on season, and in particular availability of feeds. A hen will often find a dark, quiet place for laying eggs and for brooding. She does not want to be disturbed by the others, and she wants to feel safe from predators and passers-by. Unfortunately, many eggs go bad before they are hatched, because of disturbance, lack of nests, and annoying ecto-parasites making the hen leave the nest frequently, with resulting low hatchabililty.

After 21 days of incubation remaining eggs will hatch. Most free-range poultry keepers will let young chicks follow the mother hen immediately after hatching. The result is very high chick mortality during the first weeks of age, mainly due to predation by eagles and snakes, drowning, from road accidents and general chick exhaustion.

Flock management

In general, it only takes a little continuous attention every day to improve your free-range poultry production. But before starting, it is highly advisable to make calculations of whether the enterprise will be profitable or not. For further advice on how to calculate inputs and outputs and to assess the risk, please see chapter 5 on Marketing.

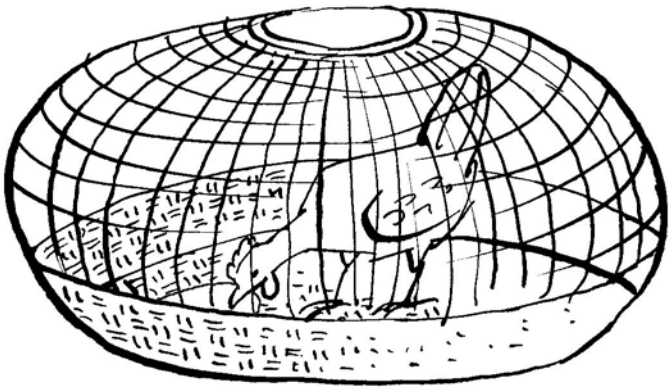


Fig. 1.3 An example of simple housing for up to 5 hens (Night basket)

Fig. 1.4 An example of a simple house for a flock of 10-20 birds in Senegal

A simple night-basket or chicken house or (Fig. 1.3 and 1.4) will diminish the risk of loss because of bad weather, predators and thieves. Inside the house the birds need perches to sit on when they sleep. If you put the nests inside the house as well, it is easy to find the eggs, and the hens will not be disturbed.

For table egg production, you only need hens. However, some farmers keep one cock with the hens to watch for predators and to facilitate the pecking order, thus minimizing conflicts within the flock. To produce fertile, hatchable eggs, you will need one cock for approximately 10-15 hens. When surplus cocks reach a marketable size, they should be sold, slaughtered, or given away as presents, to prevent the cocks from eating the scarce feed resources, as well as fighting and stressing the hens (Fig. 1.5). You may easily recognise young cocks by their tail feathers, their comb, and their general (aggressive) behaviour and appearance in comparison to the hens.

Fig. 1.5 Undesirable cock-fighting may be avoided by selling of young cocks.

Always take into consideration that the size of the flock should match the size of the house, the amount of feed you can afford to buy and the feed resources in the environment (scavenging feed resource base). Additional advice on housing and feeding may be found in chapters 2 and 3.

Do not buy animals at the market from uncontrolled sources, especially not during periods when outbreaks of diseases are common. They may introduce contagious diseases into your flock.

Vaccinate all birds against Newcastle Disease and other prevailing diseases such as Fowl Pox on a regular basis to prevent high mortality. Small chicks should be vaccinated against the common contagious diseases at the age of 2-3 weeks. Re-vaccination should always be performed according to the instructions (see chapter 4 on disease and health management for further advice).

In case of serious diseases you should slaughter the bird (it can be eaten if cooked well), call the veterinarian, or use drugs if you feel absolutely sure that you know the disease. If you do not kill it the bird at once, it must be separated from the others. Sick birds (or parts from sick birds) should be burned or buried deep enough to avoid that dogs and other animals dig them up and spread the disease. If you have many sick animals, do not introduce new birds, and do not vaccinate.

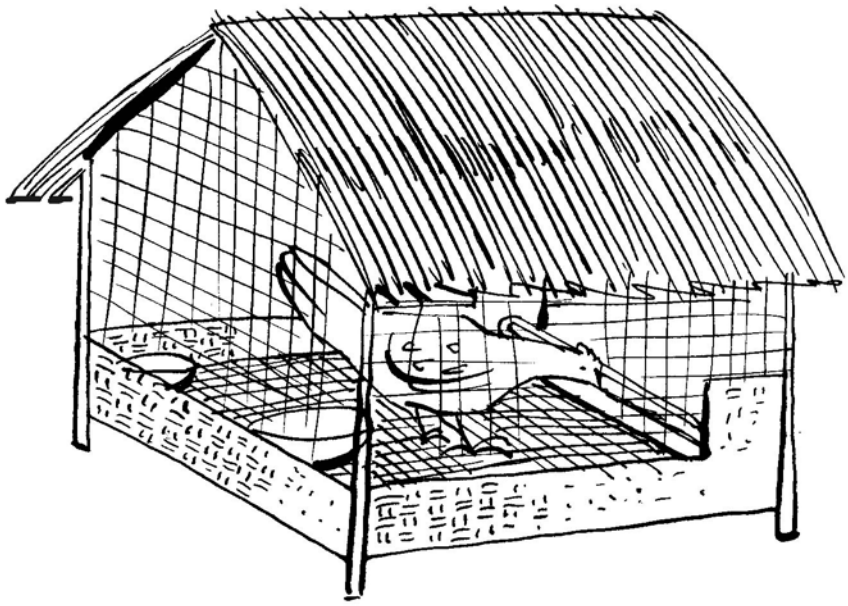


Fig. 1.6 A separate shed may be necessary to isolate ill or newly purchased birds.

Before introducing new birds to your flock, you should keep them isolated for one to two weeks (Fig. 1.6).

Fig. 1.7 Careful observation of the flock on a daily basis is important.

Daily rhythm and careful observation

It is very important to spend some time each day observing every animal carefully (Fig. 1.7). In this way early signs of disease, malnutrition, or other problems may be discovered, and the necessary precautions taken. Knowing each hen will also help you choose eggs from the best hen for hatching, so that the chicks may inherit her qualities.

Eggs for sale or hatching should be collected in the morning and again in the evening. In this way they will not be dirty or crack when the hens sit on them and the hens will not be so tempted to brood as when there are many eggs in the nests. Eggs should be stored in a cool and humid place until sale or brooding.

In order to prevent internal as well as external parasites a good hygiene is a must (Fig. 1.8). So every day the feeders and drinkers should be washed, and the house and the nests must be cleaned for droppings, insects etc. Put fresh straw or hay in the nests **weekly.** Adding a little ash on top may help prevent parasites (see chapter 2 for nest management).

Fig. 1.8 Every day the house, feeders and drinkers should be cleaned carefully.

At least once a year, and always after serious outbreaks of diseases, the house, perches, and nests should be disinfected by thorough cleaning and lime-washing (fig. 1.9). Alternative ways of disinfection, e.g. smoking, may be used but are less

effective. If problems persist in small wooden cages or houses, they should finally be burned, and a new house built, as parasites may hide in even the smallest cracks.

Fig.1.9 Lime-washing the inside of the house for disinfection.

The birds should always have access to a dry place for dust bathing. If they prefer a certain place, you may add a little sulphur or ash against the parasites.
You may encounter problems with hens pecking each other, but mostly in flocks with high density, or if you keep local birds inside during the day. Wounds from pecking should be treated immediately to avoid cannibalism in the flock.

Fig. 1.10 Pecking often occur if local birds are kept inside for days.

It is advisable to keep records of your production. This will make it easy for you to see successes and problems at an early stage. See chapter 5 for advice on record keeping.

Feed and water

To produce well and have good resistance against diseases, birds need adequate quantities of good quality feed. See Chapter 3 for more advice on feeding and watering. Supplementary feed and clean water should be given at least early in the morning and again in the evening when the birds are returning to the house for the night. It is important that the feeders and drinkers are kept clean, so that infections do not spread through dirty feed and water.

Fig. 1.11The drinker and feeder should be carefully cleaned early morning and late evening to avoid spreading of diseases.

Young chickens should be fed separately from the adult birds (Fig. 1.20B) They will often have a special diet, and it is best for them not to have to compete with the adults for food. It is very important for small chicks always to have access to clean water, as they may easily die from dehydration. There is more information on management of young chickens later in this chapter.

Laying hens

Hens start laying eggs at the age of 22-32 weeks, depending on the breed, their health, and development. Often indigenous hens will start much later than imported (exotic) breeds. Hens around 40-50 weeks of age lay the most eggs, and then gradually their egg production decreases slowly. If a mature hen lays very few eggs, you should sell or eat it. In small flocks, it is relatively easy to check whether the hens are laying eggs or not (Fig. 6.4). Laying hens should have easy access to calcium rich food that may be supplemented by calcium-rich sources such as crushed snail or egg shells.

Provide nests in the hen house for laying. This way it is easier to find the eggs, and they can be kept clean. In order to teach the hens to lay in the nests, you may place a couple of eggs or stones looking like eggs in the nests. If you mark the eggs properly, you will know which eggs are new and should be collected. When hens go broody and sit on the eggs, they always stop laying. By collecting eggs several times a day, you may avoid that the hens become broody. If a hen goes broody, and you don't want her to, separate her immediately from the rest. You may for example isolate her in a small cage in a cool place, without access to nest material for a few days (Fig. 1.12).

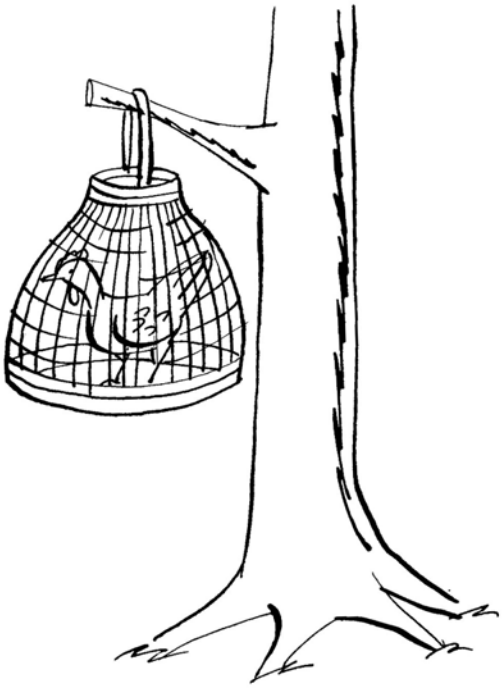


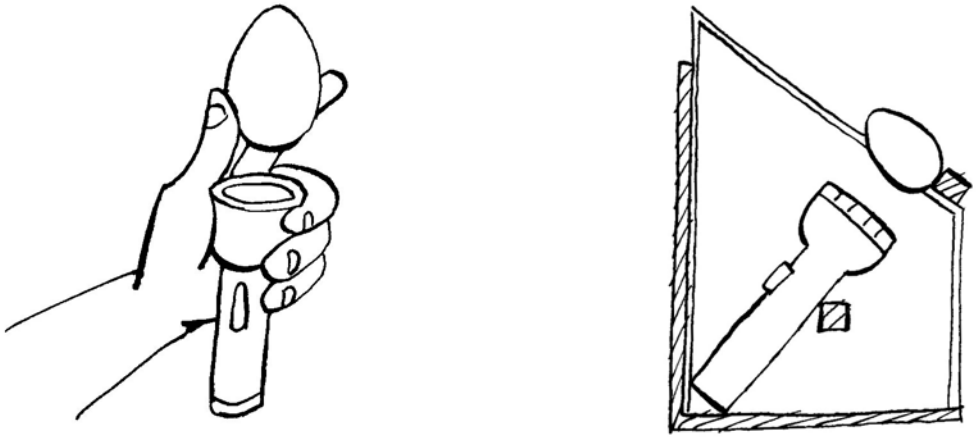
Fig. 1.12 If you do not want a hen to go broody, separate her from the rest.

Do not hatch new chicks if you don't have enough feed for them. If you hatch too many chicks, they may die from starvation or malnutrition, or their resistance to diseases may be reduced.

Natural incubation and hatching

For chickens it takes 21 days for eggs to hatch, for ducks it takes 28 days.

Eggs should be fresh before incubation. The age of eggs should be no more than 10 days, when stored at temperatures below 20° C. If the temperature is higher, the eggs should be no more than 5 days old. To obtain the best incubation result, the eggs selected for incubation should be of average size and normal shape for the breed. Further, the eggs should have a smooth uncracked shell. If there are cracks in the shell, the loss of moisture from the egg can be too high and the embryo may die. There is also a risk of bacteria entering the egg, which may lead to unhealthy or dead embryos. Store the eggs in a cool and humid place until incubation, for example in a box in a hole in the floor of the coolest part of the house. Eggs for sale may also be stored in the same place. During incubation you should always check, which eggs are fertile and which are non-fertile. Fertile eggs very quickly develop blood vessels, which may be seen against a sharp light from a torch (See figures 1.13 and 1.14).



a. b.

Fig. 1.13 Home-made candlers using either your hand or a wooden box, and a torch

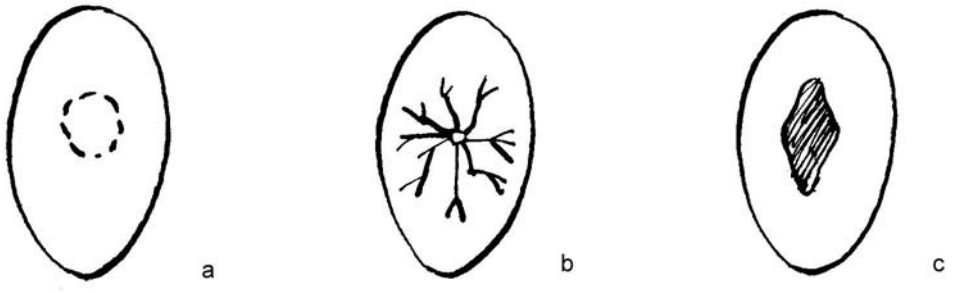


Fig. 1.14 Identification of infertile eggs (a), fertile eggs (b) and eggs with dead embryos (c)

After 7-10 days of incubation the eggs can be candled and the infertile eggs and eggs with dead embryos can be removed from the nest. Figures 1.13a-b shows two simple candlers and figure 1.14 shows how fertile eggs, infertile eggs and eggs with dead embryos are identified at the age of 7 days. When candling, a fertile egg has visible blood vessels and a dark spot that is the embryo. The blood vessels can be more or less developed depending on how strong the embryo is. If the embryo is dead, it is seen as a ring of blood around the embryo. An infertile egg has an enlarged air cell and the yolk causes and obvious dark area in the egg. It is important that infertile eggs and eggs with dead embryos are removed from the nest as they will decompose and may break and spoil the fresh eggs under incubation.

Fig. 1.15 Bad situation for the brooding hen:

- The hen is disturbed by others.
- She does not have access to feed and water.
- The nest is full of parasites disturbing her.
- The result is few eggs being hatched and a low survivability of the hatched chicks, who easily get ill and die.

Fig. 1.16. A good situation for the brooding hen:
- The hen is left alone with access to feed and water.
- The nest is well-managed with clean hay and antiparasitic remedies.
- She leaves the nest only shortly to drink and feed.
- The result is a high hatchability and healthy and lively chicks with a high survivability.

A broody hen should be separated from the flock to prevent other hens from disturbing her (fig. 1.16). Keep the hen in a separate nest with free access to fresh water and feed within a short distance. Provide the hen with a brooding nest or basket big enough to contain all her eggs. Put fresh hay or straw in the nest and add some ash to prevent parasites. Add more eggs from other nests until she has enough according to her size.

In the dry and hot season, you may spray the breast of the hen with water to increase the humidity around the eggs. The hen will do the work of hatching perfectly if she has the right conditions, for example a clean and suitable nest and quiet surroundings.

If only small quantities of chicks are to be hatched, a free-range hen is a better brooder than an artificial incubator, as she will normally have a higher rate of hatching (80-100%) than an incubator (60-80%).

After hatching and until the chicks are old enough to be on their own, usually around 4 weeks of age, the hen will directly protect the chickens from adverse weather conditions and predators by covering them with her wings. Indirectly, the hen will protect the newly hatched chicks against diseases for the first two weeks; and slowly transfer her natural behaviour to the chicks. Natural behaviour means knowing how to search for food and water; which feed to take and which to avoid, how to avoid predators by hiding or seeking shelter in bushes and trees, how to keep healthy by dust bathing, etc.

Management of small chickens (basket system)

In hot climates, the best and cheapest method to guard the small newly hatched chicks is the so-called "basket system" (Fig. 1.17). Small chickens should be kept with their mother overnight in a so-called night basket, i.e. a round conical cage with a floor, see figure 1.3. A night basket may be made from bamboo or thin pieces of wood. Dry cut straw, rice husk, saw dust or shavings of 8-10 cm depth can be used as litter. In the morning, the chicks should be removed from the night basket and kept in a day basket, which is a bottomless conical cage, see figures 1.17 and 1.18. A dry jute or straw mat should be placed in the cage if the soil is damp or wet. The day basket should be moved to a new clean spot every day to avoid diseases. The night basket is closed in order to prevent predators from entering and in order to keep the hen and chicks warm at night.

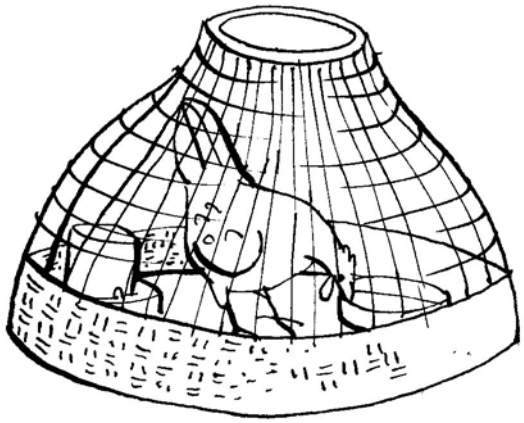


Fig. 1.17 A day basket with a jute mat, a feeder and a drinker.

The basket can easily be moved around. The day basket needs to be bigger and more open in order for the chicks to move around without the hen stepping on them and in order to secure good ventilation. There has to be room for a small feeder and drinker. When the weather is hot, the chicks often do not need extra heat, but they should be protected against wind and rain.

