1. Introduction

The purpose of this manual is to help trainers and technicians analyse small production systems and to help smallholders improve their systems effectively. Anecdotes are presented as educational material. They make it easier for the small backyard animal keepers to reach more general conclusions for themselves, and for them to feel more confident than if they received advice passively during a training period. Generally, keepers co-operate only when they receive some direct advantage from the project that they are involved in. Due to lack of trust, results are frequently short lived, even if the intervention has proved sustainable elsewhere.

Figures, tables, schemes and photographs have been used to support the text and to identify materials that are available to trainers and field technicians. Figures are indicated with the number of the chapter, followed by the number of the figure in red. The manual may also be used to browse through the 144 illustrations until an interesting topic is found. Some of the photographs represent different scenes as they appear in the field. When the caption begins with the words: " Try to analyse the system before you click on the picture to read the legend ", the reader is invited to deduce from the image as much information as possible before reading the caption.

This method demonstrates how small details can provide a lot of valuable information. Learning from details is also useful if the analysis is performed by means of interviews. Information received from interviews should agree with a direct analysis of reality. A good technician knows by experience that this is hardly ever true. Hoping to get knowledge of reality simply by asking people is an oversimplification of the job. It is much better to ask people to explain what we see and try to understand the logic that makes things as they are. In this way technicians learn before judging.

Most of the opinions reported here come from experience and are points of view that pertain to general aspects of reality. Thus, in particular conditions, these opinions are not always in agreement with the way things are commonly seen. They are useful however in helping technicians understand how important it is to analyse the systems, how these systems are often more complex than they may at first appear and how some minor detail can change the final judgement of efficiency or sustainability.

Examples are frequently given to make the subject less abstract, and also to show how many factors can play a role, because the fact that a system is small does not mean it is simple. Most of the examples

found in bold italics inside a box

come from direct experience and a few have been provided by reliable field technicians. Many examples of simple, appropriate technologies are reported. They show that improvement of rural livestock systems is

possible through adoption of equipment or structures studied and developed locally. The contribution of the Experimental Centre at Viterbo is indicated with.

Problems that may emerge even during a simple system analysis are so numerous that examples from backyard small animals may not always be available. Thus, examples from large animal husbandry have also been used when they are considered useful in understanding the nature and effect of specific constraints that must be identified before viable projects can be developed. To obtain satisfactory and sustainable results, all factors actually or potentially capable of influencing the livestock system should be identified beforehand. However, some cannot be foreseen because they are beyond the control of the rural family at the level at which intervention for food security can be effective.

10. Housing, equipment and management

All too often, the models for structures and management refer to developed Countries, even when it is matter of sustaining small animal keeping in rural areas. It must be remembered that the matters discussed here mainly refers to the poorest, low-food, no-income people and the aim is to allow them to attain a minimum level of food security. This purpose cannot be helped by modern

technologies and expensive sophisticated equipment. Academic knowledge has little chance of offering any useful ideas. But many good examples can come from a thorough analysis of actual production systems in developing Countries. Sometimes it is sufficient just to find them and to make them known. It may also be possible to improve them. Old books and the adaptation of old technologies developed by missionaries or farmers who have been settled in developing Countries for a long time, can offer some useful ideas to model. This and other options have been discussed in Chapters 5 to 5.5. The examples reported show that something simple and relatively efficient can nearly always be produced. The best attitude to problem solving is to firmly establish that materials to build structures and equipment must be appropriate to the location , available and freely obtained and priced according to the economic means of the villagers. They should be also easy to use. The matter has been considered in Chapter 3.1. Looking around in the village markets and seeking for local technologies, valuable ideas about what can be done always emerge , particularly if the search has been long and thorough. Many good examples of simple technologies have been described in Chapters from 7.1. to 7.3., in relation to different small backyard species. In figures 10.1. and 10.2. two more examples of equipment being built for initial testing are shown.

Fig. 10.1. Cement is moulded into different shapes

to form the first prototypes for practical raising purposes*. The system devised for a no cost improvement of environmental conditions for rabbits is illustrated in figures 5.5.2. and 7.2.1.14.

Fig. 10.2. First trials to insert pieces of bamboo in a structural frame to build nail-less cages. Other traits are shown in figure 7.2.1.9. Figure 10.3. illustrates how to make a new prototype drinker for guinea pigs. No figures or descriptions are used for teaching, but technicians learn directly by doing. A different prototype, moulded specifically to form a siphon drinker for poultry, is shown in figure 5.5.6.

Fig. 10.3. Learning how to make no cost

handcrafted clay drinkers for guinea pigs. The scheme is illustrated in figure 7.2.1.21.

