9

Recommendations for Optimizing Smallholder Low-input and Diversified Livestock Keeping

Learning Objectives: Understanding
- The need to adapt recommendations to livestock keeping strategy
- Main objective in supporting low-input and diversified livestock keeping: reducing mortality
- Main causes of animal mortality in low-input livestock keeping
- Recommendations for stimulating low-input systems in each of the eight special areas

Adapt Recommendations to Local Circumstances

It is important to analyse the type of animal husbandry used within a family or community, as well as the local circumstances at hand, before embarking on activities in support of the animal husbandry practices. Because of the differences in objectives between systems, as explained in the previous chapters, it is necessary similarly to adapt the recommendations. This will be done for low-input and diversified smallholder systems in this chapter, and for more specialized smallholder systems in Chapter 10. The aspects related to marketing will be detailed in Chapter 11.

Most livestock keepers in the world can be found in the low-input and diversified smallholder farmer and pastoralist systems. In addition to the low-input and diversified animal keeping of various species, the same family may be employing a more specialized type of animal production of one selected species.

Main Goal: Reducing Animal Mortality

In low-input and diversified husbandry, the animals are raised with minimal input in terms of labour and feeding costs. The animals generally roam around to find their own feeds – or may be fed with leftovers. It is accepted that the animals lose weight during the lean season. This is, however, quite an economically viable system, because all produce is direct gain, as no significant costs are needed.

Within this system, it is not possible to generate greater earnings by reducing production costs, because these costs are already minimal. Neither can per-animal productivity be substantially increased because this implies an increased investment of labour and capital, which goes against the logic of this type of husbandry.
Therefore, the best way of stimulating low-input and diversified husbandry within its own logic is to reduce the animal mortality (Fig. 9.1; van’t Hooft, 2004).

Mortality in this type of husbandry can vary depending on the species, the climate, the season, management, and the presence of predators and the epidemics of infectious diseases. Mortality can be as high as 80–90% in the case of chickens, for example. Reducing the mortality of chicks from 80% to 60% for example, will double the quantity of live chicks. For this reason, families with diversified husbandry will dedicate effort to avoiding mortality, but rarely try to increase per capita animal production. In order to find the means to reduce mortality, we must therefore take into account the limitations that characterize this type of production.

For this reason, measures for reducing animal mortality should be inexpensive and employ little manual labour; the earnings achieved in the short term – in the form of live animals – must be greater than the costs necessary to achieve the change.

In order to improve low-input and diversified animal keeping, one needs to understand the main reasons for mortality. Generally speaking, besides culling for family needs, the eight main causes of mortality in low-input livestock keeping are:

1. Nutritional deficiencies, especially during dry periods;
2. Lack of pasture;
3. Water deficiencies;
4. Infectious diseases;
5. Internal and external parasites;
6. Breeding deficiencies;
7. Lack of protection;
8. Lack of care during special moments (birth, illness).

In this chapter, these eight elements will be used as the entry point for listing improvements at farm level, aiming at reduced animal mortality. Please note that this is an overview of possibilities of improved management practices rather than a complete guide (Fig. 9.2).

1: Improved Animal Nutrition

In many community livestock development projects, the objective of improving nourishment during the dry season is one of the main themes. Despite this, the results have not often been very encouraging. Very few times have the introduced improvements been adopted in large part by the families. This may be linked to the fact that changing the feeding strategy often implies a change from low-input to more specialized system.

Deficient nutrition during the dry and cold months of the year is in itself one of the characteristics of low-input and diversified husbandry. The objective of the improvement in low-input livestock keeping, therefore, is to reduce the mortality during the dry season rather than increasing animal productivity (Table 9.1).

The recommendations for animal nutrition in low-input livestock keeping are divided into two parts: (i) dry season nutrition; and (ii) mineral supply.
Fig. 9.2. The wheel of animal well-being and production for low-input livestock keeping. The recommendations to support low-input and diversified livestock keeping are based on the eight major reasons for mortality.

Table 9.1. Objectives and recommendations for improved animal nutrition in smallholder low-input and diversified livestock keeping.

<table>
<thead>
<tr>
<th>Animal nutrition</th>
<th>Objectives</th>
<th>Dry season nutrition</th>
<th>Mineral supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-input and diversified systems</td>
<td>Reduced mortality in dry season</td>
<td>Agriculture leftovers</td>
<td>Provide ordinary salt or home-made mineral blocks</td>
</tr>
<tr>
<td></td>
<td>Reduced weight-loss</td>
<td>storage and feeding</td>
<td>Vitamins</td>
</tr>
<tr>
<td></td>
<td>Increased resistance to drought</td>
<td>Support local feeding innovations</td>
<td></td>
</tr>
<tr>
<td>Recommendations for improvements</td>
<td>Plant leguminous trees</td>
<td>Plant leguminous trees</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improved use of kitchen leftovers</td>
<td>Improved use of kitchen leftovers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Green forage</td>
<td>Green forage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hay making</td>
<td>Hay making</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cheap by-products</td>
<td>Cheap by-products</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feed troughs</td>
<td>Feed troughs</td>
<td></td>
</tr>
</tbody>
</table>
Optimizing Low-input and Diversified Livestock Keeping

Dry season nutrition

In low-input and diversified livestock keeping, the lack of food during the cold or dry season is in itself the cause of a sizeable proportion of mortality. The process for improving nourishment without leaving the logic of diversified husbandry is very complicated, as improving animal feeding generally requires significant investment of time and money.

The best way of improving nourishment in this kind of animal husbandry without abandoning the logic of little investment seems to be supporting the traditional ways of animal feeding and all other local innovations that are accepted and adapted to the local circumstances. The feed needs to be improved in both quality and quantity. In this process of improvement, the characteristics and limitations of each species must be taken into account. Moreover, the way of presenting the feed can be improved in simple ways.