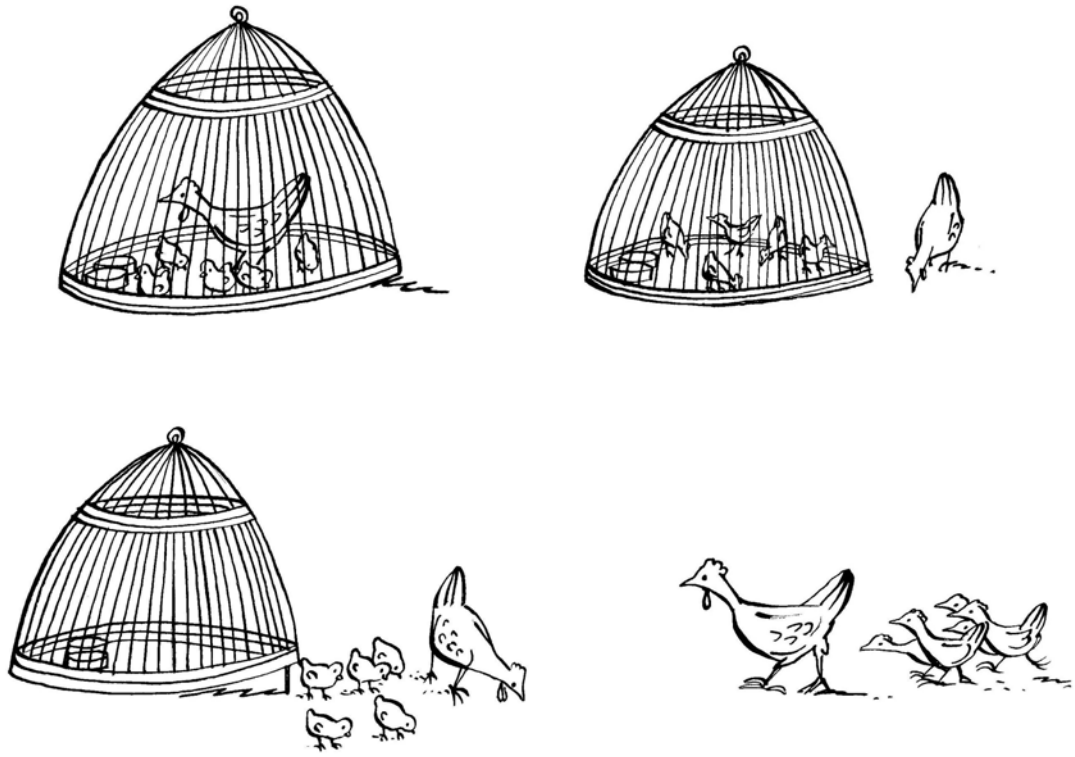


Fig. 1.18 Management of small chickens using the day basket system

The basket system may be used according to the following schedule pictured in fig. 1.18:

A: 0-1 week of age:
Keep the hen with the chicks from 4-7 days to protect them and to adjust the temperature. She will know exactly how to adjust the temperature according to the sound of the chicks. Make sure there is easy access to clean water and high-protein feed for the chicks. Ensure that the basket is kept clean, by removing droppings and spilled feed on a piece of paper or a woven mat placed beneath the basket.

B: 1-3 weeks of age:
Keep the chicks in the cage all the time, but let the hen out for scavenging during the day. She should be able to hear the chicks from where she moves. If she wants to enter the cage, she should be allowed to do so. Make sure there is easy access to clean water and high-protein feed, and ensure that the basket is kept clean at all times. Keep hen and chicks together during the night.

C: 3-6 weeks of age:
Keep hen and chicks together during the night, but gradually let the chicks out for scavenging with their mother during daytime. At first, only for a few hours during the morning, and then gradually a little longer. Make sure that the chicks still have easy access to clean water and high-protein feed under the basket, but that the entrance is too small for older birds to enter. Ensure that the basket and the ground are kept clean at all times.

D: After 6 weeks:
Remove the basket system, and let the chicks scavenge freely together with the mother hen. Give supplementary feeding in the evening for the whole flock, according to their needs (se chapter on feed).

Ten simple rules for better management

1. Provide simple houses or shelters and perches inside houses;
2. Use day baskets during day and night basket during night;
3. Give unlimited access to clean water;
4. Separate young chicks from adults, when they are fed;
5. Control the birds' health daily;
6. Apply vaccines regularly according to the advice of local vaccinators or veterinarians;
7. Isolate a bird when it becomes ill, - call the veterinary assistant or kill the bird;
8. Kill or sell non-productive birds, i.e. cockerels and old hens that have stopped laying;
9. Provide nests, and control nests for eggs two times a day;
10. Check the reproduction status of each hen once a month, and give extra care to hens that are brooding.

Why should poultry have houses or shelters?

Housing is essential to protect against predators, thieves, rough weather (rain, sun, very cold winds, dropping night temperatures) and to provide shelter for egg laying and broody hens. A suitable or comfortable poultry house is also important for efficient production and convenience of the poultry farmer. In the following, we will discuss the simple guidelines for size and type of the chicken house, site selection, and lastly the equipment needed for rearing.

Fig. 2.1 Housing should first of all protect against predators and bad weather.

Depending on availability of materials, weather, and tradition you will find different types of poultry houses and shelters in tropical regions. Choice of chicken house should be built upon a rationale involving an estimate of the costs, the durability, and immediate gain of using a house for the poultry.

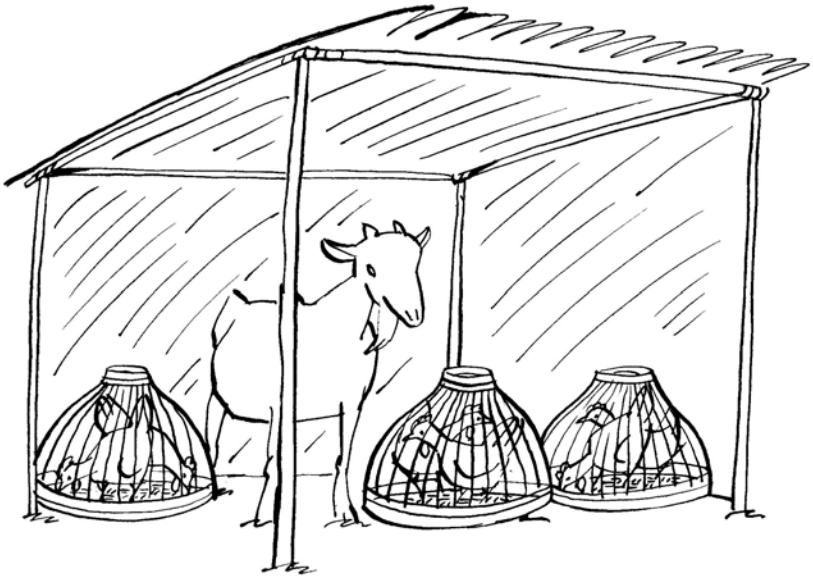


Fig. 2.2 Three night baskets kept in the stable during night

The simplest and often most cost-effective housing system is the basket system (fig. 2.2. and 1.3). Night baskets (Fig. 1.3) may be placed in a quiet and dry place in the house or in the stables on the farm during night, either on the floor or hanging from the roof. A night basket may hold 5-10 chickens depending on size.

If the need for a bigger and separate chicken house arises, you need to carefully consider the site, the materials and not least the costs involved. When choosing the right site, you should consider:

- A shady and dry place on flat ground to keep the floor dry during the rainy season. It may be necessary to dig a drain around the house, or to raise the ground first. Alternatively the house can be elevated from the ground as in figure 2.3.
- A fertile well-drained soil is desired. The area must not get flooded during heavy rains. The chickens can drown. Furthermore it is very detrimental to have wet floors in a chicken house, it leads to many diseases. A sloping hillside provides good drainage and affords some protection also.
- Trees and bushes close to the houses provide shade and are therefore beneficial. Trees serve as a windbreak in the winter and for shade in the summer and protect from flying predators.
- It is also for security reasons important to have the chicken house near the house. You must be able to hear if chickens get disturbed at night by predators, or a thief who wants to steal the birds.
- The orientation of a chicken house has to take into consideration the movement of the sun and the dominating winds, making the house naturally shaded and ventilated at certain times of the day. Select a site on which the poultry house should face South or East in moist localities. Windows placed on the south side of the house will be a good source of light and warmth in winter and a good source of ventilation in summer. In a rectangular house the end walls must face East and West. This will ensure that only the end walls face the hot morning sun or the even hotter sun during the afternoon.

<u>Building the house</u>

- *Always use cheap local materials like bamboo, wood, reeds, thatch grass, or clay bricks.*
- Remove the bark from the wood you use, as parasites often hide behind the bark.

- Clay houses should have windows. A hole in the top of the house may ensure good ventilation. These measures will also give light, making it easier to work in the house. However, make sure winds will ventilate the house without making chickens or hens cold.
- During the rainy season, rain and wind may cause severe chilling.
- Heat, humidity, and harmful gasses may be considerably reduced through good ventilation of the house or shelter. High temperatures may cause deaths or drop in egg production, low shell quality, and reduced weight gain. A combination of high temperatures and high humidity may kill young chicks.
- Placing perches and nests inside the house will safeguard against most predators. It will also help to keep the legs of the chickens and the eggs clean.
- If the nests are in a quiet place in the house, the hens will feel comfortable and at ease.
- The best protection against diseases and parasites is a good hygiene. It is therefore important that it is easy to clean the house or shelter. It should be tall enough for a grown-up person to work in there. Cleaning will also be easier if the floor in wooden houses is covered with slats.
- Make the nests and perches easy to remove when cleaning.
- Houses or shelters may be sprayed or lime washed after cleaning to disinfect and kill parasite eggs from the walls and cracks. You may put some ashes on the floor and in the nests to discourage parasites.
- Clear the grass and bushes for about 3 meters on all sides of the house to keep snakes and rats away from your chickens.
- In wooden houses, use slatted, raised floors to remove droppings and avoid predators.
- In clay houses, use wired windows to avoid predators.
- Some houses are built on poles, well above the ground to protect the chickens from predators like dogs, rats and snakes, as well as humans.
- Build your poultry house to prevent possible injury to your birds. Remove any sharp edged objects from the house.
- The house has to be so large that there is sufficient room for the birds, and so that the air inside does not become too heavy with humidity and gasses. A round or square house of 1.5-2.0 m^2 will hold 10-12 adult birds.

Figures 23a and b illustrates a badly and a well constructed chicken house.

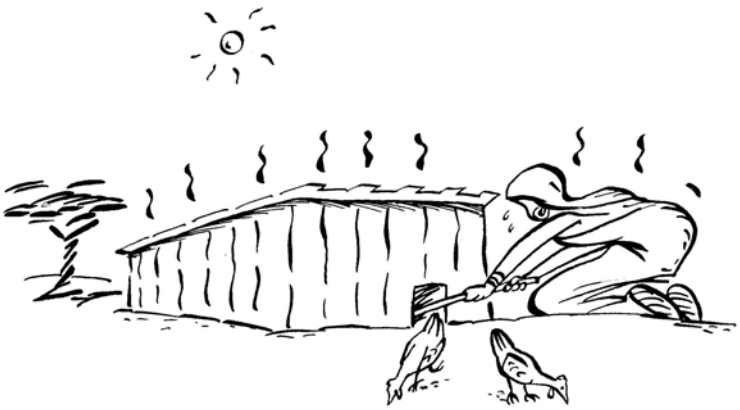


Fig. 2.3a A badly constructed chicken house is placed in the sun with a low flat roof and no windows making it very hot and badly ventilated. It has a small door, which makes it difficult to access and clean.

Fig. 2.3b A well-constructed chicken house is placed in the shade, has a high roof and windows with wire mesh, providing good ventilation. The door is facing north to avoid direct sun. The door is big enough for a person to enter to clean the house frequently.

Theft

Often the entrance to the chicken house is very small and not easily accessible. The reason is that people are worried that their chickens will be stolen. There are however, a lot of problems connected with this method of securing the chickens. It makes cleaning and collection of eggs very difficult and it also causes bad ventilation. The opening to the chicken house must therefore be so big that an adult person easily can enter and work in the house. Other precautions against theft should therefore be taken. The house should be placed near the household in order for the owner to react on any unusual noises during night. Alternatively, a lock may be fitted on the door.

Perches

Perches (fig. 2.4 and 2.5) are important for chickens to rest during night. Diseases and parasites may attack poultry resting on the floor, and perches often reduce the risk of external parasites entering the feathers at night. Each one-meter perch may roost five adult birds. Perches are best made of bamboo or round sticks to accommodate for the size and structure of the birds' feet (fig. 2.5). If the sticks are too big or too small, the birds may fall (fig. 2.4). To prevent attack of external parasites, the perches may be treated with oil or kerosene, where the perch meets the wall.

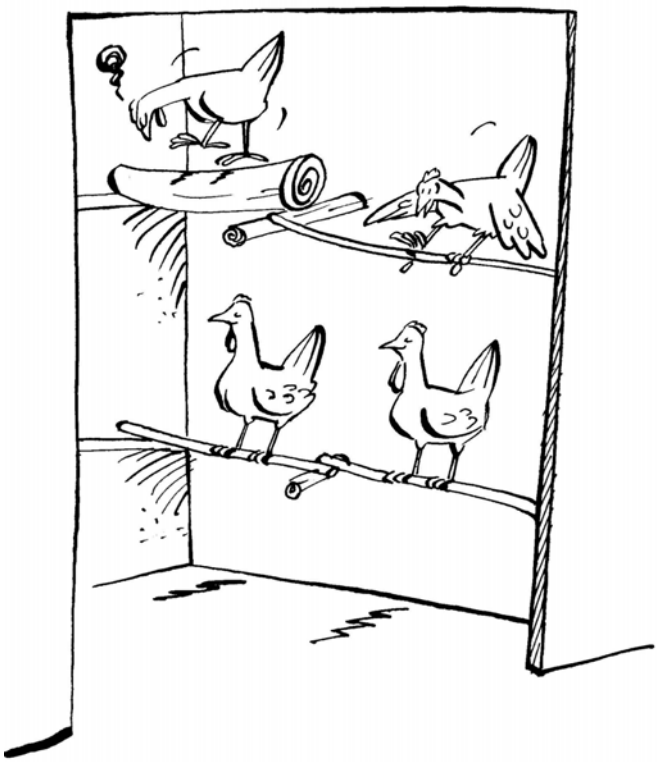


Fig. 2.4 Avoid using either too big or to small sticks as perches

Fig. 2.5 Sticks should match the size of the birds' feet

Nests

In many villages, nests are not provided for the hens and eventually the hens will lay their eggs on the ground, in high grass or in natural shelters, where they may be difficult to find. Some poultry farmers build nests on the ground outside the chicken houses. This should be avoided, as eggs outside houses are more exposed to predators and thieves. Nests should be placed inside the chicken house and preferably above the ground. For laying you may have a battery of nests where more hens can lay at a time (fig. 2.6).

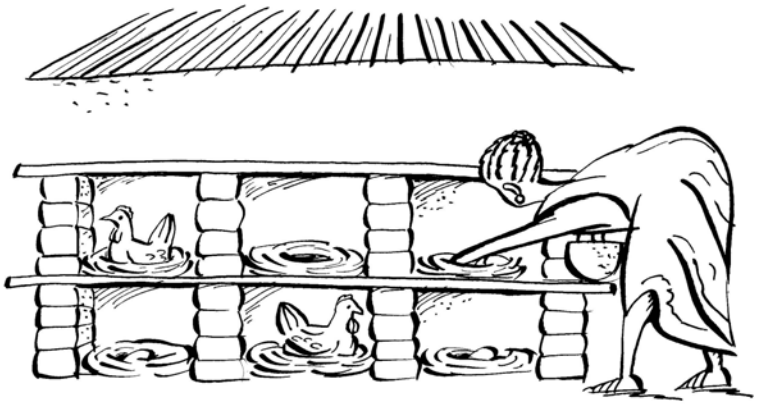


Fig. 2.6 Battery of nests for laying hens

There must be 1 nest for every 5 hens. The nests for brooding on the other hand must be individual, placed in a quiet and dark place, and they must be easily removable (fig. 2.7). Once the hen is broody it can be necessary to remove her to a different place, e.g. the farmer's house, to avoid other hens disturbing her, or even going broody as well.

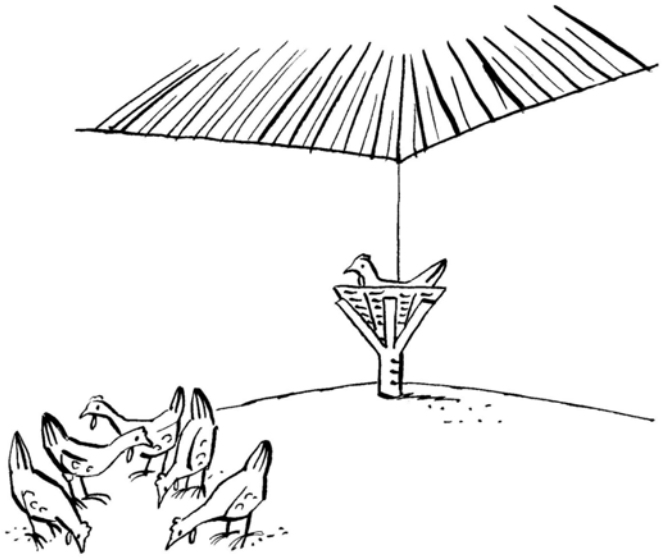


Fig. 2.7 Nests for broody hens should be placed in a quiet place

Simple nests may be clay pots, calabashes or baskets made of local fibres, cardboard, or wooden boxes (fig. 2.8). Nests should be of the right size for the hen to feel comfortable. A nest box will typically measure 30 x 30 x 30 cm. Don't make them too big, as the hen will not feel comfortable. A calabash or nest basket may measure 40 x 20 x 25 cm (upper diameter x height x lower diameter). A clay pot, more or less the same.