In the same way that it is necessary to resist using imported equipment, it is also necessary to remember that management must avoid intensification. To buy balanced feeds or to utilise concentrates is only possible in very favourable conditions and anyhow, people tend to stop using them as soon as the projects are over. The reason for this has been discussed many times. The consequence is that, when animals do not receive any nutritional integration, or it is very limited, they cannot sustain production. In such conditions, the rabbit reproduction cycle must be extended. Mating must be delayed after weaning to give the does time to recover lost energy. In summertime, when feed intake is reduced by heat stress, preventing mating is considered a good local management decision . The technical means to overcome the problem are described in Chapter 7.2.1. (Rabbits). As another example, when a few scavenging birds are kept, a small coop to protect them during the night can be prepared with any waste material, generally wood or old tin boxes. But to plant a tree in the backyard that offers shade and possibly also fruits and leaves to feed the animals is good management. It provides welcome perches for birds and if thefts are common, it is much more difficult for unrestricted animals to be stolen. Anyhow, the more that technologies and management are kept away from tradition, the more likely it is that a system is created where some simple innovation has a chance to be sustained and accepted. And low production at no cost is always better than high production with a negative economic balance.

11. External feeding resources

Before organising animal production in the backyard, it is important to study how their nutrition might be supplemented from the surrounding area. If the animals must rely only on scavenging and limited kitchen wastes, output may be restricted. But in the surroundings of villages or isolated dwellings it is always possible to find and collect some nutritional resources. The area may be cultivated or wild and normally extends for only for a few kilometres making it possible to access very quickly on foot.. Grass, leaves and seeds can be collected or by-products of cultivation can become available. Any experienced adviser or technician knows that it is possible to find edible plants that, by tradition, have not been used to feed existing or introduced animal species. Sometimes only systematic searching of the surrounding area can find a useful vegetal species (Fig. 11.1.).

Fig. 11.1. All these grasses and leaves are eaten by rabbits but none are utilised in this Central African area.

In looking for a protein source to feed poultry in the Horn of Africa, a lot of seeds of the many leguminous trees were tested. Poultry refused to eat these seeds and starved, even if a mash containing the same milled seeds was offered. No way was found to eliminate the toxic

component and make the seeds palatable. When hope success was nearly lost, a naturally occurring bush was found, the leaves of which were very appetising to poultry. The bush (Cordyla somaliensis) is a very interesting plant, growing naturally in dry sandy soils (figure 11.2.). When the leaves are collected and planted, they grow again and the resulting bush provides an excellent protein rich nutritional resource. Study of the composition and output of Cordyla somaliensis (which is known to grow in a limited area) should allow it to be widely used and cultivated, particularly on dry sandy soils.

Fig. 11.2. Cordyla somaliensis, a naturally occurring bush, the abundant leaves of which, are willingly eaten by poultry.

When trees are planted, the chances of them providing feedstuffs are frequently not considered properly. This is because the work is normally organised by forestry technicians. They think mostly in terms of trees best adapted to the local soil and climatic conditions for timber production, rather than in terms of "dual purpose" wood and forage species. But avoiding this analysis is not correct, because when the overall economics are considered , carobs, oaks, mulberries or other trees giving fruits and/or leaves can be more useful than such commonly planted trees as eucalyptus or conifers. Also feeds of animal origin can be found, such as

termites (figure 11.3.), or species like earthworms can be specifically produced as a source of food.

Fig. 11.3. Termite eggs are a rich protein source that can easily be provided or even produced to feed poultry.

Before starting with a project, all the nutritional resources of the area must be identified. The quantity that can be exploited by any single animal species should be determined and a possible balance to optimise the utilisation of the biomass should be studied. The custom of collecting freely available grass on the way

back from the field, to feed small ruminants or rabbits in the backyard (figure 11.4.) is still common, even in developed Countries. This is a typical, traditional and correct way to exploit external resources. There is no doubt that it is sustainable because the available biomasses are frequently observed to be exceeding the needs of the animals raised. This means that a larger number of animals could be raised if vegetal resources were properly exploited, particularly if a reserve is prepared to provide for the period when vegetation is scarce.

Fig. 11.4. Try to analyse the system in the figure before you click on the picture to read the legend.

To exploit vegetal resources properly it is necessary to calculate their seasonal output, because the maximum number of animals that can be kept is defined by the minimum level of feedstuffs available in any given period of the year. Only after developing accepted feedstuff conservation technologies (hay, silage, dried mills) for a reasonable period is it possible to propose a more advanced feeding strategy to increase animal production.