Improved straw storage and feeding

In most tropical climates around the world, there are traditional forms of procuring and saving animal feed out of crop residues, such as maize husks. The residues depend upon the crops grown on the farms; the residues of rice, wheat, millet or maize straw are major animal forages. In low-input diversified animal keeping, stover is usually handled and dried in the long, unchopped state (Fig. 9.3) and stored in varieties of ways. In addition, groundnut tops, halms of peas, cowpeas and soybean are also used for off-season feeding.

In many cases, the traditional storage methods or the provision of such feeds can be improved, for example by reducing the time of drying the stalks. Better results are also achieved when these feeds are piled in the shade, as they maintain more of their nutrients this way.

These feeds are low in nutrients and minerals and for this reason, it is best to chop into smaller pieces and to combine with salt. These methods can enhance the nutritional value of these feeds and make it more palatable:

- Cut the straw into 1–2-inch long pieces
- Put it into a bucket or big vessel
- Cover the straw with water
- Salt can also be added as required
- It can be fed after a few hours
- Green grasses can also be added to make it tastier.

Supporting local feeding innovations and traditions

In the Andean highlands, some farmers are using an aquatic plant locally known as q’hora for feeding their animals. Some farmers make hay from this plant. Such local possibilities can be researched and further explored to optimize animal keeping without major costs. Another example of a tradition that can be supported is to plant certain leguminous tree species, which do not only provide shade and live-fences, but also nutritious oily seeds during the period of highest feed shortage. A third example of a local innovation from the Bolivian valleys is the use of chicken manure to provide some extra nutrients for sheep during the dry season, as an alternative, inexpensive and nutrient-dense feed source (van’t Hooft, 2004).

Improved use of kitchen leftovers

Pigs and other small animals are often fed on leftovers from home kitchens, restaurants or...
local breweries. In general, cooking the leftovers and adding salt in the case of raw products will increase the digestibility.

**Green forage**

Some smallholder farmers grow small quantities of specific crops to feed their animals during the dry season. Examples are oats and barley. Oats yield more and are more palatable than barley. In high-altitude areas, barley is cultivated more than oats for its yield capacity in less fertile soils and for its ease of transport and storage. Other farmers grow lucerne—a high quality legume—to feed their animals throughout the year. Different varieties of lucerne are used depending on the climatic and soil conditions in each area. Lucerne is a more difficult crop, as it requires irrigation during the dry months. Because of this, in some areas it is sold as a cash crop.

**Hay making**

Some farmers produce hay and store for the dry season. This is not very familiar in low-input animal keeping systems, however, and attempts to introduce it in regions where the custom does not exist often tend to fail. Hay can be made from various crops such as barley, oats or lucerne. To produce it, the crop is allowed to dry for 1.5–2 days. Care should be taken not to dry it for too long, as nutrients are lost in the process. There are different ways to store the hay after the drying process. Dried lucerne or lucerne hay is a good-quality product, but making lucerne hay requires manual labour during the very busy rainy season, so many prefer not to undertake this endeavour.

**Cheap and easy to obtain by-products**

Cheap by-products are often commonly used in low-input and diversified livestock keeping. An example is the common use of wheat and rice bran in Bolivia, a by-product from community wheat and rice mills that can be purchased in small quantities. The bran is a feed rich in vitamins and proteins and is often used as a by-product to feed pigs, horses and cattle. This can be improved by adding salt and the right quantities of water.

**Use of feeder troughs**

The quality and quantity of feed can also be improved by using and improving the feeder troughs used. A trough without holes and of sufficient size can avoid the loss of feed and reduce the incidence of internal parasites.

**Salt and other minerals**

*Provide kitchen salt*

For all animal species of all ages and in all climates, supplying minerals is one of the most important elements in low-input diversified husbandry. At a minimum, common salt (sodium chloride) is required, like that found in kitchen salt. It is best to provide it in small quantities every day, even though it is also possible to ration it to livestock two times per week. These minerals facilitate the body in taking advantage of the little nourishment that it acquires so the animal can better process dry feed of poor quality. In this way, salt strengthens general health, resistance and reproduction. When ordinary salt is not given to the animals, they look for it by licking earth and sweat or biting bones. The cost of salt is relatively easy to recuperate, with the increase in milk production in the short term and the increase in growth of young stock and reproduction in adult stock in the medium term.

**Preparation of simple mineral block**

Ordinary salt is best given in combination with other minerals. Different types of mineral block can be prepared easily in the field depending upon the availability of the resources (Fig. 9.4).

**METHOD OF MINERAL BLOCK PREPARATION**

(ANIMAL HEALTH TRAINING AND CONSULTANCY SERVICE, AHTCS)

**Materials:**

- ½ kg red (iron rich) soil
- ½ kg common salt
Optimizing Low-input and Diversified Livestock Keeping

Fig. 9.4. The preparation of a mineral block in specific countries in South Asia and Africa from locally available materials: red soil, common salt, eggshells and a handful of wheat flour. After elaboration, the block is placed in the shelter where the animals spend the night. Credit: Bhandari (2009).

- 5 eggshells (shells only)
- 1 handful flour (wheat or otherwise)

Method:
- Heat/roast eggshells and crush into fine powder
- Grind the soil and salt into a fine powder
- Mix dry ingredients with water to form a paste; mould into desired shape
- Form a hole in middle of shape in order to hang block with a string from overhead
- Allow block to dry thoroughly; no sunlight for 2 full days so that it dries from the inside; then in sunlight to complete drying

Hang the block:
- Acclimatize animals to the block by putting it in the feed box for a day or two
- Hang in stall and under cover so that it does not erode in the rain
- Keep mineral block available at all times

Another example from northern Ghana shows that natural mineral licks can be made from special salty soil. Local farmers experimented with adding other nutrients to this soil, especially oyster shell and cassava flour, with support from the CSIR Animal Research Institute in Tamale, Ghana (Karbo, 1999).

Vitamins

There are several essential vitamins that animals need, especially during the dry season. Vitamins have functions similar to those of minerals. There are differences
between species with respect to needs in different periods. While ruminants can synthesize the majority of the vitamins in the rumen, vitamins need to be supplied to non-ruminants. Although there is no clarity about the necessary quantities of different vitamins in low-input animal husbandry, the use of inexpensive multi-vitamin products is generally recommended.