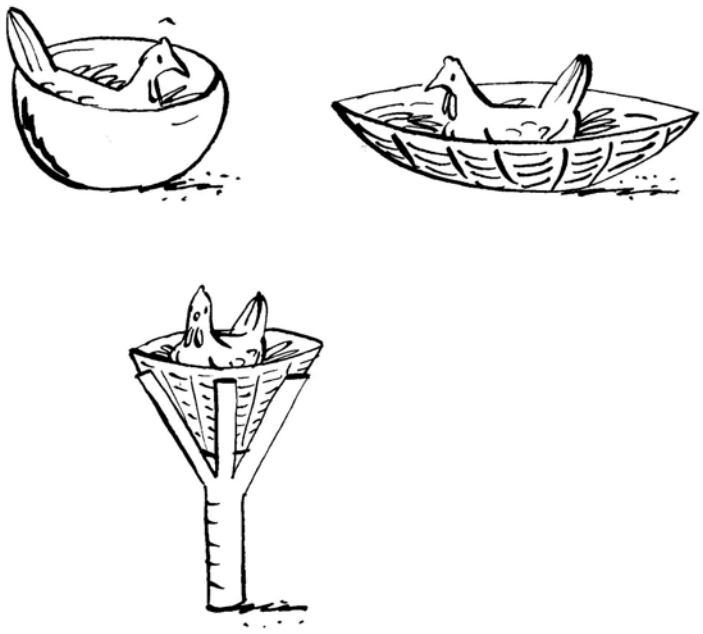


Fig. 2.8 Simple nests for broody hens should be easily transported

A healthy and attractive nest for the broody hen may be prepared by following these three steps (fig. 2.9):

1. Make sure that the pot or basket is clean and dry;
2. Fill sand mixed with ashes up to 1/3 of the depth;
3. Put clean, soft nesting material (hay or straw) on top up to 2/3 of the depth.

Fig. 2.9 Three steps in preparing a nest.

Nesting material should be changed at least once a week. You should assure that the rim is 1/3 of the depth to make the hen feel secure, and if necessary put "dummy eggs" (e.g. boiled or stone eggs) in the nest, to attract a hen. Mixing ashes, tobacco leaves or other anti-parasitic substances with the nesting material will keep out most external parasites. External parasites in nests may reduce the hatchability of eggs, as the hen will use too much time and energy leaving the nest, cleaning and scratching her body, leaving the eggs cold.

Providing nests also makes it easier to collect eggs. You may avoid dirty and cracked eggs, if the eggs are collected twice a day. Collect eggs at the same time every day, in the morning and the evening. Removing eggs continuously is important if you want to avoid that the hens become broody, as broody hens stop laying eggs.

Shelters for the mother hen and chicks

After hatching, it is important to keep the hen and the chicks close together in a separate cage: the basket (see also Chapter 1, Management of small chickens – basket system). Such a shelter should primarily protect against adult poultry competing for feed, and against predators, and it should provide a stable environment, sheltering from sun, rain, and wind.

Fig. 2.10 Shelter for chicks after hatching. Place the shelter on a mat to protect against the cold.

A shelter of basketwork with a top hole (diameter 20 cm) is useful, as feed and water may be changed without disturbing the birds unnecessarily. It also gives the necessary ventilation.

A woven mat on the floor may provide additional protection during cold periods. The mat should be cleaned daily to remove droppings and leftovers from feeding (fig. 2.10). Droppings may be recycled as manure in a vegetable garden.

Chicken runs

In some regions, chicken runs are very popular, a fenced open air space of 25 m^2 or more, where poultry may be kept in protection against predators and thieves. Fenced areas are also used for feeding, watering, observation of the flock, and collection of eggs. 1.5 – 2 meter high walls made of clay or woven mat are constructed as fences (fig. 2.11). A chicken run is relatively costly, but may provide a sort of security to the farmer. It is however crucial that adult birds are left scavenging outside during daytime in order to keep feed costs low.

Fig. 2.11 Chicken runs may be used for feeding, watering and observation of the flock.

Ten simple rules for good housing

1. Use baskets for night shelter and day shelter for small chicks to reduce costs and labour involved;
2. Always use local materials to reduce costs;
3. In wooden houses, use slatted, raised floors to remove droppings and avoid predators;
4. In clay houses, use wire netting for the windows to keep out predators;
5. Place the perches and nests inside the house, and make them removable to facilitate cleaning;
6. Make sure winds will ventilate the house without making chickens or hens cold;
7. Consider heavy rains and hot sun when placing the house or shelter.
8. Provide nests with clean straw, which are easy to access, clean an move.
9. Always house young chicks with their mother away from other adults.
10. Make sure that houses are easy to access and clean.

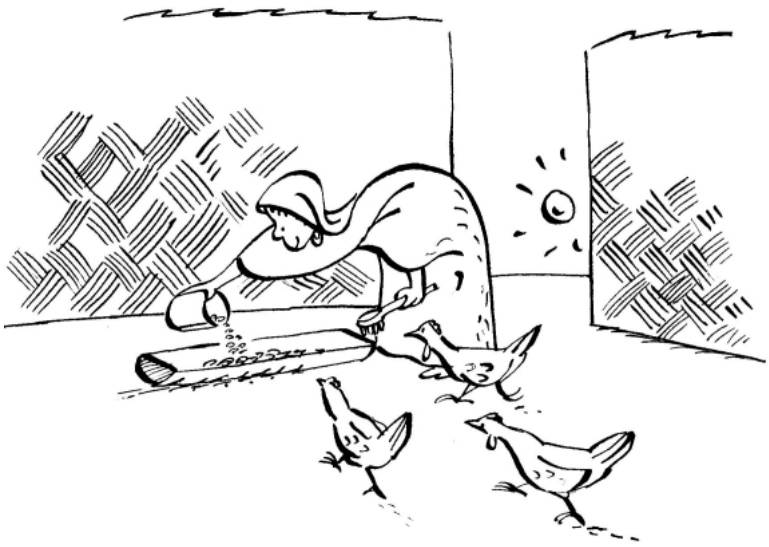


Fig. 3.1 Supplementary feeding and water is essential to increase production

Why give supplementary feed?

Feeding is essential if you want to increase the production of meat and eggs from poultry. Even small flocks will eventually starve during certain periods of the year, if they are fed only leftovers and feed, they find by scavenging. Lack of feed or water will reduce the birds' resistance to diseases and parasites, and subsequently increase flock mortality.

Egg production and the birds' growth are limited by access to feed and their genetic potential. Local birds living in the villages are normally the best converters of feed to eggs under fluctuating environmental conditions, although their production potential is much lower than genetically improved breeds. You may easily increase egg production and growth of local birds by giving supplementary feeds, but also improved breeds may perform well under village conditions, if they are given a steady supply of feeds. However, you should always start by making calculations of the cost-benefit and judge the risks involved (Chapter 5), before choosing the quantity and type of feeding. Advice on feeds and feeding will be different for free-range, improved free-range systems or small-scale confined systems of poultry production, basically due to different economic situations. In the following, we will focus only on improved free-range systems and discuss the importance of feed requirements, feed types, feed mixing, and lastly needs for storing and the equipment needed for feeding and watering.

What to feed?

The composition and availability of feeds will vary, depending on the season, site location and farming systems. In general, poultry, as other animals, need feed

containing energy and protein, as well as vitamins and minerals. The need for feed will change, depending on the age and status (chicken, grower, egg layer, broody hen) of the bird. The cheapest – and also often the best – way to supplement the diet of your poultry, is to use local resources. However, many vitamins and nutrients are destroyed if stored too long or under sub-optimal conditions, e.g. high humidity and heat. Knowledge of the quality and source of different feedstuffs is thus important, to reduce the risk of bad feeding.

If your production is based on improved breeds for egg production, different types of commercial diets may be given: usually they are divided into three distinct categories, with decreasing amount of protein, e.g:

A. A starters' diet: high in protein; from hatch up to 4 to 6 weeks of age;
B. A growers' diet: medium in protein; up to 20 weeks;
C. A layers' diet: lower in protein; hens from 20 weeks.

If you consider buying commercial feeds, you have to calculate whether it is profitable to do so. If the price of eggs or meat is lower than the price of feed, it does not pay. Avoid giving commercial feeds to local breeds, as it is rarely feasible. Only during the first four to six weeks of age, you may consider giving premixed supplementary feed bought in the market.

Scavenging

In a free-range or improved free-range poultry rearing system, adult hens and cocks should always be given enough time and space for finding feed in the surroundings (scavenging). Small chicks should be kept in confinement for the first 4-6 weeks (see Chapter 1- Management). The best time for scavenging is early morning and late afternoon, as there are most insects and less heat. The best time for giving supplementary feed will be in the morning and in the evening, when the birds come back to the house. *Ad libitum* water should be provided in shady areas during the day to avoid heat stress.

Types of feeds

Depending on the type of feed, it will contain more or less energy and protein, as well as vitamins and minerals (fig. 3.2).

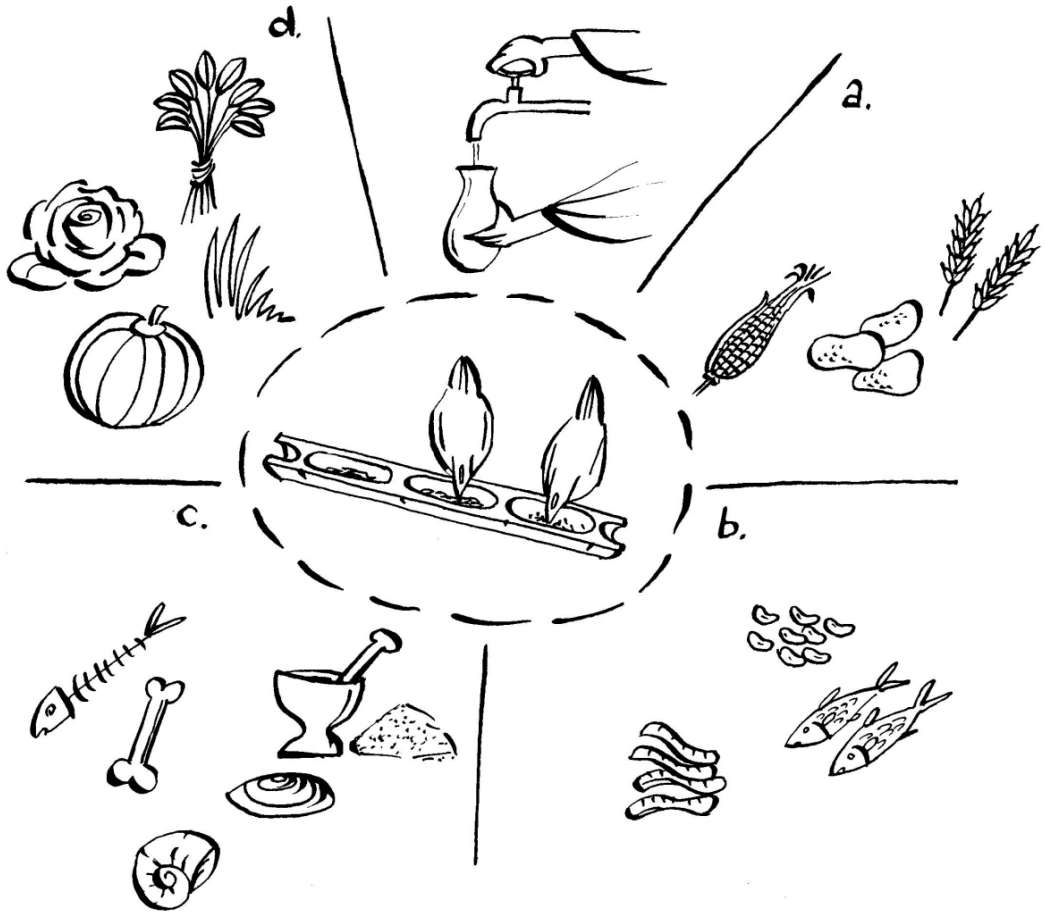


Fig. 3.2 Feed types split into sources of energy (a), protein (b), minerals (c) and vitamins (d). Remember always to give free access to water.

Energy feeds

Normally, at least ¾ of a poultry diet is made of energy feeds. Energy feeds are the most important feeds to maintain body temperature and exercise levels of the birds. Cereals, grain, roots, and tubers are the most important energy feeds. Examples of energy feeds are cereals like maize (corn) and its by-products (bran), sorghum (milo), wheat and its by-products (bran, shorts, screenings), rice and its by-products (bran, polishing), cassava root meal (farina, tapioca), malanga (taro), yam meal, yucca meal, sweet potato meal, plantain and banana meal. Roots and tubers should be soaked in water for 60 minutes or cooked before drying to remove harmful substances, and the proportion in the diet in general kept below 1/10.

Fat is also a good source of energy, in particular in hot climates, as the heat produced during metabolism is less than from traditional energy feeds, e.g. cereals. Sources of fat are e.g.: tallow, lard, oil cake meals, poultry fat, fish oil, restaurant grease. However, fat should only be given in small amounts, i.e. less than 1/10 of the total diet.

Protein

Protein is needed for growth and keeping up a good health status. Normally no more than 1/5 of a diet is protein-rich feeds, as they are normally very expensive. Protein may come from either animal sources or plants. Examples of protein-rich local feeds are: Maggots, termite eggs, insects, worms, meat scraps, fish scraps, fish meal, meat meal, bone meal, blood meal, feather meal, peas, beans, and oil cakes from e.g. ground nuts, cotton seeds, palm kernels, and coconuts. Harmful substances are present in some protein-rich plants, e.g. beans, and the proportion in the diet should thus be kept low. The level depends on the type of plant, and whether the feed is being prepared before feeding.

Minerals

Minerals are important for bone formation, eggshell formation and a good health status. The most important minerals are calcium and phosphorous. To produce strong shells for their eggs, laying hens need free access to calcium (limestone or crushed shells), and adult birds are usually able to balance their intake according to needs. If you add phosphorous rich feeds, it should be balanced with calcium, since too high levels of one may cause deficiency of the other. Examples of sources for minerals are: bone meal, crushed oyster shells, snail shells, and burned eggshells. Using bone meal or eggshells is a good way of balancing the calcium and phosphorus levels. Eggshells should always be scorched or cooked before re-use in diets to remove any disease germs, see figure 3.3.

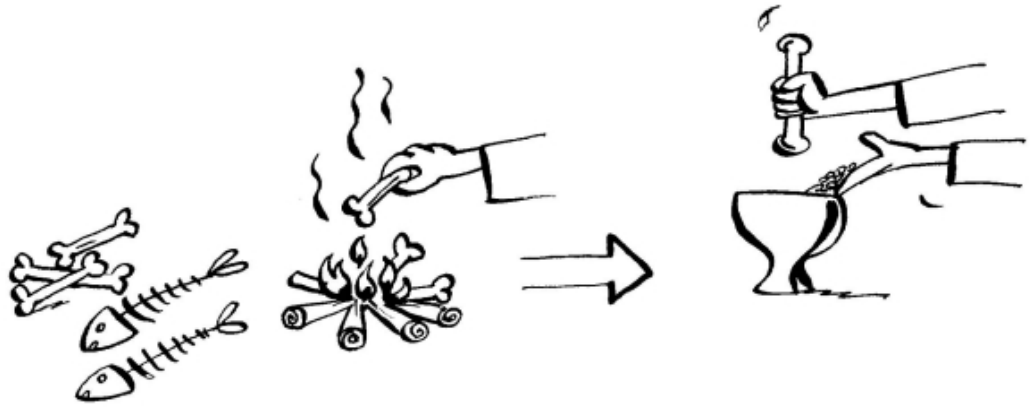


Fig 3.3 Scorching bones or eggs shells to produce calcium-rich bone meal

Vitamins

Scavenging birds get vitamins by eating green grass, vegetables, fresh cow dung and through sunlight. Vitamins A, B2, and D3 are considered very important

because many problems arise when birds lack these vitamins. Sunlight and green grass or green fodder normally provide Vitamin A and D, whereas Vitamin B may come from fresh cow dung. Vitamin B may also be added by giving e.g. Riboflavin tablets. Additional vitamins may be given in very small quantities and purchased through drug stores or feed sellers, but this is normally not needed for scavenging poultry. Confined birds always need additional vitamins mixed into their feeds.

Simple feed mixing

It is advisable to make a semi-balanced diet for the small chicks from 0-6 weeks of age. Locally available ingredients should be dried in the shade (the sun may destroy important vitamins) and grounded in a mortar before mixing. Locally available containers such as tomato tins or matchboxes may be used for easy quantification of the different ingredients. Grams or percentages should be transferred into local quantities for field practice. Large ready-mixed quantities should only be stored, if adequate storage capacities are assured (see under "Twelve simple rules" in this chapter). In general you should not store mixed feed more than a few weeks to avoid contamination from mould, bacteria or rodents. Above 6 weeks of age, poultry may be fed in a cafeteria system saving time and energy on mixing feeds. The cafeteria system is described later in this chapter.

Table 3.1 Simple ration for supplementing local chicks age 0-6 weeks (total 930 g)

Ingredient	Quantity
Crushed sorghum/millet grain or maize	1 tin can (1 kg tomato tin)
Wheat bran, sorghum bran or millet bran	1 tin can
Groundnut or sesame oil cake	2 match boxes
Sea shell or bone meal/salt mix	1 match box (1 salt with 13 bone meal)
Fish or blood meal	2 match boxes
Sesbania leaves	2 match boxes

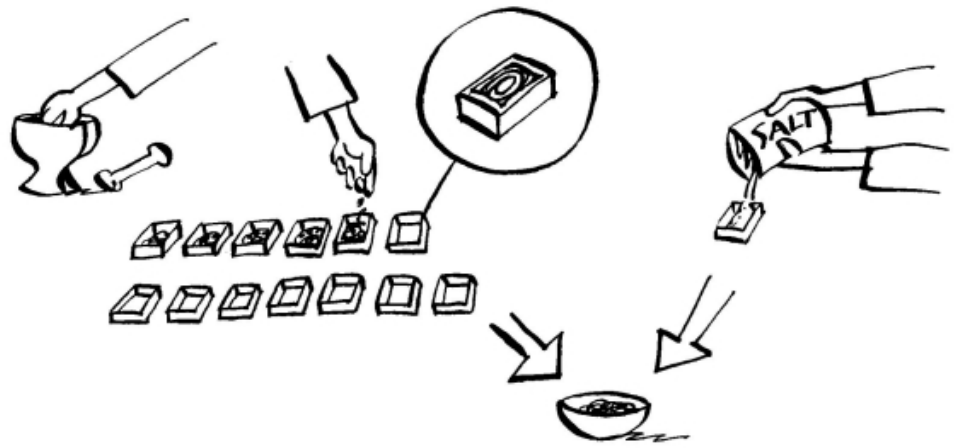


Fig. 3.4 Bone meal (see fig. 3.3.) and salt are mixed in matchboxes in a 13:1 ratio.

Termites or maggots may also be added during the first 6 weeks. Depending on the types of crops grown in particular areas, substitutes for cereals, oil cakes etc. will have to be found. Alternatively a chick starter ration can be used during the first 4-6 weeks of age. In this way you will ensure that the chicks are provided with everything they need during these most vulnerable weeks.

Simple techniques for growing maggots and termites

Maggots and termites are excellent and cheap sources of protein in the improved free-range systems. However, they will only be a supplement to other feeds. Give the maggots or termites to the small chicks, as they have the biggest need for a good protein source.

Fig. 3.5 Growing maggots

Maggots may be grown by a simple technique and used to supplement the diet of the young chicks (Fig. 3.5). Blood, offal, and cow manure are mixed in a large open pot. The pot is filled with 1/3 water. Flies will lay their eggs in the mixture, and the maggots will feed on it. Leave the pot open during daytime and closed during the night. After 5-10 days (depending on temperature), when the maggots are ready to pupae, you collect the maggots by gently pouring water into the pot. The maggots will float and you can then wash them, and feed them directly to the birds. Remember to place the pot away from public places, as the smell at times may be offensive.

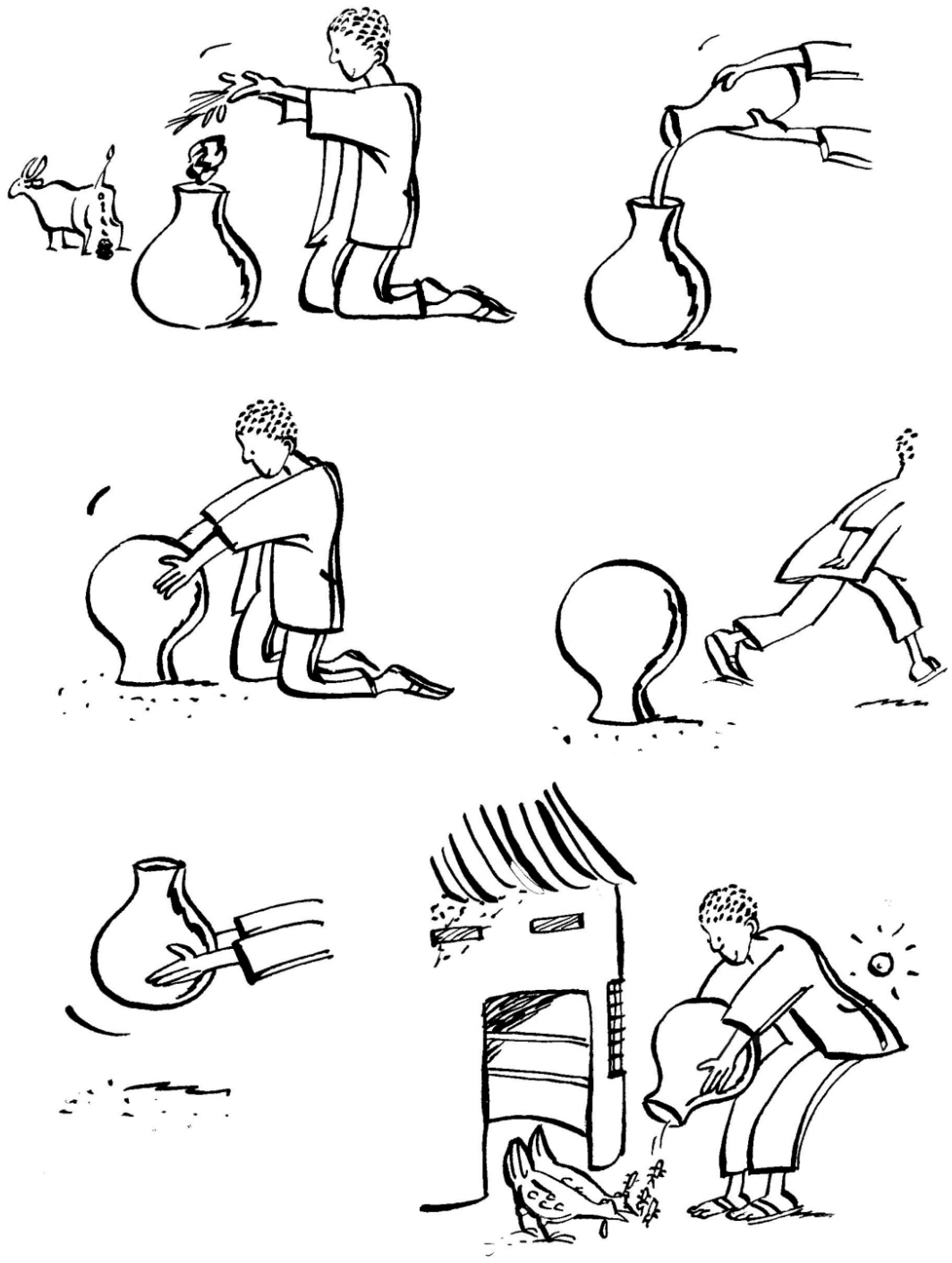


Fig. 3.6 Growing termites

Fig. 3.6 shows a simple method for growing termites to be applied in dry areas. You take a pot with a short neck and a capacity of at least 10 litres. Fill it up with cow dung and straw, and sprinkle it all with a little water. Set the pot upside down with

the opening on sandy soil. After one day and one night, the pot will be full of termites and you may empty the living contents in front of the hen house in the morning.

How much to feed?

In the free-range or improved free-range systems, the economic advantage is based on the poultry finding a majority of their feeds scavenging the surroundings. This so-called *scavenging feed resource base* (SFRB) will change over the seasons and depend on the climate, geography and farming systems of the areas on which the poultry scavenge for feeds. Depending on the season, the chickens may find nearly all they need in the surroundings (e.g. during harvest) or close to nothing (during lean season).

Table 3.2 Amount of feed given and eaten at different ages of local poultry

Age, weeks	Approximate amount given to each bird per day (g dry weight)	Approximate amount eaten per day per bird (g dry weight)
1 week	10-15 grams dry weight	12-15 grams
2 weeks	15 – 20 grams	15 – 21
3 weeks	21 – 30 grams	21 – 35
4 – 6 weeks	30-40 grams	35-50
8 weeks	30-40 grams	55-60
16 -27 weeks /grower	30-50 grams	65-80
28 weeks /adult	30-50 grams	100 grams

You should limit the quantity you give to local birds to no more than 30% - 50% of their full intake as an adult (see table 3.2. for feed levels and needs). In general this means giving maximum 30-40 g/bird/day from week 4-6 and onwards, gradually reducing the supplementary feeding. At age 0-4 weeks, the small chicks will receive feed according to their needs. As the birds grow, they will gradually get a smaller portion of what they need, until they only get between 1/3 and half of their needs as adults. In practice this means estimating the economic benefit from sale of eggs and live birds, and the costs for medicine, housing, labour and feed, calculating the break-even point, and learning how to reduce costs without reducing benefits (see Chapter 5 for risk assessment and simple estimation procedures).

To assure a stable egg and meat production, it is better to give a little feed on a continuous basis, than to give large quantities during harvest seasons or festivals and no feed during lean seasons. If feeds are too costly, you should consider reducing your flock size, rather than reducing the amount of feed given to each bird.

How to feed?

It is important to use simple local measures to administer your feeds. By using table 3.2, you can calculate how much feed to use. Fig. 3.7. shows the calculation on how is needed per day based on a flock of 1 cock, 4 hens and 15 three week old chicks.

Table 3.3 Simple calculation on how much feed is needed per day

1 cock: 35 g.	=	35
4 hens: 4 x 35 g.	=	140
15 chicks: 15 x 25 g.	=	375
Total:	=	at least 550 grammes per day

If you use a container (e.g. a tomato tin or a cup) and measure how much the container holds when full, it is easy to calculate how many containers of feed you need to feed every day. If the container holds 750 g of feed you will need to fill the container only ¾ full. To keep the birds hungry for scavenging, you should give no more than half in the morning, which is then equal to an almost half full container. To avoid competition, you give a little more than half of this to the small chicks under a separate shelter. Then you feed the hens and finally, before the feeder is empty you give the cock. If you give the cock at first, he will eat too much and leave little to the others, and you will gain very little. If the cock is hungry, he will be better at finding feeds in the surroundings. The young chickens will need relatively more protein in their diet than adult birds, so the best solution is to mix two different kinds of rations for young and adult birds, respectively. If you do not want to mix two different rations, you can alternatively give a little extra supplement of a good protein source to the young chickens, e.g. maggots and termites (see table 3.4)

Cafeteria system

Adult birds are able to mix their own feed according to their needs. The best way to feed Improved free-range birds **above** 6 weeks of age is the cafeteria system, whereby the most common types of feeds are given in separate compartments.

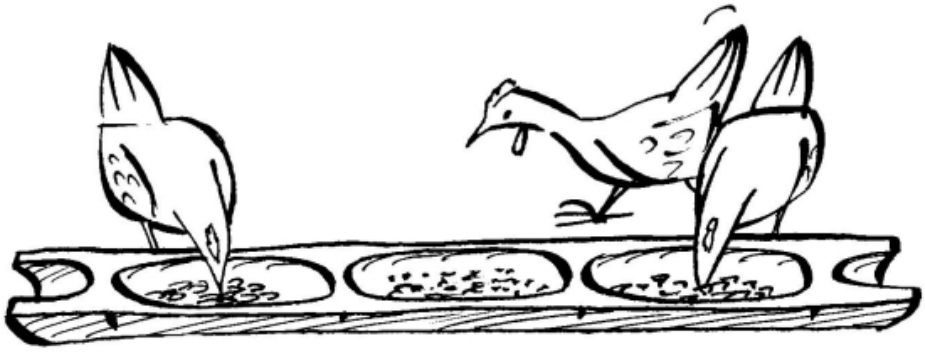


Fig. 3.7 Cafeteria system. A bamboo pole is split and feed divided into three compartments, enabling the poultry to choose from feed ingredients according to their needs.

In the cafeteria system, there should be at least one feeding compartment for

A. Energy rich feeds, e.g. maize, millet, sorghum.
B. Protein rich feeds, e.g. beans, peas, oil cakes, fish, meat, bone meal, maggots, termites.
C. Mineral rich feeds, e.g. bone meal, crushed oyster shells, snail shells, burned eggshells.

An additional compartment for oil rich feeds may be added, e.g. tallow, oil cake meals, fish oil. By giving adult birds feeds in compartments, you can observe feeding behaviour of your birds and avoid feeding unnecessary amounts and types of feed. For example, during harvest seasons you may find that they feed less on energy feeds in the evenings because there is plenty of cereal in the environment. You may also try out alternative feeds that the birds do not find tasteful. The cafeteria system is a good way of learning about your birds´ behaviour and taste.

Feed mixing

Mixing and formulation of poultry feeds may be based on simple assumptions about the nutritional requirements of the birds and the content of the feedstuffs, or it may be calculated by use of computers and of so-called Least Cost Formulation Programmes (see reference list).

If possible, it often pays to have samples of feed ingredients analysed at a national nutrition laboratory once or twice a year, depending on season and geographical area. National tables on nutritional content of feed ingredients could also be used. Table 3.4 shows the content of energy and protein for some locally used feedstuffs.

Table 3.4 Examples of protein and energy sources. + = low, + + = medium, + + + = high content

Feed ingredient	Protein	Energy
Cassava tuber	+	+++
Sweet potato tuber	+	+++
Millet bran	+	+ +
Rice hulls	+	+
Rice bran	++	++
Sorghum bran	+	++
Maize bran	+	+
Sorghum grain	+ +	+ + +
Sesbania leaves	+ +	+
Cowpeas	+ +	+ + +
Chick pea	+ +	+ + +
Cotton seed oil cake	+ +	+ +
Sesame oil cake	+ + +	+ + +
Groundnut oil cake	+ + +	+ + +
Soya bean meal	+ + +	+ +
Maggots	+ + +	+ +
Fish meal	+ + +	+ +
Meat and bone meal	+ + +	+ +
Blood meal	+ + +	+ + +

It is important to realise that the nutritional requirements of the birds may be met in many ways by offering a large variety of feed ingredients. Final decisions on which feed ingredients to use in which seasons, will depend on the availability, quality, and not least **the price**. Tables 3.8 and 3.9 give you an example of how to calculate the price of feed based on local feedstuffs.

Table 3.5 Example of composition of 1 kg feed mixture for local chickens at different ages

Ingredients Age	Cereals: millet bran, sorghum bran, rice bran (g)	Oil cake, e.g. ground nut or sesame (g)	Meat, blood, or fish meal (g)	Cassava, tubers (g)	Total (g)
0 – 8 weeks	700	200	100	–	1000
9 – 20 weeks	650	150	50	150	1000
> 20 weeks	600	100	100	200	1000

Table 3.6 Examples of diets for chickens (layers, growers 7-20 weeks and chicks 0-6 weeks) in Asia, East Africa and West Africa. Contents of 1 kg

Ingredients **Age**	Rice hulls (g)	Rice bran (g)	Sorghum bran (g)	Sorghum grain (g)	Millet bran (g)	Millet grain (g)	Soya bean meal	Fish meal (g)	Ground nut oil cake	Cassava tuber (g)	Bone meal
Asia Layers	200	600					150	50			Ad lib.
Growers	300	500					100	100			Ad lib
Chicks		300		400			150	150			
East Africa Layers			400	400					200		Ad lib.
Growers			500	300					200		Ad lib
Chicks			100	600					300		
West Africa Layers					300		300			400	Ad lib.
Growers					400		300			300	Ad lib
Chicks						600	100	100		200	

The diets in table 3.6 are based on a simple feed formulation using the Pearson Square (the Envelope method). As it can be seen from the table, young chicks need a cereal grain. For older birds some of the cereal grain can be substituted with cereal residues as bran or hulls. Which cereal and cereal residue to use will depend on the area, availability and price. All age groups will need to be fed some kind of protein source. Again area, availability and price will determine which one is best to use. There can also be problems in using too high concentrations of some feedstuffs. Harmful substances in some feeds can cause problems if fed in excessive amounts, or they may contain anti-nutritional components and should not be fed in raw form, see table 3.7.

Table 3.7 Problems related to some feeds

Feedstuff	Problems
Fish meal	Can give a fishy taste to meat and eggs. Can contain excessive amounts of salt.
Cassava tubers	Contains cyanide, which is toxic, and the tubers must be sliced and dried in the sun before fed to chickens.
Oil seed cakes	Can contain excessive amounts of oil and fibre, which lower digestibility of the feed.
Beans and peas	Contain a number of anti-nutritional components and should be dried in the sun or cooked for a short period (chick pea and pigeon pea are exceptions and can be fed raw after crushing)

Table 3.8 Examples of poultry feed prices and quantity measures in Benin (January 2002)

Ingredient	Price USD/kg	kg in a tomato-tin
Maize	0.323	505
Wheat bran	0.129	320
Soya cake	0.517	467
Fish meal	0.536	500
Sea shell/salt mix	0.106	587
Dry Sesbania leaves	Found locally	125

Table 3.9 Simple feed price calculation based on feed prices (table 3.7.) and ingredients and quantities (table 3.1.) for supplementing free-range growers and adults.

Ingredient	Local containers	Quantity (g)	Price (USD)
Wheat bran	50 tomato tins	50 x 320 g	= 16 kg x 0.323 = 2.07
Soya cake	2 tomato tins	2 x 467 g	0.934 kg x 0.517 = 0.48
Fish meal	2 tomato tins	2 x 500 g	1 kg x 0.536 = 0.54
Sea shell/salt mix	1 tomato tin	587 g	0.587 kg x 0.106 = 0.06
Sesbania leaves	2 tomato tins	2 x 125 g	0
Total	1 bag	18,8 kg	3.15 USD
Price/kg			0.168

Feeders and drinkers

Feeders and drinkers are the same, whether being used in free-range, improved free-range systems or small-scale confined systems. Feeders and drinkers should always be kept clean to prevent spread of diseases (see also Chapter 1 on Management). They should be big enough for all birds of the same age to feed at the same time. One metre trough or a 35 cm (diameter) tube feeder is big enough for 20 adult birds to eat and for 40 to drink. Feeders and drinkers may easily be produced out of local materials. An empty tin can placed upside down on a plate forms an excellent drinker. By keeping the tin can upside down, you avoid dirt contaminating the water (fig. 3.8). You start by making two small holes near the rim diagonal to each other. Pour clean water in the can. Put a flat plate with a small rim on top and turn the can and plate upside down, while pressing them against each other. Gently place the drinker on the ground. The rim of the plate should be low enough for small birds to drink, but also high enough for adult birds to dip their wattles to keep them cool during hot weather. Usually several waterers in different sizes should be applied. It is important that the feeders are constructed in such a way that feed waste is avoided. Also feed waste can be decreased if feeders are not filled to the top. It is better to fill feeders just half full and then check them regularly for refills.