### 2: Improved Pasture and Rangeland Management

Overgrazing is a common problem associated with low-input and diversified livestock keeping, especially with ruminants in dryland and rain-fed areas. Goats are perceived as especially destructive in this perspective. Overgrazing is an initial process, which triggers land degradation and favours further poverty of soils, plants and people. The problem is often especially acute in communal grazing areas. At the same time, when managed correctly, animals can also provide the key to improving soil fertility and forage production (Table 9.2).

The recommendations for pasture and rangeland management in low-input and diversified livestock keeping are divided into two parts: (i) pasture management; and (ii) rangeland management.

#### Improved pasture management

**Controlled grazing instead of roaming animals**

Many families strive for pasture management by pinning individual animals on a specific spot during a few hours or by herding (Fig. 9.5). This is often used for sheep and goats as well as pigs, and represents an efficient way of controlled grazing.

**Weed control**

A certain level of critical weed control is often taken care of by strategic rotation of animal species or mechanical means.

**Zero-grazing system**

In order to reduce the pressure on the pastures, sometimes it is advantageous to use the zero-grazing system, in which the feed

<table>
<thead>
<tr>
<th>Pasture and rangeland management</th>
<th>Objectives</th>
<th>Pasture</th>
<th>Rangeland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-input and diversified systems</td>
<td>Reduced overgrazing and soil erosion</td>
<td>Controlled grazing</td>
<td>Reviving communal grazing control</td>
</tr>
<tr>
<td></td>
<td>Reduced brush encroachment</td>
<td>Zero-grazing systems</td>
<td>Fence off grazing areas</td>
</tr>
<tr>
<td></td>
<td>Increased carrying capacity</td>
<td>Special grazing areas for dry period</td>
<td>Rotational grazing</td>
</tr>
<tr>
<td></td>
<td>Increased resistance against drought</td>
<td>Controlled and prescribed fire</td>
<td>Special grazing areas for dry period</td>
</tr>
<tr>
<td>Recommendations for improvements</td>
<td>Community organization</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
is brought to the animals. This is often recommended in the case of goats. In most cases, however, this implies a transition to a more specialized animal keeping system.

**Improved rangeland management**

In low-input and diversified systems, rangeland management objectives relate to reducing the encroachment of brush, reducing soil erosion, increasing the carrying capacity of the land and managing through drought conditions. This is done by using long-standing practices of community-managed rotation of herds and flocks. Indigenous people have recognized ways of preparing for droughts, prevention of overgrazing and protecting fragile areas for many years within their rangelands (Flintan and Cullis, 2010).

**Reviving communal grazing control**

A workable plan for regulating the grazing of communal grasslands in diversified animal raising communities is to re-establish traditional structures and systems. For example, in the most isolated zones of Bolivia, these structures are still in force today. Their communal decisions are based on climatic predictions and a profound knowledge of the productive capacity of the local forages. At the same time, there are continuous discussions on the need to maintain the animal load in balance with the capacity of the grasslands. There are large variations according to zone and it is very difficult to determine exactly the optimal animal load for each zone (Fig. 9.6).

**Use of traditional animal species**

Animal species such as camels, llamas and alpacas are less destructive for fragile pasturelands than other ruminant species, such as cattle, goats and sheep. The camelid species have soft-padded feet that prevent soil erosion. Moreover, their feeding habits can actually stimulate the growth of palatable plant species.
Fencing off grazing areas

Traditional fences made of stone can be found especially in the hilly areas. Other fences are made with posts and barbed wire. Some projects with camelids in the Altiplano of Bolivia aim to create native fields of protected grazing, delineating certain special grazing areas with such fences. The delineation has the advantages of improving management of native grasslands and freeing up the shepherd to do other things. At the same time, there may well be disadvantages to this activity, as it interrupts the traditional movement of animals, which may well have an important ecological rationale (van’t Hooft, 2004).

Rotational grazing

Rotational grazing practices, either with herders or fencing, can improve the utilization of local forages or extend the grazing season for all livestock. Rotational grazing is periodically moving livestock to fresh paddocks, which allows pastures to regrow. Rotational grazing requires close monitoring. If used properly, animal health improves and soil nutrients are effectively managed.

Reviving indigenous practices to reduce bush encroachment

Efforts by pastoral communities to revive indigenous rangeland management practices, such as the use of prescribed fire, are now gaining the attention of policy makers. For example, in the Borana Plateau in southern Ethiopia, heavy grazing by livestock, reduced mobility of pastoralists and lack of fire have contributed to the conversion of open mixed savannah to dense woodlands and bush lands. Herbaceous forage production for cattle and sheep has declined because of competition with woody plants for water and light. Residual grass is subjected to intense grazing pressure, further exacerbating the downward spiral.

Prescribed fire is the traditional most cost-effective means of manipulating vegetation in the savannah ecosystems of Eastern Africa. However, a blanket ban on the use of fire was introduced during the 1970s. This was intended to protect cropland and other natural resources from indiscriminate burning. An unintended consequence of this policy has been a weakening of traditional forms of range management that depended, in part, on the regulated use of fire to control
undesirable woody plants, to promote herbageous forage production and to reduce populations of disease-carrying ticks. An alliance of pastoral communities, researchers, policy makers and development actors is now experimenting with ways to re-introduce prescribed burning into the Borana Plateau (Fig. 9.7). They have found that useful trees, such as the acacia, remain intact after the prescribed fire (Gebru Tegegn, 2010).

3: Water Provision

Dirty or insufficient water is a factor that seriously limits low-input and diversified animal husbandry. This essential and basic element is too often neglected and underestimated, especially in smallholder conditions. The possibilities logically depend on the conditions of each place (Table 9.3).

The recommendations for water provision in low-input livestock keeping are divided into two parts: (i) access to water; and (ii) water quality.

**Access to water**

**Regular watering**

In low-input animal keeping, the access to water is usually limited, as this often requires special resources and inputs. Moreover, water can also be a vehicle for diseases to pass from animals to humans (zoonoses). This can be a major and often underestimated reason for animal as well as human disease and mortality. Depending on the species, animals need to be watered at least once or twice a day. With sufficient clean water – and especially in combination with sufficient minerals (especially common salt) – the animals can much better resist the periods in which they receive limited nourishment.

Opt for animal species or breeds that require less water

Some animal species, especially camelids, require very little water in comparison to other species. This is especially relevant in
Table 9.3. Objectives and recommendations for improved water provision in smallholder low-input and diversified livestock keeping.

<table>
<thead>
<tr>
<th>Water</th>
<th>Objectives</th>
<th>Access to water</th>
<th>Water quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low-input and diversified systems</strong></td>
<td><strong>Regular water uptake</strong></td>
<td>Water 1–2 times per day</td>
<td>Prevent polluted water sources</td>
</tr>
<tr>
<td></td>
<td><strong>Water quality sufficient</strong></td>
<td></td>
<td>Prevent polluted water sources</td>
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<tr>
<td></td>
<td><strong>Pollution of human water-source prevented</strong></td>
<td></td>
<td>Protect human water supplies</td>
</tr>
</tbody>
</table>

Recommendations for improvements

- Water 1–2 times per day
- Prevent polluted water sources
- Animal species that require less water
- Protect human water supplies

Dryland and desert areas. For example, in the deserts of Rajasthan in northern India, camels are better suited than cattle. They can subsist entirely on the local drought-resistant trees. Moreover, their soft-padded feet prevent soil erosion and their feeding habits can stimulate the growth of desert plants (Köhler-Rollefson, 2010).

**Water quality**

*Prevent polluted drinking water for animals*

Drinking water can be of insufficient quality, related to various factors:

- Muddy water source in which animals have trampled to get to the water;
- Non-cleaning of the water resource, such as cans or tins;
- Water used has been polluted, for example with soaps, chemicals or residues, for example, from mining activities.

*Prevent pollution of drinking water for human consumption by animals*

In low-input animal keeping, people and animals live closely together. Animals can pollute the drinking water for humans, which can be a source of disease for humans. This can happen for example:

- When they can defecate in the source of drinking water for humans;
- When animals drink from cans that are later used for human consumption;
- When dead animals are present in swimming or drinking water.

4: Control of Infectious Diseases

Contagious infectious diseases with high mortality are a common problem in low-input and diversified livestock keeping. Each animal species has one or two major infectious diseases that are often possible to prevent relatively easy. In order to accomplish the aim of reducing animal mortality, it is necessary to focus especially on the control of these infectious diseases (Table 9.4).

The recommendations for the control of infectious diseases in low-input livestock keeping are divided into two parts: (i) animal health services; and (ii) vaccination.

**Animal health services**

Animal health services usually aim at a combination of disease treatment and disease prevention.

*Supporting ethno-veterinary practices and practitioners*

To keep animals healthy, traditional healing and prevention practices have been applied for centuries, and have been passed down orally from generation to generation. Local health care systems combine the application of medicinal plants with careful grazing,
Table 9.4. Objectives and recommendations for improved control of infectious diseases in smallholder low-input and diversified livestock keeping.

<table>
<thead>
<tr>
<th>Infectious diseases</th>
<th>Objectives</th>
<th>Animal health services</th>
<th>Vaccination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-input and diversified systems</td>
<td>Reduced incidence</td>
<td>Support ethno-vet practices and practitioners</td>
<td>Vaccination of 1 or 2 major infectious diseases</td>
</tr>
<tr>
<td></td>
<td>zoonosis</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Reduced animal mortality because of infectious disease</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Promote synergy between traditional and modern remedies</td>
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<td></td>
<td>Improved access to local animal health services</td>
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Recommendations for improvements

- Support ethno-vet practices and practitioners
- Vaccination of 1 or 2 major infectious diseases
- Train community animal health workers
- Awareness of zoonosis

Feeding and breeding management. These so-called ‘ethno-veterinary practices’ reflect the in-depth knowledge of livestock keepers of their animals, ways to prevent and cure livestock diseases, as well as their environment.

It is becoming more common now for ethno-veterinary practices and collections of remedies to be recorded and even published. The wealth of information and methods to use ethno-veterinary medicines are collected, more commonly, by a few people in each community (Fig. 9.8). These healers are respected and valuable people for the health care of the animals as well as the people of the region (FRLHT and Tanuvas University, 2010).

Promote synergy between traditional and modern remedies

To support low-input animal husbandry, it has become increasingly recognized that enhancing ethno-veterinary practices and supporting the community animal health workers can play an essential role. This can lead to synergy between the use of local and modern remedies. The modern remedies most used in these systems are vaccines and very few antibiotics. These are of special

Fig. 9.8. The indigenous Tzotzil women pastoralists in Chiapas in southern Mexico have learned to prevent and cure the diseases of their animals, especially in their sheep. Credit: Ellen Geerlings.
importance for acute problems, especially in the case of species that involve cash (e.g. cattle and pigs). In most other cases, traditional remedies are used in several parts of the world. Community animal health workers provide basic modern remedies and they also use only effective local remedies to treat several diseases.

Train Community Animal Health Workers (CAHW)

In regions with low-input livestock keeping, animal health care is usually left up to livestock keepers. There is no private veterinary practice available to provide health advice, services or product – and if there is, the costs are usually far too high. The government livestock veterinarians are often engaged in administrative issues at regional and national levels. Livestock keepers are left with their own ethno-vet experience to protect and treat illness and injury.

Throughout the world, there are programmes to train community animal health workers: these are specially trained local community members who help fellow-farmers and community groups to prevent and cure animal diseases, and to optimize animal production (Fig. 9.9). The primary purpose of the CAHW programme is to increase the access to affordable, basic, animal health services. The sustainability of community-based animal health care is enhanced with payment for service by the farmers and by providing adequate training to the workers. Often the community animal health workers combine traditional and modern medicine, but this is not always the case. They will especially favour modern medicine when this is their major source of income.