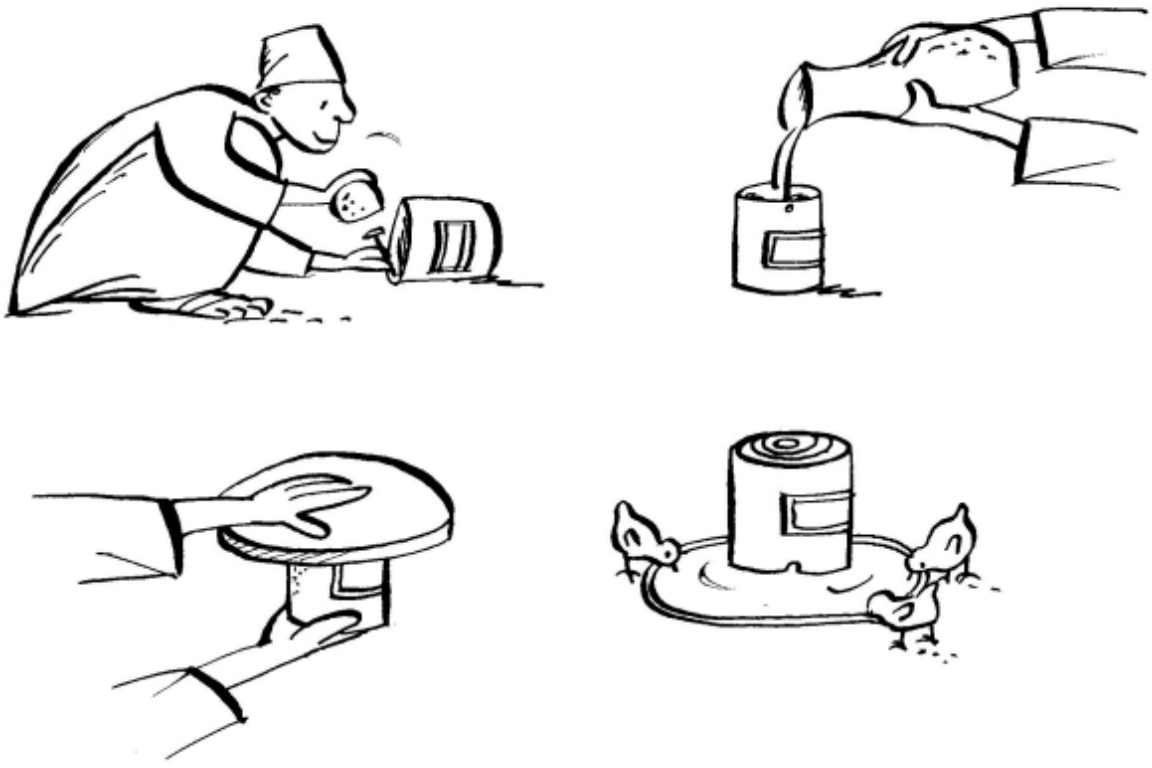


Fig. 3.8 Simple drinker made of an old tin can and a plate

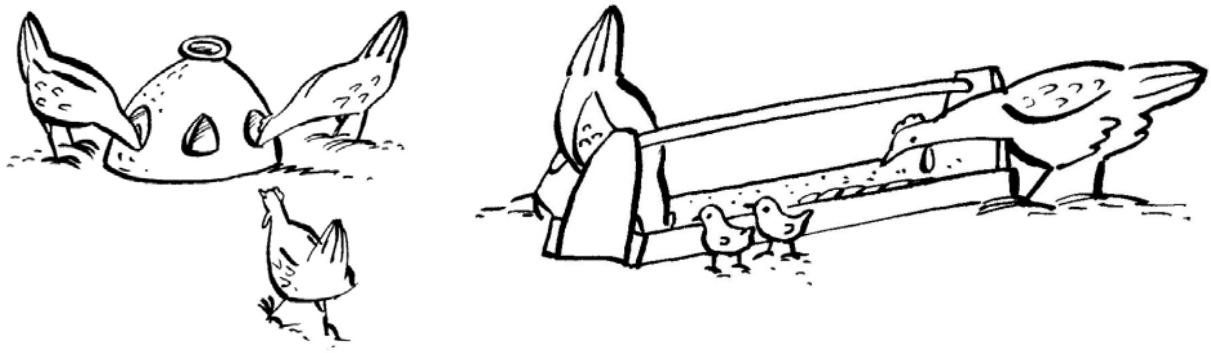


Fig. 3.9 Feeders and drinkers may also be made locally of wood, clay, or metal.

Fig. 3.10 Commercial drinker/feeder in plastic or metal

Commercial feeders and drinkers may also be bought at the market, either in metal or plastic. They are often expensive and normally not any better than locally produced feeders or drinkers.

Twelve simple rules for feed management

Before buying, mixing, and storing feeds, it is important to understand some underlying principles of good feed management.

It is crucial to:

1. Use local feed ingredients for local birds;
2. Know the quality or feed value, and changing prices of each feed ingredient;
3. Buy missing feed ingredients, such as vitamins or protein sources locally;
4. Change the feed formulation depending on availability, quality or feed value, and changing prices;
5. Reduce the flock size in free-range systems during lean seasons and if the feed becomes too costly;
6. If you change feed and feeding level, always do it slow and gradual;

7. Mix feed ingredients uniformly in relatively small quantities to avoid too long storage time;
8. Use locally available materials such as tomato tins or matchboxes for quantifying the different ingredients to be mixed. Grams or percentages do not work in practice;
9. Store mixed feed or feed ingredients separately upon a platform approx. 30 cm above the floor;
10. Stop the entry of rats, pigeons, or other type of birds into the feed store room;
11. Make sufficient ventilation of air so that the feed ingredients are not wet due to humidity;
12. Be careful that feed ingredients, which are mouldy, discoloured or from which pests have eaten, are not used.

Healthy and unhealthy birds

It is very important for the farmer to learn how to detect an unhealthy or sick bird, so he can initiate the right action In fig. 4.1 you will find the main characteristics of healthy and unhealthy birds. Healthy birds may be able to fight against the diseases themselves whereas unhealthy birds will have difficulties in fighting diseases. It is important to isolate unhealthy or sick birds from the healthy flock in order to ensure a minimum of loss.

Healthy birds	Unhealthy/Sick birds
- Alert and on guard	- Tired and lifeless
- bright eyes and comb	- dull eyes and comb
- walk, run, stand, and scratch continuously	- sit or lie down
- eat and drink normally	- eat and drink less
- lay eggs normally	- lay less or stop laying eggs
- smooth and neat feathers	- ruffled and loose feathers
- soft compact droppings	- wet droppings with blood or worms, diarrhoea
- breathe quietly	- cough, sneeze and breathe noisily

Fig. 4.1 Characteristics of healthy and unhealthy birds

If you find an unhealthy or sick bird, isolate the animal and call for the veterinarian or health assistant for disease identification and further advice. If the bird dies, burn it or bury it. You should remove dead birds, so that the germs are not left on the ground to be passed on to the other birds.

Ten simple rules for disease prevention:

1. Give access to the right feed and clean water, in particular for small chicks;
2. Build shelters against wind and rain;
3. Clean houses regularly and apply lime wash on the floor and the walls;
4. If necessary, provide dry litter regularly;
5. Do not put too many birds together;
6. Different species of poultry, for example hens, turkeys, pigeons, ducks and guinea fowls should be kept separate;
7. Separate chicks from adult birds except from the mother hen;
8. Vaccinate chicks against the most important diseases and revaccinate if necessary;
9. Isolate and treat sick birds – if medication is not available then kill the sick birds;
10. Burn or bury killed birds.

Prevention of diseases

Diseases are everywhere and will attack birds at all ages, but careful management will prevent many diseases. Figure 4.13 shows a poultry house, which is clean and nicely kept outside and inside. A woman is vaccinating a bird with eye-drop method. One sick hen is isolated in a small shelter away from the others. Birds are well fed and characteristically healthy. Figure 4.2 shows a poultry house with food and droppings lying around, with sick and dead birds among each other, dirty water in the pot and dirty feed in the feeder. Birds are characteristically sick and the farm generally badly managed.

Feeding

Supplementary feeding, in particular for small chicks, is one of the most important means of preventing diseases. Feeds should always be stored in a dry and clean place, as they may easily get contaminated and spread diseases.

Clean Water

Clean water from a well, not a pond, is important to avoid the spread of waterborne diseases, such as Fowl Cholera and Avian Influenza (AI). If a highly contagious strain of AI is present in the environment strict care should be taken to avoid water potentially contaminated by wild birds.

Hygiene

Dry and clean housing is essential for diseases not to spread or develop. Once in a while after cleaning, houses and shelters should be disinfected with lime wash (see

Chapter 1 for detailed advice on proper management). It is best to slaughter hens that are too thin and do not grow or produce eggs any more, as they do not resist diseases well and can pass diseases to poultry in good health.

Fig. 4.2 Bad management = diseases

Space

Too many birds together may wound or even kill each other, as the stronger ones peck the weaker (see fig. 1.10). You should never keep local breeds in confinement without free access to outdoor areas. If you use outdoor runs, you should provide at least 5 square meters per adult animal. When space is limited, diseases are passed more easily from one bird to another. Other species of birds may carry diseases without showing any signs of being ill. For example, ducks, guinea fowls, and turkeys can pass on diseases to hens, or vice versa. The best way to avoid spreading diseases from one species to another is to keep them separate in different cages, baskets or houses. Always keep domesticated birds as far away from wild birds as possible.

Table 4.1 Disease types and possible treatments

Disease type	Possibilities for control or cure
Virus	Viral diseases cannot be cured, but may be prevented or controlled if the animals are vaccinated before the disease occurs in the flock. If the disease is present in the flock, vaccinations might increase the severity of the disease, ultimately killing the birds.
Bacterial	Many bacterial diseases can be treated with the use of antibiotics. It is important to diagnose the disease in order to choose the right antibiotic.
Parasites	Most parasites can be treated with traditional and conventional medicine (anthelmintics).
Fungus	Fungal diseases might be treated with antibiotics.
Nutritional diseases/disorders	Nutritional diseases or disorders are caused by a wrong feed composition. Depending on the disease it can be prevented by mixing the right feed with minerals and vitamins, or giving access to a diversity of feedstuffs from the surroundings, e.g. green grass and fresh cow dung.

Important diseases

Diseases are often characterised according to their biology, such as Virus, Bacteria, Parasites, Fungi, and their causes, e.g. nutritional disorders (table 4.1). However, in the following the most important diseases in poultry are divided into three categories according to their severity and importance in village-based small-scale production systems. Distinct features such as their characteristics during outbreaks (symptoms), and possible treatments (prevention or control) as well as the time of occurrence, will be presented. The importance of a disease is judged by mortality rates and effect on production, and will vary greatly from area to area and from season to season. High importance (▼▼▼) signifies a common disease with high mortality (more than 30% of the flock), highly contagious and difficult treatment. Medium importance (▼▼) common, medium mortality (10-30%) of the flock and/or difficult treatment. Less importance (▼) signifies not common, lower mortality and/or easy treatment.

Combination of diseases

Some less important diseases may interact with other diseases to create a more severe effect on the birds. This is the case for e.g. E.coli infections, nutritional

deficiencies and internal parasites. Such diseases rarely kill the individual bird, but have a remarkable effect on the immune system of the birds, thus creating the basis for easy infection by other diseases.

▼▼▼Newcastle Disease (fig. 4.3)

The disease is very common during dry seasons, and is often seen in young chicks, but also in adults. High flock mortality, often between 30% and 80% of the birds die, when the disease hits. The chickens lose appetite and have poor digestion. They might show heavy breathing, greenish droppings, and sometimes bloody diarrhoea . They may show nervous symptoms, paralysis and die suddenly, and the symptoms may occur all at the same time. The disease is a virus, so there is no treatment, but it may be prevented through vaccination of all birds including chicks from two weeks of age.

▼▼▼ Avian Influenza (AI)

The disease is found naturally in ducks and other waterfowl, and may spread as a highly contagious and potentially dangerous form to chickens. High flock mortality, blue and swollen comb and wattles. Infects through contaminated feed and drinking water from ponds. The disease is a virus, so there is no treatment. Best prevention is strict hygiene and slaughter of sick birds. AI can presently NOT be prevented through vaccination of birds. Culling and burning of all birds in the flock and strict cleaning of chicken houses must be considered after a disease outbreak. Always call a veterinarian, if you suspect an AI outbreak. Do not eat infected birds.

▼▼▼ Fowl pox (fig. 4.4)

Is often seen in young chicks, but also in adults, and shows as pocks (small lumps) on wattles, comb and face. High body temperature, tiredness followed by sudden death. The disease is common during dry seasons, but may be found all year around. The disease is a virus, so there is no treatment. Vaccine is available and highly effective.

▼Marek´s disease (fig. 4.5)

Seen only in birds older than 16 weeks. Initially the birds may show paralysis of one or both wings. Or one or both legs might be paralysed. The disease is a virus, so there is no treatment, but commercial vaccines are available.

Fig. 4.3 Newcastle disease in advanced stage

Fig. 4.4 Fowl pox

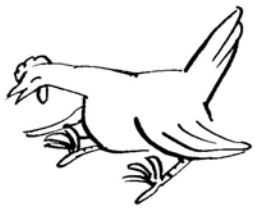


Fig. 4.5 Marek´s Disease

▼ E. coli infection

Common among newly hatched chicks, causing infection in the stomach region. Symptoms in older birds: Respiratory distress or infection in the egg organ with stop of egg production. The best prevention is improved hygiene of eggs for hatching and of the nests. Treatment of sick chicks might be possible with antibiotics.

▼▼▼Fowl cholera (pasteurellosis)

May occur any time in all ages. Symptoms are severe diarrhoea, respiratory symptoms, loss of appetite, blue combs and wattles. May occur as a chronic disease or hit as sudden death. Infection through contaminated feed and drinking water. There is no treatment. Best prevention is strict hygiene and vaccination. Kill and burn affected birds. Vaccine is usually available.

▼▼ Pullorum disease (Baciillary white diarrhoea)

Usually in young chicks. Chicks walk with difficulty, show big bellies and drag their wings. Faeces is liquid and turns white. There is no treatment. Prevention is strict hygiene. If illness occurs, isolate or kill and burn the birds. Disease is transmitted to chicks from the eggs of infected hens, which may not show signs of being ill.

▼▼ Fowl typhoid

Usually seen in older birds. Symptoms: high body temperature, tiredness, blue comb, sudden death. No treatment. Prevention through strict hygiene and culling of ill hens. Do not buy chicks from unknown sources, and do not use eggs for hatching from hens that have been ill.

▼▼Gumboro (fig 4.6) (Infectious Bursal Disease, IBD)
Only seen in chicks younger than 6 weeks, and normally only in large flocks kept in confinement. Not common in small-scale village based systems. Common symptom: Diarrhoea. The disease is a virus, so there is no treatment. Vaccine is available.

▼▼ Infectious coryza
Symptoms: Runny nose, swellings under the eyes, closed eyes, drop in egg production. Treatment by adding antibiotics in drinking water.

▼▼ Chronic respiratory disease (Fig. 4.7) (Mycoplasmosis)
Symptoms: Runny or blocked nose, swollen face, closed eyes, drop in egg production, rare deaths. Treatment by adding antibiotics in drinking water.

▼▼▼Coccidiosis (internal parasites)
The disease may occur at any time at all ages, but can be prevented by regular and careful cleaning of troughs and poultry houses. Symptoms: Sick, tired, head down, ruffled feathers, bloody diarrhoea. Death in young chicks. If the chicks survive, they will remain thin and be late in laying. Treatment: Anticoccidiostatics in drinking water or feed. Prevention: Not too many birds together. Avoid different age groups of birds in the same house, as the disease may spread from adults to young chicks.

Fig. 4.6 Gumboro

Fig. 4.7 Chronic respiratory disease

Fig. 4.8 Diarrhoea may be caused by several diseases, but the looks and colour will differ.

▼▼Roundworms and tapeworms (internal parasites) (fig. 4.8 and 4.9)
Internal parasites are very common in all ages in the village based production systems. These parasites will cause poor health, weight loss, drop in egg production, and bloody diarrhea. The best treatment is adding anthelmintics in the drinking water once or twice a year, at best two weeks before vaccination against ND (See above). Careful hygiene may prevent heavy infection.

Fig. 4.9 Internal parasites as found in the faeces

▼▼External parasites (fig. 4.10)

Attacks all ages any time, but occurs more frequently in humid chicken houses with bad hygiene. Adult birds are clearly disturbed and spend a lot of time pecking and polishing feathers. Young chicks may die from anemia. If not treated, mites, lice, fleas, ticks will cause weight loss and possibly loss of feathers due to the parasites sucking blood and to skin irritation. Lice can be seen around eyes and nose. Fleas can be seen on the belly. Treatment: Spray or dust with pesticides, ashes, and oil. Ashes and sulphur powder may be used where the hens do dust bathing. Nests may be protected by putting a few tobacco leaves mixed with ashes in the nests.

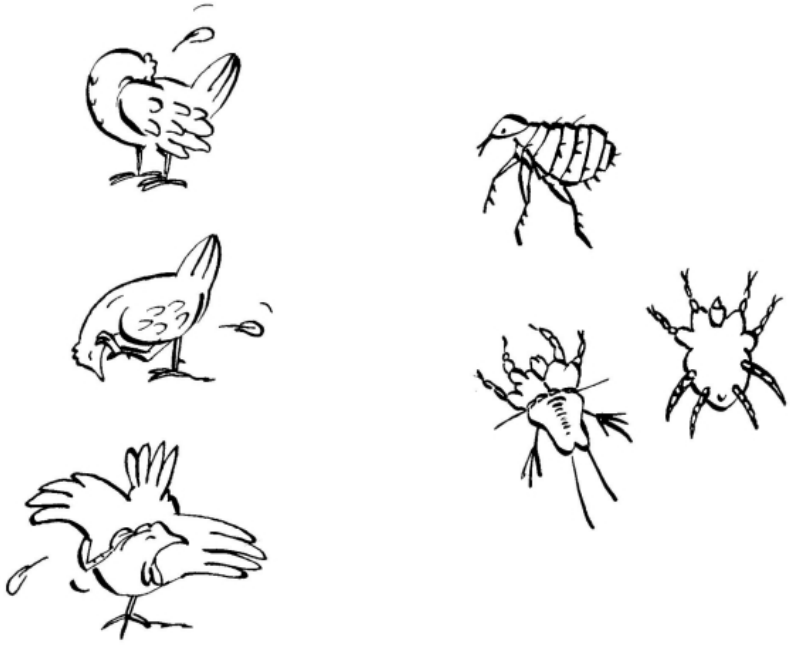


Fig. 4.10 External parasites (behaviour and parasites)

▼ Scaly legs (fig 4.11)

Scaly leg is caused by an external parasite irritating the skin on the birds' legs. Symptoms: Legs clearly have scales and wounds and may become crippled in their appearance. Treatment: Dip the legs daily in kerosene, oil or in an insecticide until the scales disappear.

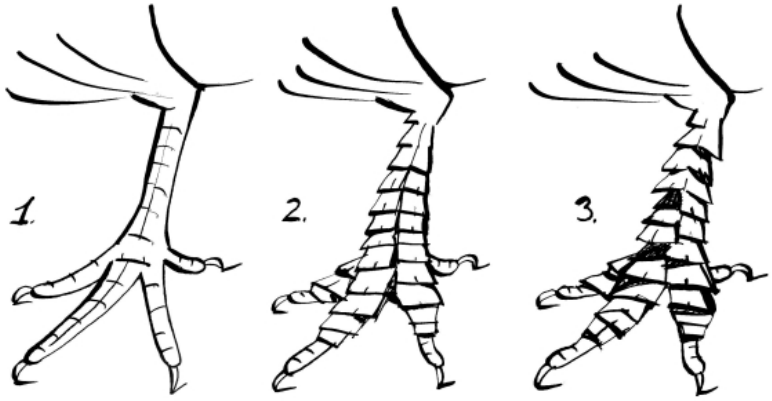


Fig. 4.11 Scaly legs in three stages

▼Nutritional diseases (fig. 4.12)

Symptoms: Bone deformation and feather loss. The birds walk with difficulty; they limp. Legs are deformed. Some deficiencies may cause feather loss. Treatment, if detected in time: Supplementary vitamins and calcium, fresh grass, and cow dung. Nutritional diseases may be avoided when the birds have access to normal vegetation and are therefore rare in scavenging chickens.