Increase awareness about zoonosis

Zoonoses are diseases that are passed from animals to humans. These diseases are especially common in low-input livestock keeping, because of the close ways of living together. Several of the zoonoses are officially considered neglected by the World Health Organization (WHO, 2005). One of these, a very common parasitic disease in pigs, is cysticercosis.

Fig. 9.9. Community-based animal health worker in the Philippines prepares a treatment. These trained local farmers provide cheap animal health services at the doorstep. The activities of these practitioners are not officially recognized in all countries, however.
Cysticercosis is found as cysts in the flesh of pigs and cattle. The parasite can be passed to people via raw or poorly cooked meat, and will result in long tapeworms (Taenia species) in the intestines of people. While training community animal health workers, it is also good to inform them about the ways to prevent this zoonotic disease – in the case of cysticercosis, by keeping pigs away from human stools, and by thoroughly cooking all pig meat before consumption.

Disease prevention through vaccination

Many livestock species have one or two infectious diseases that cause occasional high levels of mortality. The necessary vaccinations depend on the major diseases prevalent in each zone or country, for example in Latin America, swine fever in the case of pigs; Newcastle disease in the case of chickens; blackleg, hemorrhagic septicaemia and anthrax. In some cases, for example Newcastle disease in chickens, the occasional outbreak can cause the death of up to 90% of the animals. The other major reason for vaccination is to prevent zoonoses, such as rabies in dogs and cattle.

Vaccination against infectious diseases with high animal mortality

Modern vaccination is one of the main ways to reduce mortality in diversified husbandry, as it has been tested in different projects in different countries around the world. The combination of modern vaccination opportunities with traditional forms of treating and avoiding these diseases is of great importance.

There are, however, various factors that complicate the practice of vaccination in diversified husbandry. Most vaccines have been developed under the conditions of high-input and specialized husbandry. Some of the most common difficulties in promoting vaccination against major infectious diseases are:

- Vaccines requires a monetary investment when the animals are healthy, which goes against the logic of this husbandry when there is no understanding of the importance and function of the vaccine. If the illness has not appeared over several years, families often choose not to vaccinate – even though the risk is greater than in the case of more recent outbreaks because the animals do not have a developed resistance.
- Vaccines are inexpensive and effective, but often come in large quantities and in single-dose bottles that must be used in a limited period. This is difficult for the conditions of diversified low-input husbandry.
- In order to be effective, the majority of vaccines require constant refrigeration from the time they are made until their application to the animal; this is complicated by the conditions of the farming areas in diversified husbandry.
- There can be side-effects with some vaccines.
- Because of the large quantities and the need for constant refrigeration, the application of the majority of the vaccines usually requires organization of campaigns between the families and the community animal health workers that apply them (Box 9.1).

Vaccination against infectious diseases that are required by law

In many countries, vaccination against certain diseases is obligatory by law – or strongly re-enforced by government regulations. These diseases are often of major importance for the export of animal products, especially meat to the EU or the USA where many diseases are strictly regulated. At the same time, the disease may not be a serious threat to low-input animal keeping, as it has become endemic. This means that most animals have developed antibodies against the disease and do not die of it. In many other cases, farmers have developed ethno-veterinary remedies to cure the animals.

An important example is foot-and-mouth disease. The fact that the disease does not seriously affect their animals...
Box 9.1. Vaccination of birds against Newcastle disease in southern Nicaragua.

In the Project of Rural Integral Development ‘Manuel Lopez’ in El Sauce, Nicaragua, the vaccination programme against Newcastle disease was gradually developed, based on trained advocates, mostly women, for every 20–50 families. The day prior to the vaccination, the advocates were going to retrieve the vaccine for the project, returning to their houses with the vaccine in ice in a coolbox. In the early morning of the following day, the female participants received this vaccine in a 1-cc syringe with some ice cubes to be able later to vaccinate their animals that they had closed up for the night. A little drop was placed in one eye of each animal with the syringe without a needle (Fig. 9.10). In this way, approximately 120,000 birds were vaccinated two to three times a year (Kyvsgaard et al., 2001).

Fig. 9.10. Vaccinating local chickens against the common and highly contagious Newcastle disease can give good results, but requires good organization and trained animal health workers.

implies that farmers may not be motivated to spend effort and money on vaccinating their animals. This is worsened when there are (real or false) side-effects of the vaccine. Special incentives for vaccination may be necessary in this case – and it may be of national interest to do so.

5: Parasite Control

The reduction of parasite levels is another key element in low-input and diversified animal keeping. Usually there is multi-parasitism, with a large number of different internal and external parasites affecting the animals, especially the young ones. In general, parasites have a worse effect on young animals and exotic breeds – such as Holstein cows or Yorkshire pigs – than on adults and animals of local breeds. They also affect weak and malnourished animals more than healthy ones. Moreover, in warm and humid climates, the problem of parasites is worse than in dry and cold climates. Therefore, the incidence and the necessary controls have many elements that vary according to zone, species, breed, age and general state of the animals. For this reason, specific guidelines are difficult (Table 9.5).
Table 9.5. Objectives and recommendations for improved parasite control in smallholder low-input and diversified livestock keeping.

<table>
<thead>
<tr>
<th>Parasite control</th>
<th>Objectives</th>
<th>Internal Parasites</th>
<th>External Parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-input and diversified systems</td>
<td>Reduced incidence of internal and external parasites</td>
<td>Make use of natural resistance of local breeds</td>
<td>Make use of natural resistance of local breeds</td>
</tr>
<tr>
<td></td>
<td>Preventive parasitic zoonosis</td>
<td>Reducing parasite incidence in grazing and feeding areas</td>
<td>Use ethno-vet remedies for parasite control</td>
</tr>
<tr>
<td></td>
<td>Reduced loss of young stock because of parasites</td>
<td>Parasite control especially in young stock</td>
<td>Community control activities (dip/baths)</td>
</tr>
<tr>
<td></td>
<td>Improved leather quality</td>
<td>Support ethno-vet remedies for parasite control</td>
<td></td>
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</tbody>
</table>

Another problem related to internal parasites in animals is that some of them can pass to people (so-called parasitic zoonosis).

In general, it is worth the effort to explore the possibilities of controlling parasites within the logic of low-input animal keeping for each species and according to the characteristics of each zone. The objective of internal parasite control is not eradication of the parasites but rather control of their number while the animal can build up sufficient resistance. When the animal grows older, it can better deal with the parasites, at least under normal circumstances. For this purpose, both ethno-veterinary and commercial treatments can be used.

The recommendations of parasite control in low-input livestock keeping are divided into two parts: (i) internal parasite reduction; and (ii) external parasite reduction.

**Internal parasite reduction**

Most types of internal parasites reproduce through eggs that come from the animal with the manure. The eggs can survive outside the body for a certain period, and develop through several stages and life forms. Finally, the juvenile forms climb up the plants to be eaten by livestock. This process is greatly enhanced by high temperatures and humidity. As a result, the control of parasites in all animal keeping systems is a combination between animal-related measures and control of grazing.

*Make use of natural resistance of local breeds*

Several local breeds have innate resistance against (external and internal) parasites. In traditional systems, this is consciously stimulated in selecting the breeding animals with lowest problems related to malnutrition and parasites. This system has been broken down by introducing animals of high-yielding exotic breeds that do not have natural resistance against most internal and external parasites. One of the ways to reduce the impact of parasites is to use local breeds again instead of exotic animals or crossbreeds.
Reduce parasite incidence in grazing and feeding areas

Understanding parasite life cycles allows us to manage the grazing areas of our livestock and can be a means of avoiding their infective stages. Pasture rotation and the use of feeding troughs is a part of preventative and curative anti-parasitic management. Feeding on the ground increases the risk of parasitic disease.

Special focus on young animals

Internal parasites have a dramatic effect on young animals, of both exotic and local breeds – though the effect on young animals of exotic breeds is more dramatic. The young become thin, their bellies swell, they do not grow normally and eventually they may die. Young animals need extra treatments to reduce parasite numbers (Fig. 9.11) – whereas good nutrition can help to overcome the effects of parasites to a large extent.

Medications for parasite control can be on basis of plant treatment (ethno-veterinary treatments) or as commercial products. The latter are usually more expensive. Therefore, these commercial products are not often used in low-input animal keeping, except for large animals or in case of emergency. The commercial products lead to more rigorous expulsion of internal parasites. These products must be used with a thorough understanding and compliance with the label recommendations, as indiscriminate use can lead to resistance of the parasites against the drug.

Support ethno-veterinary treatments and practices for internal parasite control

Traditional remedies for the control of different types of parasites can be stimulated. Examples are:

- Regular drenching with medicinal plant liquids against internal parasites (ethno-vet treatment) to reduce parasite numbers – all ages but especially and regularly in young animals;
- Control grazing with muzzles while passing through areas with parasites, such as in the case of liver flukes in Chiapas, Mexico (Perezgrovas, 2006).

External parasite reduction

All animals can be hosts to external parasites that live on the skin, such as ticks, lice, mites, fleas and flies. In llama and alpaca husbandry, for example, external parasites are one of the most serious problems. Animals with mange and lice become thin and skinny, scratch themselves and injure their skin and the wool.

Ticks can also infect and transmit certain internal diseases such as redwater, gall sickness and heartwater. Exotic breeds tend to be at greater risk from these diseases than indigenous and local breeds. Older animals are more at risk than young animals for redwater and gall sickness.

External parasites, such as lice and mites, can reproduce directly on the animal. Other species, such as ticks, have another reproduction strategy, in which the juvenile forms live on the vegetation. At certain stages, they need to encounter an animal in order to complete their life cycle and reproduce. Therefore, the control of external parasites is a combination of measures directly related to the animals with measures to reduce parasite levels in the environment.

Fig. 9.11. In young animals, regular drenching with medicinal plants against internal parasites (ethno-veterinary treatment) can largely reduce parasite numbers.
Make use of natural resistance of local breeds
Several local breeds have innate resistance against external parasites. See the corresponding section above, for internal parasites. Again, to reduce the impact of parasites, use local breeds instead of exotic animals or crossbreeds.

Support additional ethno-veterinary treatments and practices
Many local ethno-veterinary products and practices for parasite control exist in each region. These traditional remedies for the control of different types of parasites can be stimulated. Examples are:

- The use of chickens in the corral to rid the cows from ticks;
- Regular baths with ethno-vet herbal remedies.

Community control activities of external parasites
If an animal has only a few ticks, these can be carefully pulled off, making sure the mouthparts of the tick are removed. Rubbing ticks with a cloth soaked in kerosene or paraffin will make them drop off the host. Large numbers of ticks, mites and lice are best controlled by spraying or dipping the animal with a suitable treatment, based on medicinal plants or a chemical product. All of the flock or herd must be treated at the same time. In some cases, community external parasite control activities can be organized – especially of wool producing species – and sometimes in combination with other community gatherings.

6: Breeding and Selection
Breeding the best animals is a central challenge in any animal production system (Table 9.6). Farmers want healthy and high-producing animals that are adapted to their environment. In low-input systems, this challenge is especially great, because of the challenging environment with seasonal feeding shortages, specific parasites and diseases as well as the multiple roles of the animals. In this context, numerous local animal breeds have been developed over time.

The recommendations related to local breeding and selection in low-input and diversified livestock keeping are divided into two parts: (i) use and choice of breeds; and (ii) breeding management.