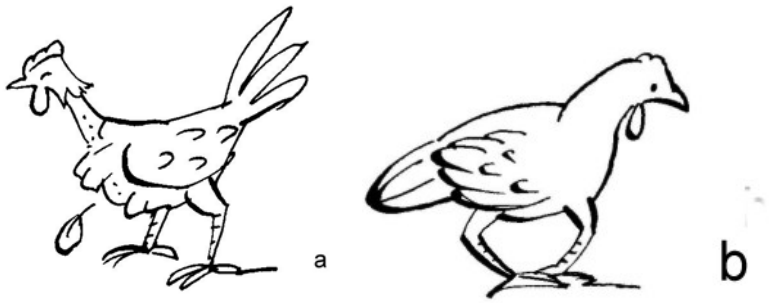


Fig. 4.12 Nutritional diseases. Feather loss (a) and leg deformation (b)

▼▼Mycotoxicosis (fungal poisoning)

Symptoms: Weakness, pale combs. Treatment: Supplementary vitamins. Prevention: Proper storage of feed to prevent growth of the fungi producing mycotoxins, the cause of the disease.

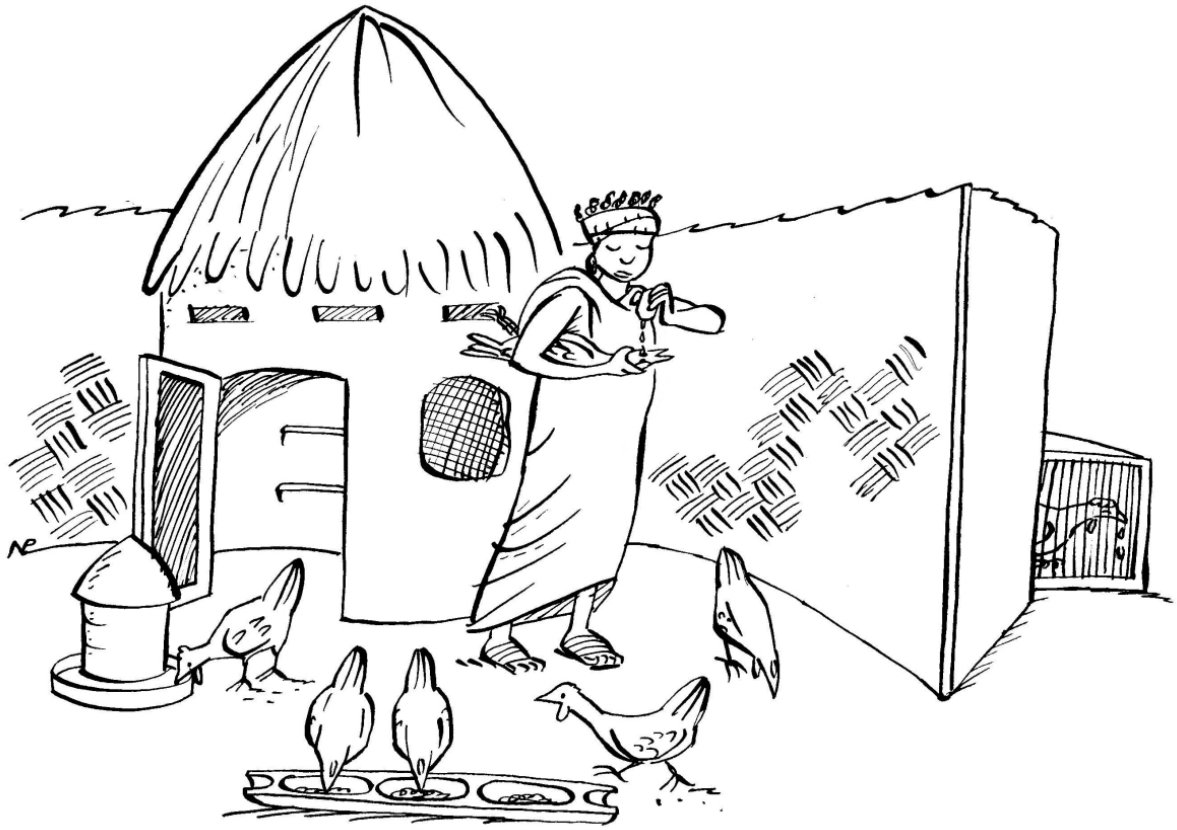


Fig. 4.13 Good management = healthy birds

Medication and vaccination

Medication

Some diseases may be cured by drugs. Parasitic diseases, such as lice or worms may be cured by use of anti-parasitic drugs or by applying simple methods such as baths in oil. Some bacterial diseases causing diarrhoea, may be cured with antibiotics. For viral diseases there is no treatment. But the viral diseases may often be prevented by vaccination.

Vaccination

All poultry should be vaccinated against the most common viral disease(s) in the area. Vaccination schemes at village level should cover Newcastle Disease and Fowl Pox. **Vaccination against Avian Influenza should be avoided, unless recommended by veterinarian authorities**. Other viral diseases such as Gumboro and Marek's disease may be covered by vaccination, but they are often less important at village level. A bacterial disease such as Fowl cholera may also be prevented by vaccination. Poultry should be vaccinated when they are very young, and before they have begun to lay eggs. Most young birds that have not been vaccinated do not resist diseases, and often die. Vaccines should only be given to healthy birds. If you vaccinate a sick

bird you may kill the bird, see fig. 4.14. Anthelmintics against internal parasites should be given two weeks before vaccination, to improve the effect of the vaccine.

Fig. 4.14 Never vaccinate a sick bird

Vaccination methods

There are four fundamental ways of vaccinating birds:

1. Eye drops
2. Injections
3. Skin piercing.
4. Orally (in feed or water)

For scavenging poultry, you should avoid mixing vaccines with drinking water or feed, as it is difficult to give the right dose. Research have shown that protection against e.g. Newcastle Disease is highly variable if vaccine is given through water or feed. Giving the right dose is essential for the vaccine to work properly. A too high dose of a live vaccine may kill a young chick, whereas a too low dose will not give adequate protection. Thus, it is important to consult a veterinarian or auxiliary veterinarians (barefoot vets, village vaccinators) for further advice before carrying out a vaccination.

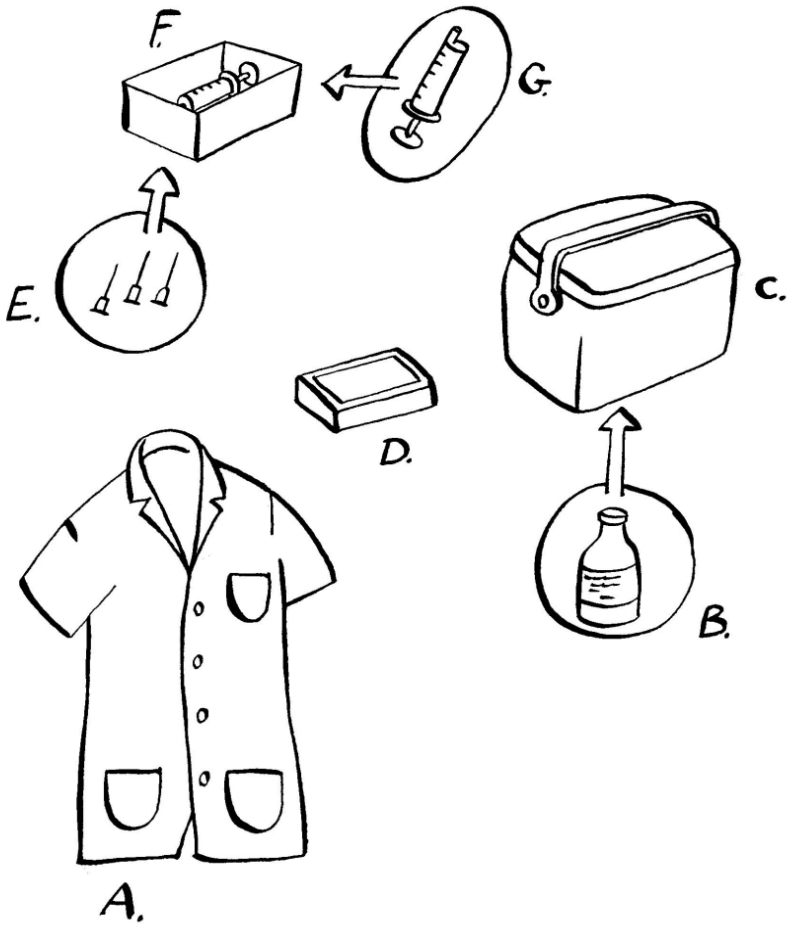


Fig. 4.15 Important vaccination tools

Tools for application normally include a clean apron (green or other dark colour if possible) (Fig. 4.15A), vaccine vial (B) stored in a cool box (C), soap to clean hands (D), clean needles (E), clean syringe (G) and a clean box for needles and syringe (F). Needles and syringe should be boiled in water for 5 minutes and cooled before re-use (Fig. 4.16).

Fig. 4.16 Boiling water to clean needles and syringe before vaccination

It is important to treat the clean syringe and needle carefully. Do no touch the end of the needle after cleaning. Put the needle gently on the syringe holding the needle with the sharp end upwards (Fig.4.17A). Put the vaccine vial upside-down and press the needle gently through the plastic seal of the vial cap. Pull the syringe handle gently down, while sucking the vaccine out of the vial until the syringe is full (Fig. 4.17B). Press the syringe handle back until you reach the right volume (Fig.4.17C). Make sure that there are not air bubbles trapped in the syringe or the needle. Air bubbles will give the wrong dose to the chickens. Normally a full 1 ml syringe will match 10 doses, one for each of ten adult birds (Fig. 4.18). This however depends on the weight of the bird and the type of vaccine, and the application method.

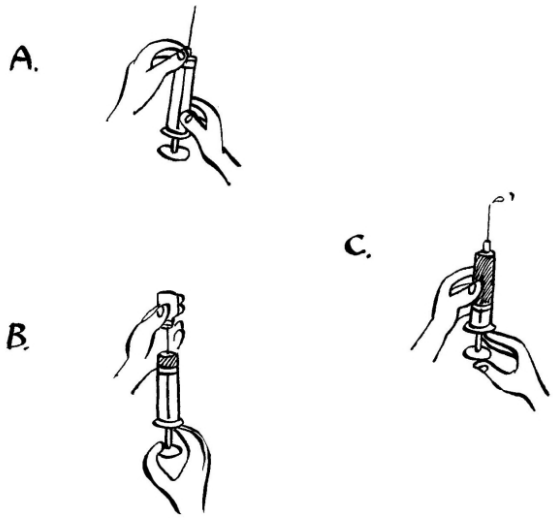


Fig. 4.17 It is important to handle the syringe and needle correctly

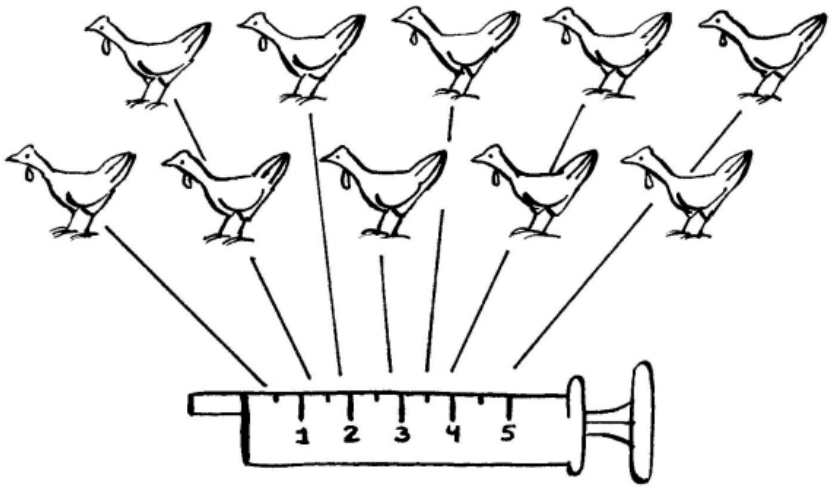


Fig. 4.18 One full 1 ml syringe is usually enough for ten adult birds

A. B. C.

Fig. 4.19 The most common methods for vaccinating adult poultry are eye drops (A), injections in the breast or thigh muscles (B) or by piercing the skin of the wing (C).

The most common methods for young chicks are eye drops and skin piercing (fig. 4.19, A and C). When the birds grow older, injections are given in the breast or thigh muscles (Fig. 4.19, B). Depending on the vaccine type, eye drops may also be used for adult birds. Please consult the reference list in Appendix A for technical literature on how to vaccinate against Newcastle Disease and other diseases. Vaccines should be given either early morning, before letting the birds out of the chicken house or when the local birds are easy to catch resting in the trees. When vaccinating adult poultry for the first time, you should preferably be two persons, one holding the bird, the other one vaccinating (Fig. 4.20).

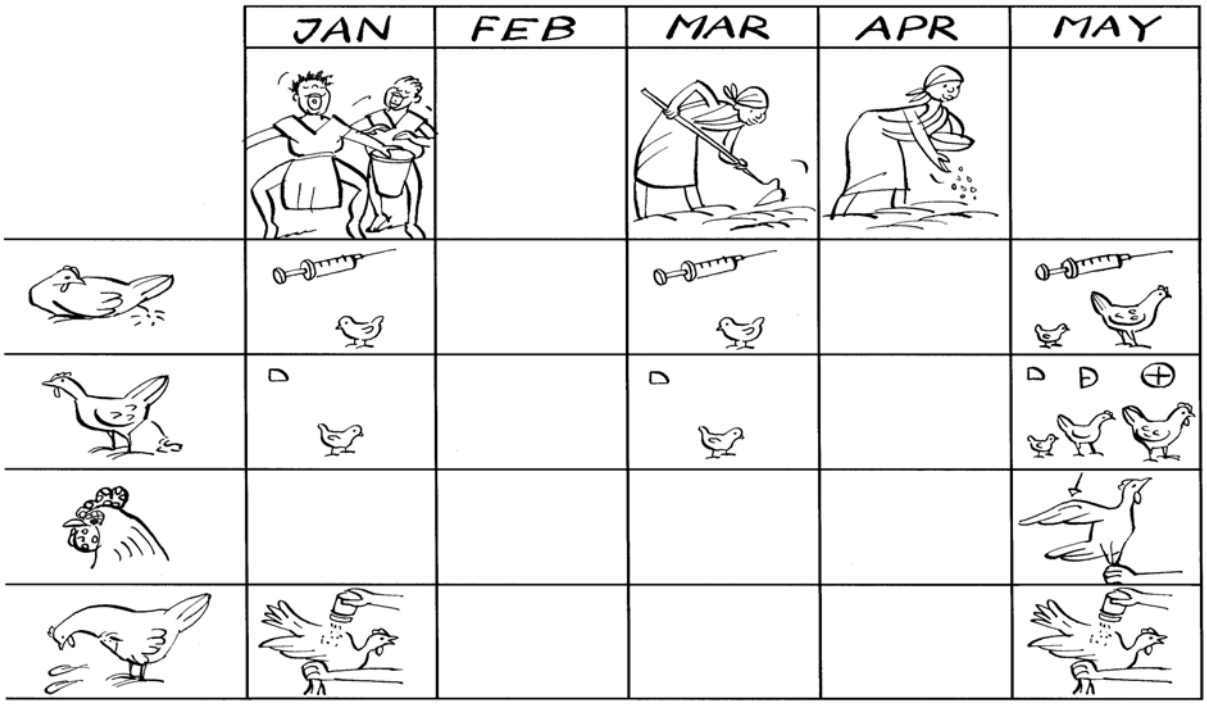
Fig. 4.20 Two persons vaccinating adult poultry by injection in the breast muscle

General precautions for vaccination with live vaccines

1. All vaccines should be stored in a refrigerator before use.
2. Some vaccines are so-called heat stable, which means that the vaccine will tolerate high temperatures. However, heat stable vaccines should also be stored in a cold place to keep them viable. You should always keep vaccines out of direct sunlight.
3. When using vaccines in the field, you should as far as possible transport them in a cool box with ice.
4. The syringe, needle and other equipment to be used for vaccination should not be cleaned by any chemical disinfectants, as these may destroy the vaccine. They should instead be disinfected in boiling water (Fig. 4.16) and be used after cooling.
5. The vaccines must be mixed or diluted in cold distilled water, and care must be taken to ensure that the vaccines do not come in contact with direct sunlight.
6. It is best to vaccinate birds during the cool hours of the day, either in the morning or evening.
7. Some mixed vaccines should be used within 30 minutes. Otherwise they will be useless and should be thrown away.
8. Always consult a veterinarian or an auxiliary veterinarian before conducting a vaccination campaign.

Disease prevention calendar

It is important to prevent and treat diseases according to the occurrence of diseases. Vaccination campaigns against Newcastle Disease (ND) or Fowl Pox should be implemented before the onset of the disease, as the vaccine otherwise may kill already sick birds. To plan vaccination and medication, it is advisable to use a so-called “disease prevention calendar”, where veterinarians, farmers and extension workers together identify the periods, where diseases should be prevented or treated. The last table in chapter 4 shows “disease prevention calendar” indicating how birds at different ages are vaccinated against ND (a) and Fowl Pox (d) and treated against internal parasites (worms) (b) and external parasites (d) following the annual cropping cycle and festivals.