Use and choice of breeds
Local animal breeds are often despised as being unproductive and backward. In most

<table>
<thead>
<tr>
<th>Breeding</th>
<th>Objectives</th>
<th>Use of breeds</th>
<th>Breeding management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-input and diversified systems</td>
<td>Maintain important local breeds</td>
<td>Breed selection on basis of local criteria</td>
<td>Prevent inbreeding</td>
</tr>
<tr>
<td></td>
<td>Make use of important traits of local breeds</td>
<td>Selection of better quality local breeds</td>
<td>Timely castration</td>
</tr>
<tr>
<td></td>
<td>Effective selection</td>
<td>Change males before</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prevent inbreeding</td>
<td>mating with own offspring</td>
<td></td>
</tr>
</tbody>
</table>

Table 9.6. Objectives and recommendations for improved breeding and selection in smallholder low-input and diversified livestock keeping.
countries that want to boost their animal production, a recipe of importing exotic breeds and crossbreeding programmes is almost standard procedure, even under smallholder conditions with severe limitations. This is done at the cost of the breeds that are used locally, which has resulted in severe loss of local breeds worldwide (Fig. 9.12).

One can say that especially in low-input animal keeping, the use of exotic breeds and crossbreeding is not the best option available. Experience has shown that – because of the severe limitations in terms of feeding and management inherent in this animal production system – improving local breeds through selection is a more viable and promising option. Bringing in exotic breeds and crossbreeding are options that imply a change from low-input into a more specialized animal keeping system. This will therefore be discussed in the following chapter (Chapter 10).

The myth of the ‘unproductive’ local breeds is a hard-to-crack notion, because indeed local breeds are usually less productive in conventional terms than the so-called exotic or high-yielding breeds. Some elements need to be taken into account in that respect, however (ANTHRA, 2008):

- Local breeds produce even under difficult circumstances and with very low inputs; therefore local breeds are especially productive in marginal areas.
- Local breeds do not only produce milk, eggs or meat – but also other essential products such as manure and draft power and transport.
- Local breeds are very diverse and often look more ‘messy’ than animals of standardized high yielding breeds (Fig. 9.13).
- Local breeds are usually smaller. This looks as if they are genetically degenerated.
- Because of deficient management, the mortality in offspring in local breeds is high; therefore, it seems as if they produce less.
- Inbreeding and deficient management is all too common in local breeds, which leads to problems, including low productivity.

Fig. 9.12. Raika pastoralists have been able to maintain several special breeds that are well adapted to their dryland conditions in Rajasthan in northern India. Credit: Ilse Koehler Rollefson.
Local breeds often have special traits, which are more difficult to measure than productivity, such as drought resistance, disease resistance, high fertility and special product quality.

The potential for improvement of local breeds through selection is high – but practical experience in supporting this process is still very limited.

Any exotic high yielding breed was once a local breed!

The characteristics of local breeds are sometimes more appreciated outside the local environment. An example is the experience of local cattle breeds from India (Gir and Kankrej from Gujarat, and Ongole from Andhra Pradesh) that were imported into Brazil in the 1960s. Besides producing meat, these breeds were developed as excellent milk breeds after a process of selection. In fact, the world’s best Gir cows today live in Brazil and give around 5500 l of milk on average per lactation. Comparing these with the neglected cousin in India, which does not yield more than 980 l, the Brazilian Gir yields roughly six times more (Sharma, 2010).

Genetic improvement of local breeds through selection

Improvement of animals of the local breeds can be very successful, with a careful look at the individuals that are available and using the local selection criteria of the desired traits in males and females. Over time, the desired characteristics can be enhanced within the local breeds, based on the roles of the breed and the specific challenges it needs to face. This process can be effectively supported. Animals of improved local breed, especially selected males, can then be re-introduced into their environment (Perezgrovas, 2006).

Breeding management

Prevent inbreeding

Many livestock keepers have effective knowledge and practice related to breeding. It is, however, common to find inbreeding in low-input husbandry. Related animals breed among themselves, gradually resulting in a genetic degeneration. It does not cause

Fig. 9.13. Because of high mortality, chicken of local breeds seem to produce only few chicks. In fact, these ‘Naked Neck’ local breeds are very fertile and productive, even under difficult circumstances. Credit: Ellen Geerlings.
mortality directly, but can lead to deformed, weak and poorly growing animals that are more likely to die. Depending on the species, there are practices to deal with this problem, such as dividing animals into age groups. When this is not possible, it is necessary to take other measures such as:

- Timely castration of males, so they cannot mate with their mother/sisters;
- Regular exchange of reproductive males;
- Selection of breeding males and castration of all other male animals.

**7: Protection and Housing**

Efficient protection is another central element to reduce animal mortality effectively in low-input and diversified animal keeping. No major constructions are necessary – efficient constructions based on local materials have been developed by livestock keeping families (Table 9.7). A world can still be gained in this respect, however, as mortality related to predators, theft and trampling is excessively high in low-input livestock keeping. This is especially the case among young animals. Moreover, effective protection in simple constructions can reduce the risk of transmitting animal diseases to humans.

The recommendations related to protection in low-input livestock keeping are divided into two parts: (i) prevent predators, accidents and theft; and (ii) protection against weather conditions.

**Protection against predators, accidents and theft**

**Protection during first weeks of life**

Newly born and young animals are more affected by predators and accidents. Depending on the species, small investments can be made for the construction of temporary shelter and thus considerably reduce mortality. It is important to know the customs of the place and to see the innovations that some families have developed in this respect, each with advantages and disadvantages.

It can be observed that many women have experimented with a simple shelter for the chicks during their first three weeks of life. Their feed needs to be provided during

<table>
<thead>
<tr>
<th>Protection</th>
<th>Objectives</th>
<th>Predators, accidents and theft prevention</th>
<th>Weather protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-input and diversified systems</td>
<td>Reduced loss because of predators, theft and trampling</td>
<td>Protection of young animals during first weeks</td>
<td>Provide simple night shelters</td>
</tr>
<tr>
<td></td>
<td>Effective low-cost construction with local materials</td>
<td>Protection during brooding and caring for young</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prevent transmission of zoonotic parasites</td>
<td>Night shelters</td>
<td></td>
</tr>
<tr>
<td>Recommendations for improvements</td>
<td></td>
<td>Control between animal and man parasite transmission</td>
<td></td>
</tr>
</tbody>
</table>
this period, such as ground maize. Though this implies more work, the mortality of the chicks decreases significantly during this most dangerous period.

Protection during brooding

Adult animals also need special protection when they are brooding (Fig. 9.14) or caring for their young. Again, it is possible to build on special protection experience existing within the locality for good ideas and examples.

Protection against adverse weather

Shade and wind breaks in the field

Protection against sun, rain, wind, cold and lightning is important for reducing mortality, especially for young animals. Depending on the species, this can be provided by trees with wide shade areas, natural or tree wind breaks as well as the use of a roof or a little shed. Raised areas in times of flooding are necessary.

The construction and cleaning of these shelters are very important for avoiding parasites and other bugs, such as the assassin bug. Livestock on the open range needs protection from strong winds, cold winds, severe rain, flooding, and extreme heat and humidity to prevent lung disease especially.

Special night shelters

Night shelters are an essential element, especially for animals that roam around during the day, to protect them from theft, predators and adverse weather.

An example of special night shelter is the custom of penning animals, such as chickens, in the houses at night. Though this effectively protects the animals, epidemiological studies have shown that this custom also increases the incidence of diseases and parasites, such as assassin bugs and Chagas disease.

Special care is another effective way to reduce animal mortality in low-input animal keeping. Special care is especially relevant around birth and for individual animals with a disease or other problem (Table 9.8). In this way, the foundation is laid for a healthy future and productive life. This only requires special knowledge and attention without the need for expensive constructions.

The recommendations related to special care in low-input livestock keeping are divided into two parts: (i) special care for sick animals; and (ii) special care before, during and after delivery.

Fig. 9.14. Chicken effectively protected from predators and weather during brooding. Credit: Ellen Geerlings.
Table 9.8. Objectives and recommendations for improved special care in smallholder low-input and diversified livestock keeping.

<table>
<thead>
<tr>
<th>Special care</th>
<th>Objectives</th>
<th>Sick animals</th>
<th>Around delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-input and diversified</td>
<td>Increased survival rate</td>
<td>Separate sick from healthy animals</td>
<td>Observe carefully animals before birth</td>
</tr>
<tr>
<td>systems</td>
<td>of sick animals</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduced mortality of newborn</td>
<td>Shade, water, fresh feed</td>
<td>Attend birth when necessary</td>
</tr>
<tr>
<td></td>
<td>Reduced disease female animal after birth</td>
<td>Ethno-vet/commercial treatments</td>
<td>Check afterbirth</td>
</tr>
<tr>
<td></td>
<td>Neo-natal bonding</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduced disease transmission around birth</td>
<td>Disposal of dead animals</td>
<td>Assure colostrum intake</td>
</tr>
<tr>
<td>Recommendations for</td>
<td></td>
<td></td>
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<tr>
<td>improvements</td>
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**Sick animals**

Special care is very important to increase the survival rate of sick animals (see also Birmingham and Quesenberry, 2007).

*Isolate sick animals*

It is necessary to isolate sick and recovering animals from healthy stock and give them special attention. If mixed with healthy animals, there can be competition for feed and water, which slows down recovery.

*Provide shade, fresh water and feed, treatment*

It is essential to keep the sick animals in the shade and protected from wind and rain. The animals need to be supplied with fresh water all the time and some good quality food.

*Disposal of dead animals*

When an animal dies, it is important to dispose of the carcass in a correct way. This is especially relevant in the case of infectious disease, in order to reduce the chances of infecting other animals. In the case of death related to anthrax, for example – a highly contagious infectious disease of ruminants – remnants of the animal can remain in the soil and water, and infect other animals, even years later. In this case, it is essential to prevent vultures from eating from the carcass, but rather bury or burn it.

**Special care before, during and after delivery**

*Extra assistance around delivery*

Extra care is especially relevant just before, during and after birth. Sometimes assistance is needed to ensure that delivery is normal and the young can breathe well. Moreover, the young need to be protected from cold and drink the first milk with special qualities. The feeding will also stimulate good bonding between mother and young. The umbilical cord needs to be cleaned and protected from infection. Finally, it is important to see that the afterbirth comes off normally.

*Simple birthing pen*

While many livestock young are born outdoors and under conditions of minimal care from the livestock owner, birthing under more controlled conditions can greatly reduce mortality. There is a balance that seasoned livestock owners know – that
some mothers need to be left alone and not bothered, while others need help. A general rule of thumb, though, is to let nature take its course during birthing and let the mothers do what mothers are supposed to do – with a watchful eye from the caretaker.

All livestock giving birth need to be observed – whether on the range or in confinement – and assistance needs to be given if anything is not going smoothly with delivery.

- If the newborn is too large or in an unusual delivery position or if the mother is too small and too weak, assistance needs to be given right away.
- If the weather is bitterly cold or excessively wet, a dry spot out of the wind is a sanctuary.
- If predators or theft are common, safe areas can be provided.
- If the newborn are weak or if the weather is extremely cold, sheds with a means of warmth are necessary.

Facilitate feeding with first milk (colostrum)

The first feeding of milk needs to be assured within a few hours after birth. This milk with special antibodies – also known as colostrum – has special relevance in preventing disease in the first year of life. In order to have this quality, it needs to be consumed during the first few hours of life.

Special care for recently born piglets

Simple protective measures are also possible to reduce piglet mortality. The highest mortality of these animals is common in the first hours after birth, until 6 days after birth, and is in fact the major reason for piglet mortality in low-input systems. This occurs because of the cold, when the young look for heat and thus can be smothered by the mother when she wants to lie down. When a piglet is born, it can be temporarily placed separately and kept warm – for example under a warm light or using a bottle with hot water wrapped in a rag. After having delivered all the piglets, these can be placed back with the sow. During the first few days, the young need to be placed with the mother every 2 hours to nurse. With small adaptations, such as placing a table where the young can sleep separately, the death of young piglets can effectively be avoided (van’t Hooft, 2004).

References and Further Reading