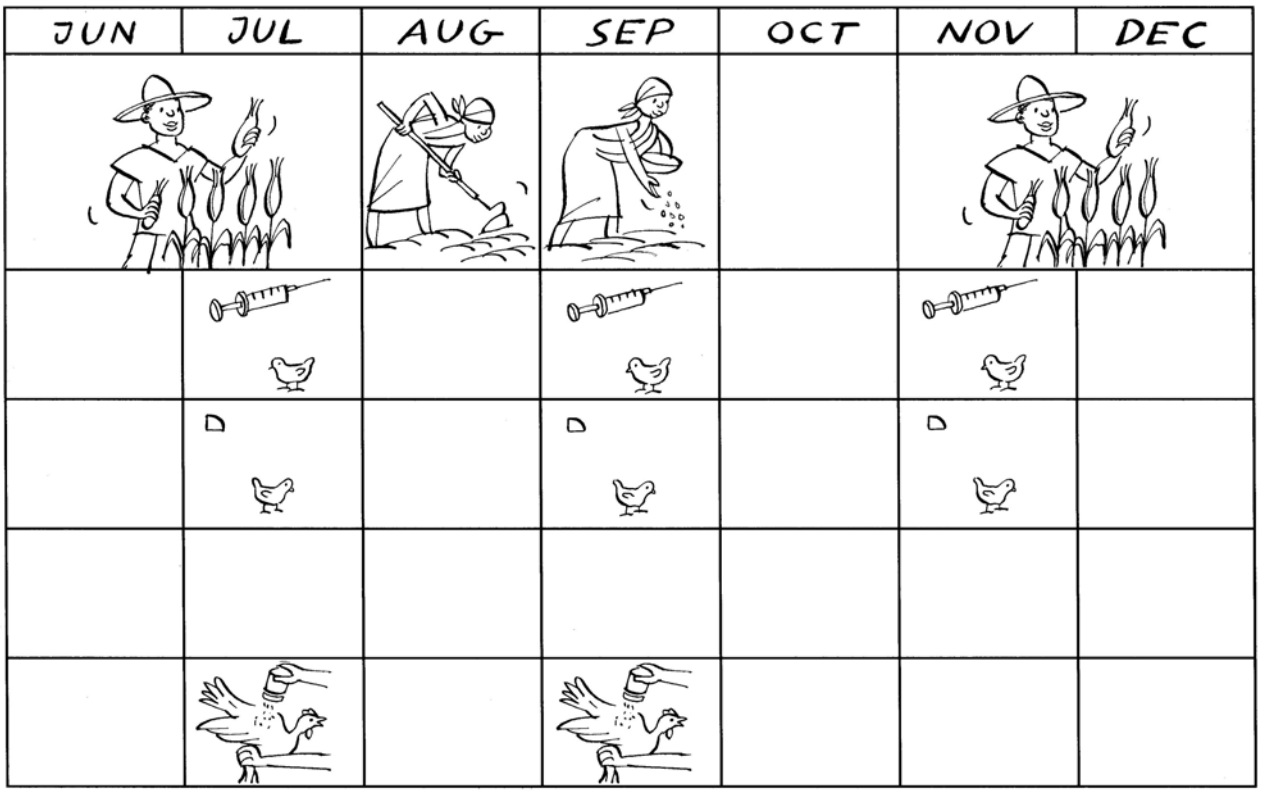


Fig. 4.21 Disease prevention calendar

Chapter 5 Profitability and marketing of products

Introduction

Before starting any production, it is important to know the market situation, the investment costs, running costs, and expected revenue for the different products.

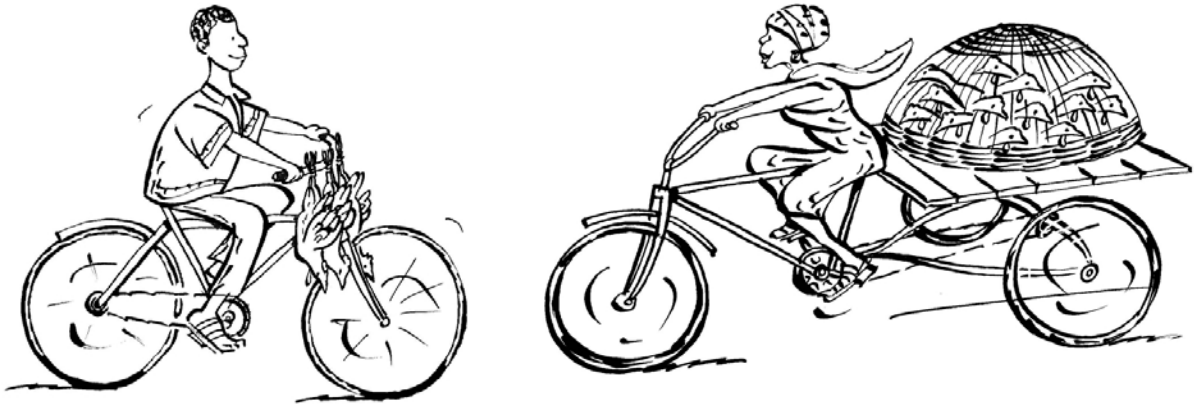


Fig. 5.1 Marketing your products is essential

It is advisable to know the local situation very well through detailed market studies and cost and benefit analysis, before deciding on the type of production to introduce. At village level, it will often be advisable to start with a production based on local breeds, local feeds, and local demands, before entering into a more sophisticated production system with improved breeds and a need for a more stable market outlet. In general the economic outcome as well as the need for investments and the risk involved in the production, will be very different for improved free-range systems (relatively low risk) and small-scale confined systems (higher risk).

Commercialisation

At traditional village markets, mainly live birds and sometimes fertile eggs are for sale. Imported non-fertile table eggs are more often found in peri-urban areas or along traffic corridors, where confined production systems can be managed.

At local markets cocks and hens are sold at highly variable prices depending on factors such as demand (high during festivals), size and weight, plumage and colour (often a higher price for white-feathered birds). Cocks are usually higher priced at the market than hens. In most regions, local birds are also higher priced than imported improved breeds, although they are often smaller. Also local eggs are often higher priced than imported eggs, despite their smaller size. Taste and texture of meat and eggs are major reasons for the higher price of local products.

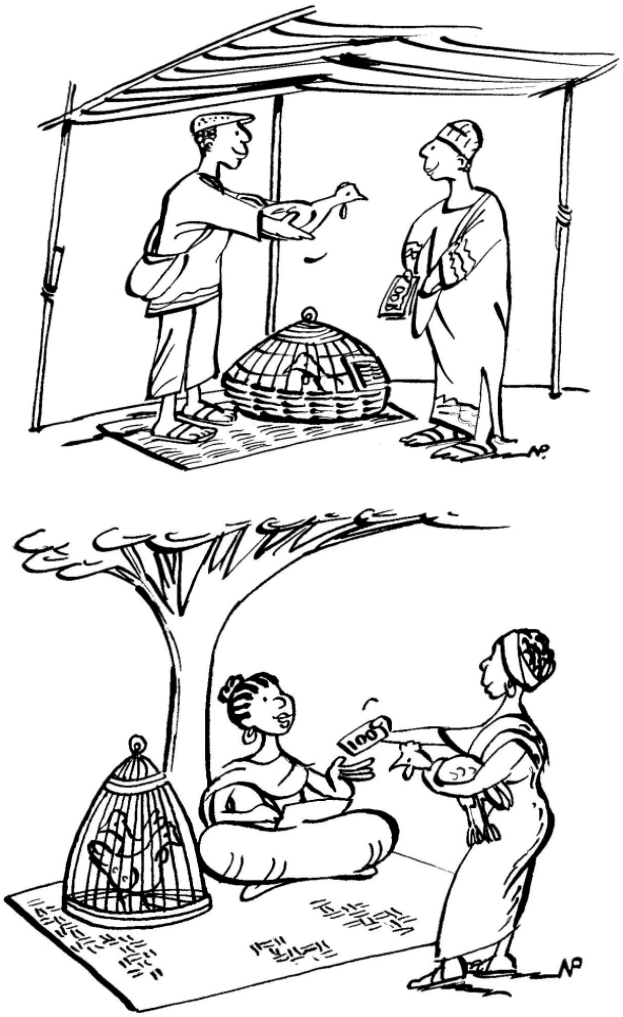


Fig. 5.2 A-B Birds for sale

Birds for sale

Cockerels should be sold as soon as they fetch a good price, as one cock to 10-15 hens is sufficient to produce fertile eggs. In some cases, you may also want to sell a cock, if it is not doing a good job in mating. At the age of 6 months and a weight of approximately 1 kg, cocks are usually big enough to be sold at the market. Birds should always be sold alive in the markets, but no live birds should be returned from the market, as this is a major cause of transfer of diseases. Old hens, which are no longer laying (See fig. 1.13), should also be sold. When you want to catch the birds, you catch them in the house in the late evening during sleep, or attract them with feed, or by using a long stick or a piece of metal wire, bent at the end.

Eggs for sale

Eggs should be collected and marketed while fresh, in particular if not cooled. Collect eggs from the nesting boxes at least once, but rather two times a day, and

store them in a dark and cool place. Eggs should normally not be cleaned, but kept clean in the nests. If they are dirty, clean the eggs with a clean, dry sponge or cloth, and sell the eggs immediately. Cleaning eggs with water may disturb the natural protection of the shell and introduce infections to the egg.

Fig. 5.3 Eggs for sale

Pack eggs in boxes, egg trays, or other suitable package, e.g. banana leaves. Sell eggs in the market two to three times a week, so you get a good name for selling fresh eggs. If profitable, grade your eggs according to size. Always keep records of your production and sale, as explained below.

Fig. 5.4 Keep records of your production and sale

Keeping records

To manage a poultry production, you have to keep detailed records on a daily or weekly basis. Table 5.1-5.2 and fig. 5.5 -5.6 give two examples of how to keep records. The first may be used for literate, the second for illiterate people. It is very important to spend some time each day observing your flock carefully. In this way early signs of disease, malnutrition, or other problems may be discovered, and the necessary precautions taken (see chapter 1 for advice on management).

Table 5.1 Record keeping for small-scale chicken production. ***Animals***

Production Record			**Week/Day:**
Name of farmer:			**Family:**
Record	**Number**	**Price**	**Comments**
1. Hens			Health status, in lay?
2. Cocks			Health status,
3. Growers			Health status, age, weight
4. Chickens			Health status, age, weight
5. Dead birds			Cause of death
6. Eggs laid			
7. Fertile eggs incubated			
8. Chickens hatched			
9. Cocks sold			Where and to whom?
10. Hens sold			
11. Growers sold			
12. Chicks sold			
13. Eggs sold			To whom?
14. Eggs/Poultry consumed			
15. Poultry given as gifts			
16. Hens and Cocks vaccinated			What treatment/vaccine and how?
17. Growers/cockerels vaccinated			
18. Chickens vaccinated			
19. Birds given medicine			

Table 5.2. Record keeping for small-scale chicken production.

Materials and feed

Name:			**Day:**
Record	**Numbers**	**Price**	**Comments**
Materials			
a. Baskets			
b. Shelters			
c. Chicken houses			
d. Nests			
e. Feeders			
f. Drinkers			
g. Other materials			Type, quantity
Feed			Type, quantity
h. Feed stuffs			
i. Formulated feeds			
j. Vitamins, minerals			
k. Medicine			

Fig. 5.5 Record keeping for small-scale chicken production. ***Animals***

Fig.5.6 Record keeping for small-scale chicken production. ***Materials and feed***

Records should be kept on chickens and hens, noting their approximate age or time of hatching. As you know that hens should start laying eggs at 22-32 weeks of age, you should monitor the age of first lay and the production over time. If egg production is delayed or drops suddenly, you should check conditions in the house, access to feed, water etc. If egg production drops gradually, it may be time to change the older hens. If your costs for feed exceed the income from selling cocks and/or eggs, you may also consider selling birds, or reducing the amount of feed given.

All expenditures for feed or feed ingredients should be registered carefully, noting quantities, price and date of purchase. If you buy feed from feed sellers, note the name of the seller and the time of purchase. Feeds of bad quality should as far as possible be tracked to the seller or producer of feeds. The price and date of purchase of vaccines and medicine should also be carefully noted. Supplementary feed consumed on a daily or weekly basis should be noted for each flock or poultry house separately. Sudden changes in feed intake may be the first indicators of bad health. Income from sale of eggs, cockerels or chickens should be carefully noted. Gifts and home consumption of eggs and birds by your family and friends should also be noted.

Economic analysis and simple risk assessment

Before you start a poultry production, you should calculate if it is economically feasible to do so, thereby making the right decisions about the production type and the type interventions you may start with.

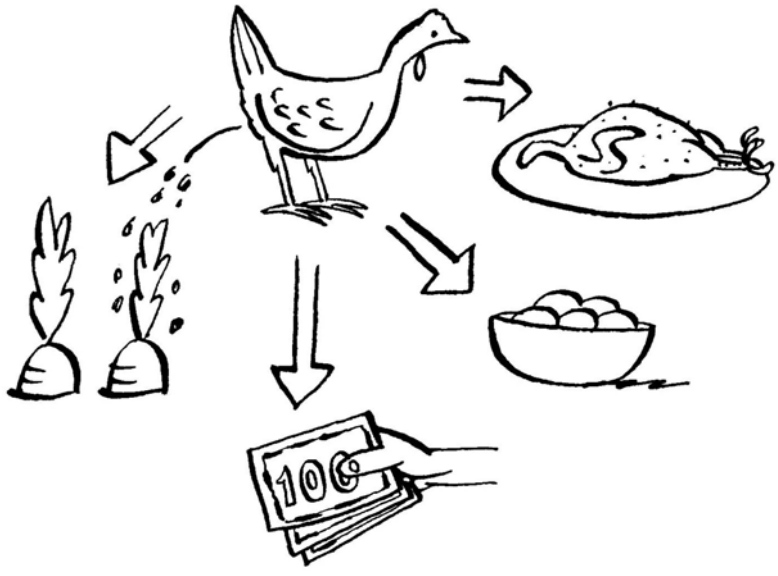


Fig. 5.7 The revenue from poultry may be in terms of meat, eggs, money or manure.

The revenue or income are all the money you earn in relation to your poultry, that is:

- Income from sale of live birds, e.g. growers, cockerels or spent hens;
- Income from sale of eggs;
- Value of eggs or poultry eaten or given away.

To this you may add the value of standing stock, e.g. the flock you have built up, that you will not sell, but which is the foundation of your future income. Poultry manure also represents a value when given to your plants. It provides many nutrients to the plants, and you may reduce cost for buying fertilizer (fig. 5.7)

The costs involved are all the expenses you have in relation to your poultry, which are for buying:

- Materials for constricting baskets, shelters or poultry houses;
- Growers, hens or cocks;
- Fertile eggs for incubation;
- Day old chicks;
- Supplementary feed, vitamins or minerals;
- Vaccines and medicine;
- Labour and technical advice.

If you feed with crops that could otherwise be sold, this also represents a value and should be included in the calculation. If you borrow money, the repayment and interest on loans is also an expense that has to be included among the inputs. In village poultry, where the outputs are usually low, the inputs should also be kept low. This means that expenses for buildings and other equipment should be kept at a minimum. Small basket or shelters (Fig. 1.3. and 2.2) may be built of local materials without high costs.

Cost-benefit calculation

In order to calculate the profit in your enterprise, you should estimate costs and revenues on an annual basis. Tables 5.3 -5.4 show examples of the information you need to make a simple cost-benefit analysis.

Table 5.3 Example of small-scale free-range system, 52 weeks plan (Benin, 2000)

Flock size	**Numbers**
Local hens laying and brooding	3
Local hens laying eggs, not broody	2
Cocks	1
Surviving chickens/hen/batch*	8
Growers. Weeks 4-24	24
Total Flock size	30
Feed consumption: 1 Kg /bird/4 week =35 g/bird/day	**Kg**
Adults feed: 1 kg x 6 birds x 52/4 weeks	78
Chicken/growers feed: 1 kg x 24 birds x 46 /4 weeks	276
Egg Production:	**Numbers**
Local broody hens. 72 eggs/bird/year	216
Local hens not going broody. 104 eggs/bird/year	208
Eggs for hatching. 3 hens x 12 eggs x two batches /year	-72
Home consumption, 1.5 egg/week	-82
Saleable birds: 3 batches x 8 growers	**Numbers**
Cockerels. 22 weeks of age	24
Pullets for sale. 24 weeks of age	24

**(12 eggs laid=10 eggs hatched=8 chicks surviving after 6 months)*

*Table 5.4 Cost-benefit analysis based on example in table 5.3.(*540 Fcfa = 1 USD)*

Cost-benefit Analysis	**Text**	**Cost/Unit**	**Cash flow**
Costs		Fcfa*	Fcfa
5 hens and 1 cock	5 x 1500 + 1 x 2000		-9500
Baskets, 3 night + 3 day baskets	6 baskets	1000	-6000
Low cost home made feed	354 Kg	100	-35400
Vaccine (ND)+medicine (Coc+anti-worm)	60 Doses/year	50	-3000
Miscellaneous			-5000
Cash out-flow			-58900
Income (Benefit)			
Sale of Eggs	424 - 154 = 270	30	8100
Sale of cockerels, 22 weeks	24	1500	36000
Sale of pullets, 24 weeks	24	1200	28800
Total cash in flow			75000
Net cash flow			**14000**

In the example referred to in table 5.3 and 5.4, the flock size is initially 5 hens and 1 cock, all local breeds. A production may also start with less, i.e. only 1 hen laying eggs, fertilised by a local cock in the village. Figures will then have to be adjusted accordingly. With 1 cock and 5 hens, of which no more than 3 hens at one time are allowed to go broody, the flock size may grow to a maximum of 24 growers and 6 adults, which is manageable for a small-scale farmer. Very important for this system

is that the scavenging feed resource in the village will be less depleted, if the flock size is kept below 6-10 adults and 20-30 growers and chicks.

Supplementary feeding should always be kept at a reasonable low level to reduce costs. However, chicks at age 0-4 weeks should be given what they need (See chapter 3 on advice for feeding). On average each bird will be given 1 kg feed every 4 weeks. This corresponds to 1000 g/28 days = approximately 35 grams per bird per day. 2 batches of 24 growers will need feed two times 22-24 weeks, i.e. 44-48 weeks, on average 46 weeks. The total annual need for feed in a flock of 6 adults and 24 chicks and growers is calculated in Fig. 5.8.

Table 5.5 Supplementary feed needed for a flock of 30 birds in one year.

1 cock:	1 x 1 kg/ 4 weeks x 52 weeks	=	13 kg
5 hens:	5 x 1 kg/ 4 weeks x 52 weeks	=	65 kg
24 chicks/growers:	24 x 1 kg/ 4 weeks x 46 weeks	=	276 kg
Total:		=	354 kg

It is assumed that by improved management and feeding, the egg production of the non-broody hens will increase to 104 eggs/hen/year, i.e. 2 eggs per week on average. Broody hens will also on average lay 2 eggs per week, however excluding 2 x 3 weeks hatching + 2 x 5 weeks brooding, i.e. 2 x 8 weeks = 16 weeks non-laying period per year. Annually each hen will then lay: 52 - 16 weeks = 36 weeks x 2 eggs = 72 eggs/hen/year. For three hens going broody only twice a year, the total egg production will be 3 x 72 = 216 eggs/year.

A production of 24 cockerels and 24 pullets per year (table 5.3.) is based on the following assumptions: A well-managed broody hen will sit on 12 eggs and hatch on average 10 chicks. Using the basket system and the improved management will reduce the overall mortality on the chicks to a maximum of 1 chick out of ten during the first 4 weeks (equal to 10%) and 1 grower out of nine in the remaining 20 weeks. At the age of 22-24 weeks, when the growers are to be sold, on average 8 growers per batch will be alive. Using three broody hens, a total of 3 x 8 growers = 24 birds may be sold twice a year. Out of these, the half will be cockerels and the other half pullets.

A well-managed production plan means selling birds at the time of highest price, and buying feeds, new hens or inputs (e.g. baskets, feeders and drinkers) at the time of the lowest price. For many farmers this means keeping the birds in the flock until the time of festivals (e.g. Eid festival, Christmas, Easter or national holidays), where they may get a price often two or three times the normal price. However, it is

important to stress that keeping birds in the flock means more feed and a higher risk in terms of loosing birds caused by predators, diseases or theft. In general birds should be sold no later than at the age of maturity, e.g. 22-32 weeks of age.

In the example from Benin in table 5.3 and 5.4, the cost of feeding one bird was 100 Fcfa every 4 weeks, as one kg feed costing 100 Fcfa would be spent during 4 weeks. In this case, if you want to keep a bird 4 weeks longer in the flock, you should be sure to gain more than 100 Fcfa on the market price. Otherwise, it would be better to sell 4 weeks earlier at a lower price, and thus be able to restock with new growers.

Thus, by knowing the market and environmental conditions and by doing simple economic calculations, you will be able to plan when you should sell your birds, when you should let your hens go broody, and when you should keep your birds in the flock.

Risk assessment

A risk assessment is a judgment that most farmers do every day in their normal lives. They judge, whether they should buy some seeds, sell a chicken, call a veterinarian for a sick animal etc. or whether it would be better to wait until conditions are more favourable. In particular, when starting a new enterprise, the risk assessment becomes crucial. When improving your free-range poultry production, it is important to judge whether your choice of intervention (e.g. feed, vaccination, housing, chick shelter) has an effect and which risks may be involved.

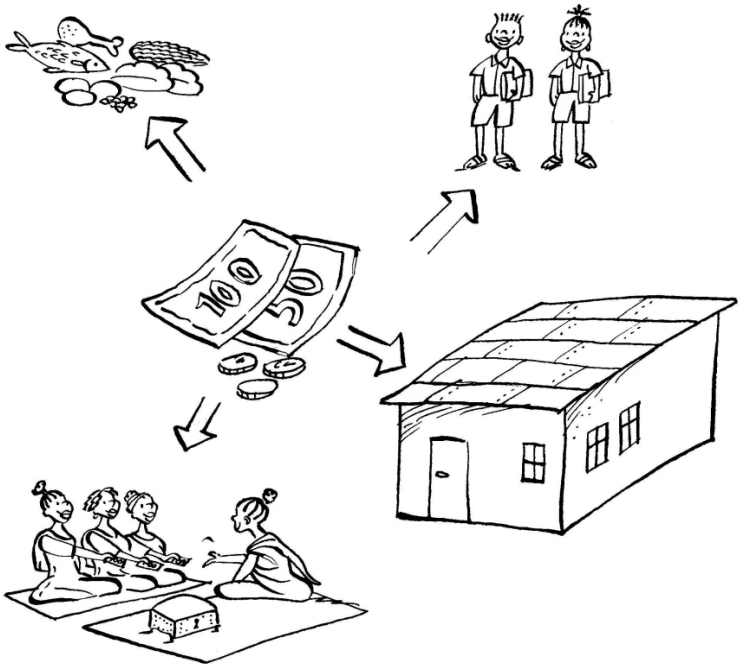


Fig. 5.8. Income is often spent on a variety of items, such as food, children, housing and savings

Ten simple rules for marketing and financial analysis

1. Analyse the market situation, demand for products, investment costs, running costs, and expected revenue for different types of poultry production before starting.
2. Make a thorough calculation of expected costs and revenues for different production systems.
3. Always keep records of your production and sale.
4. Keep your flock size below 30 birds to assure a feed resource in the environment.
5. Estimate the production of eggs and birds over the year
6. Plan beforehand when and how you want to sell your birds
7. Never introduce birds from the market directly to your flock.
8. Sell birds, if feed costs are too high or there are high risk of diseases or dwindling market prices
9. Remember that costs involve investments, running costs, labour, losses, and maybe loan repayment and interest on loans.
10. Judge the risks involved in each type of production system before starting.

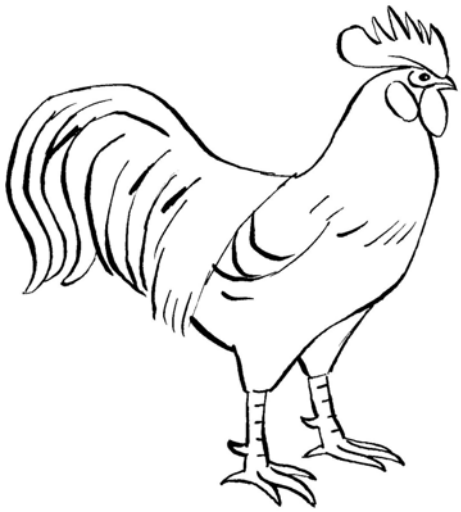


Fig. 6.1 A healthy and strong cock

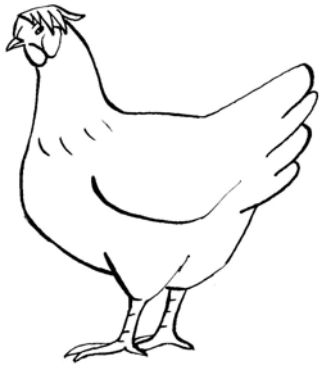


Fig. 6.2 A healthy egg-layer

Introduction

Selection of healthy and sound-looking animals in the villages or markets is important, if you want to assure a healthy flock and a high productivity.
You should therefore know how to judge the quality of different breeds in different ages and sex, based primarily on their looks, sound and behaviour. Judging a day-old chick, a full-grown cock or a laying hen, naturally demands different skills. The features to look for become even more complicated, when dealing with different breeds with distinct looks, behaviour and purpose, i.e. egg laying or meat producing. In the following, we will introduce simple guidelines on how to select a sound animal at different ages, and introduce what to consider in terms of breed selection.

Animal Selection

It is important to look for different features in chicks, growers, hens and cocks. Select or buy your new animals early in the day, as stress from lack of water, feed and rest, will make most animals look rather sick and drowsy.

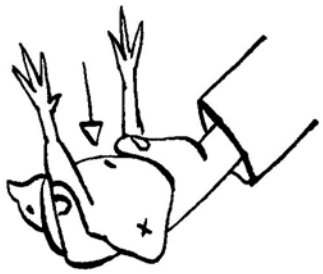


Fig. 6.3 A soft belly and a clean, dry navel are important features of a healthy, newly hatched chick

A healthy, newly hatched chick should have the following features (Fig. 6.3):

- Well developed body length and depth
- Shiny, dry, thick and coloured down feathers
- Soft belly
- Clean, dry navel hollow
- Thick shanks with spaced and straight toes
- Big clear eyes
- Lively behaviour

A healthy and good grower should have the following features:

- should appear healthy and lively
- feathering shiny and normal (may depend on the breed)
- large size for the age
- eyes clear and shiny
- clean and dry beak and nostrils
- clean feathers around the vent
- straight legs and toes

A healthy and good egg-layer should have the following features (Fig. 6.2)

- should appear healthy and lively
- feathering normal for the breed
- A red comb (more coloured when in lay)
- eyes clear and shiny
- clean and dry beak and nostrils
- clean feathers around the vent
- straight legs and toes, with no signs of scaly legs
- Legs less coloured in lay
- The breast bone should not be too sharp
- A big broad bottom (laying status can be checked, see fig. 6.4)

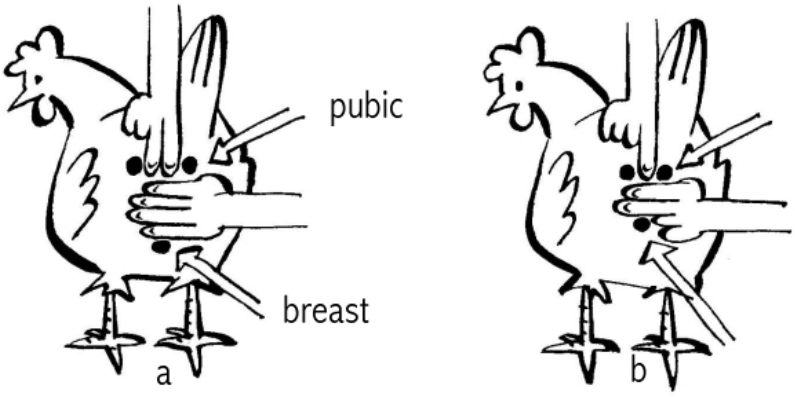


Fig. 6.4 Hen in lay (a) and outside lay (b)

In small flocks, it is relatively easy to check whether the hens are laying or not (Fig. 6.4). Check with your hand. The distance between the pubic bones (top) will be equivalent to two fingers, when the hen is in lay. Only one finger may pass between the pubic bones, when the hen is outside lay.

A healthy and good cock should have the following features (Fig. 6.1):

- alert and protective nature
- shiny and normal feathering for the breed
- clear and shiny eyes
- clean and dry beak and nostrils
- clean feathers around the vent
- straight legs and toes with no signs of scaly legs
- large size relative to the hens

It may be an advantage to keep records on the growth and productivity of each bird in order to select birds according to features such as egg production, growth (meat

production) and broody behaviour. Keeping records may help you select the best layers or the best mother to protect the chicks. See chapter 5 for example on record keeping.

If new birds are bought on the market it is important to isolate the new birds in separate baskets for the first two weeks. This will enable you to discover possible diseases or disorders in the new birds. If they show signs of any kind of illness you should return them to the seller or slaughter them.

Breed selection

When you have succeeded in improving your productivity and survival of you local free-range poultry through improved management, housing, feeding, chick protection etc, you may want to further increase productivity by introducing better breeds.

A breed is a group of poultry with a characteristic body form and feather contours. These unique characteristics are inherited from one generation to the next. Also features such as the comb, colour of ear lobes and shank colours and length are usually determined by breed. In every breed, different varieties can occur usually determined by plumage colour. Thus a white and a black hen may just be different varieties of the same breed. Figures 6.5 – 6.7. shows three different breeds commonly found in tropical regions, i.e. Frizzled Feathers, Naked-Neck and the Dwarf. Naked-Neck genes are found in almost every village, and are believed to be a natural adaptation to avoid heat stress. Frizzled feathers may look ill at a first glance, but is also common in most village based systems. In some countries, Frizzled Feathers are higher priced in the markets than normally feathered poultry. Dwarf poultry show standard colours and plumage, but tend to be 2/3 of the normal size for poultry, mostly because of the short shanks.

Figure 6.5. Frizzled Feathers

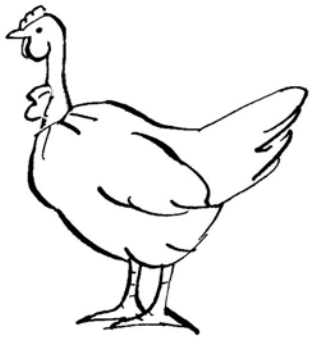


Fig. 6.6. Naked-Neck

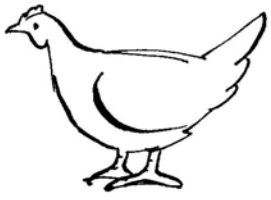
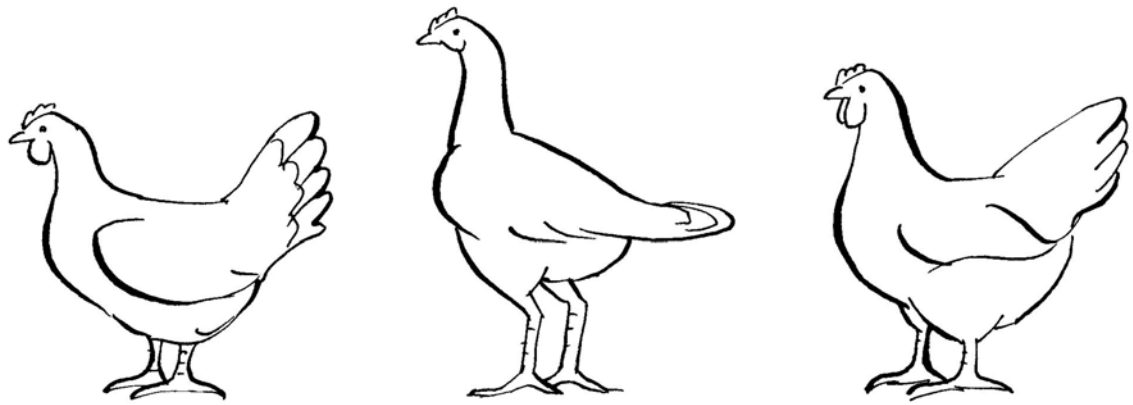


Fig. 6.7.Dwarf breed

Chickens and ducks in industrialised systems are usually kept for two distinct purposes, that is either egg or meat production. A high productivity in either egg or meat production is a result of specialised breeding programme. The so-called dual-purpose breeds is also a result of breeding programmes, and may produce more eggs as well as more meat than traditional birds. It is important to select birds, which are suited for the kind of production you have in mind, and which are suited for the conditions under which they are kept, e.g. free-range or confinement.

The features of birds specialised in egg production, meat production or both (dual-purpose) are shown in figures 6.8abc. Laying hens are "boat-shaped" with a long straight back and a big bottom. Meat producers (broilers) are long-legged, in a more upright position and wings in high position on the body. Dual-purpose breeds is a form in between the layers and broilers. Local breeds often have the form of a dual-purpose breed, although much less heavy in body form and size.



a *b* *c*

Figures 6.8a, b and c Typical breeds producing eggs (a), meat (b) and both (c)

The commercial sector has developed highly specialised hybrids (crosses of several breeds) of which layers can produce 300 eggs per year and broilers can reach 2 kg in 6 weeks. To obtain this high production, the hybrids have very specific requirements to management, feeding and disease management and production costs are high. They are therefore not normally suited in free-range and improved free-range systems.

Cross-breeding

To increase production from local chickens, crossbreeding with other breeds can be practised. It is however, important to consult professional breeders or breeding

companies, who may recommend suitable and available breeds to increase egg production, growth or both. It is important to be aware that the offspring will obtain different qualities depending on whether the cock or the hen of the new breed is used. This is because some qualities are sex-linked and thus it is important to consult a breeder.

In Bangladesh, the female of an Egyptian breed, Fayoumi, and the male of an American breed, Rhode Island Red (RIR), were crossed to produce a crossbreed layer suitable for a semi-scavenging life under village conditions. The result was a laying capacity of up to 160 eggs/hen/year and a growth rate under semi-scavenging conditions of 10 g/day. Furthermore, the brown-golden feathers were highly praised by the farmers, who named the breed "Sonali" (meaning "Golden" in Bangla). The cross of male Fayoumi and the female RIR did not give the same satisfactory results.

It is also important to stress that if a cross-breed is introduced at village level, it is crucial that management, feeding and health protection schemes are improved.

Cockerel exchange programs

In many countries, a common attempt to increase production from local chickens has been to establish so-called cockerel exchange schemes. The idea was to improve the productivity of local birds by mating them with improved cocks. For several reasons these schemes usually failed to work. First of all the introduced breeds could not adapt to the hot climate, low feeding and management and thus many of them died. Furthermore, the improved cocks were not as lively and active under village conditions as the local cocks and thus lost in the mating competition for the hens. When reproduction succeeded, the first generation of these cocks often showed a slight increase in production, but as no strict breeding schemes were maintained, the effect was gone after a few generations. Another set of important potential disadvantages were loss of broodiness, reduced scavenging capacity and reduced survival. Diseases such as Newcastle Disease and Leucosis were introduced to new areas and the result was high mortality among local birds. For all these reasons it is very important that selection of breeding birds take place in the existing environment. Simple cockerel exchange programmes are as such not recommended.

Simple rules for animal and breed selection

1. You should practice judging the external features of cocks, hens, growers and chicks, knowing what signifies a good animal.
2. Always choose birds with a lively behaviour.
3. Always check whether the hens are in lay (Fig. 6.4).
4. A potentially good layer has a long straight back a broad bottom.
5. Always check the belly and navel spot of newly hatched chicks (Fig. 6.3).
6. Keep new birds isolated for a few weeks before introducing them into the flock.
7. The results of crossbreeding should always be monitored carefully.
8. Uncontrolled release of exotic cocks into the environment should be avoided.

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Network for Smallholder Poultry Development

www.poultry.kvl.dk

The Poultry Network is globally recognized as a multidisciplinary centre of excellence, when it comes to using poultry as a tool for alleviating poverty and empowering women. The Network and its partners have supported poverty-focused poultry activities in the following countries: Bangladesh, Benin, Bolivia, Burkina Faso, Eritrea, Ghana, India, Kenya, Malawi, Mozambique, Nicaragua, Senegal, South Africa, Tanzania, Vietnam and Zimbabwe. A powerful triangular connection between research, field level activities, and education & training are the cornerstones in the Poultry Network's approach to poverty alleviation. The Network's main areas of expertise are support to project identification, formulation, implementation, monitoring and evaluation, research identification and support, curriculum development, development of farmer field schools, training of trainers' courses and research-based higher education programmes.

International Network for Family Poultry Development (INFPD)
www.fao.org/ag/againfo/subjects/en/infpd/home.html

INFPD is mainly an Information Exchange Network. One of the objectives of the INFPD is to encourage higher standards that can sustainably increase the productivity of the family poultry sub-sector's. This will be achieved through providing advice and collecting data and detailed information about family poultry production systems. Information is disseminated through a trilingual (English, French and Spanish) newsletter, which is produced twice a year and distributed electronically with a printed version for members without e-mail facilities.

Rural Poultry in Developing Countries

www.kyeemafoundation.org

This rural poultry website was developed by staff of the School of Veterinary Science at the University of Queensland and funded by the Australian Centre for International Agricultural Research. The aim is to provide a resource for farmers and workers from research and diagnostic laboratories, extension services, non-government organizations and development agencies. It is hoped the website will encourage collaboration between these groups and provide a forum for the exchange of information and ideas about rural poultry.

Front pictures from Bangladesh, Burkina Faso and Benin by Jens Christian Riise.

Published by:
Network for Smallholder Poultry Development
Copenhagen, Denmark
With support from DANIDA

Illustrations: Niels Poulsen

Layout and printing:
Kailow Graphic A/S

ISBN no:
87-990401-0-7