Maximising it, according to nutritional resources, is certainly a correct goal. In this case the focus is on the animals and it cannot be otherwise, when backyards are involved. The inverse of the problem is

seldom considered. But, as a matter of fact, it is possible to take into account that a country has a natural or cultivated vegetal production and that its exploitation can be maximised . In this case the focus is on available biomasses. When the interest is on the animals, only the "part" of the vegetal production which "can" be utilised is considered, but when the point of view is inverted, the interest is on the "totality" of the vegetal production, which "must" be utilised by means of the animal production. This is obviously a better target, and it should be properly advised when promoting development. Backyard management is an important element of a general strategy of exploitation of national or local vegetal resources. This should be always considered at any time that a settlement needs to be created in a particular area. . When a large desert area of a North African Country was made fertile by means of a vast irrigation system, many families were settled to exploit the newly available vegetal production. Many harvests of alfalfa were obtained per year due to the fertility of soils, irrigation and favourable climatic conditions. The government project correctly included small animal production in the backyards to support the welfare of the families. A few rabbits and Muscovy ducks, able to feed on alfalfa, were successfully given to each family to support its settlement (Finzi, 1987). The above mentioned is a good example of considering the utilisation of the total vegetal production as the main goal of a project, and the small animal backyard keeping as an important element of it and as a necessary guarantee of success.

11.1. Feeding integration problems

When the seasonal output of each single vegetal species has been roughly determined, the aim is to integrate them in such a way that the mean composition of the administered aliments is as close as possible to the nutritional needs of the animal species. The nutritional value of many feedstuffs and the needs of different animal species is now well known. But this is not enough to give an answer to the problem. In fact many specific conditions must be considered. In rural areas most feedstuffs are administered fresh. Composition of the fresh forage changes continuously. It is possible to dry it, but conservation is difficult and there are no means to mill it. Many plants can be freely collected but the amount is small, composition is not known and sometimes, for traditional reasons, they are not fed to the animals. When an inventory of local nutritional resources is prepared and the vegetation period is determined, that is to say the seasonally available output, a classification according to the most important nutritional traits should be prepared. It is necessary to know if they are rich, moderate or poor in protein, energy and fibre. Their palatability and the presence of toxic components should also be known. Generally grasses are fed to the animals without specific criteria and a single vegetal species can be administered during all of its growing period. In these conditions the diet cannot be balanced. It can be easily understood why a very simple classification, as the one mentioned above, can be very useful in permitting a kind of integration that, though rough, can improve the balance among the nutritional components. For instance, a feedstuff rich in fibre can be administered freely to rabbits but in a lesser amount to poultry. A feedstuff providing energy can be integrated

with a certain amount of another that provides protein. When searching through old books, it is easy to find a list of plants that are palatable to different animal species.

But no information can be found with reference to their chemical composition or the best way to mix them to obtain a better-balanced combination. In modern books, on the contrary, a lot of useful information is offered for each possible ingredient, but everything is oriented towards producing perfectly balanced industrial mashes. But they utilise components that are not customarily available at field level in developing Countries. Needs of milling, mixing, conservation, storage and in some cases, marketing must also be considered. These are major constraints when operating at family level.

As a matter of fact, the historical gap between the rural and the industrial systems of animal keeping makes sense at the level of nutritional problems. While old technologies can still be utilised, the information available in the old books is not sufficient for the purpose of a better utilisation of local feedstuffs. The only positive aspect of the old books is that they frequently have beautiful drawings illustrating the different plants which can be fed to the animals. These illustrations are very useful because they avoid the complex problem of translating names. Projects have been found that simply planned to supply, or even to import, the nourishment to start rural breeding. These projects were not based on a sound analysis of the systems. As soon as the project was over, rural people ceased buying the mash to feed their animals. A case was observed in which maize,

provided to feed poultry, was used, during the project, to satisfy the more urgent needs of the family. But there is a specific requirement and a realistic chance that improving feeding is possible without external inputs. An experienced technician should be able to prepare an inventory of available nutritional resources in a particular area. Then he should plan how to obtain some extra input, if necessary, as described in Chapters 6 (Differentiation and integration) and 9 (Small species and horticulture). For instance, by-products of horticulture to feed rabbits, or insects and worms to be scavenged on faeces as a protein source for poultry. Then the technician should be able to suggest how many animals of each species can be reared. Periods in which available feed is insufficient have to be well considered and appropriate strategies must be developed. Feed conservation and reducing the number of the animals or, at least, stopping or delaying reproduction are the main factors to consider in this respect.

11.2. Feeding and simple technologies

When different animal species are being raised, the best use of each feedstuff should be considered. Since it is rather easy to provide poultry with insects, worms and sometimes with termite larvae, vegetal production rich in protein should be reserved for mammals. The problem has been studied with respect to alfalfa and the utilisation of hay has been considered. This legume, if fed fresh, allows rabbit production, without integration of other feeds. Unfortunately it gives a lot of problems when fed as hay. In fact, as soon as it is dried, the leaflets detach very easily from the stems and 73% of them are

lost during the different phases of collecting, storing, feeding and utilisation by rabbits (Finzi, 1999). As a proportion of the total crop (including stems), the loss represents 50% of the total weight of the hay, but the stems are scarcely utilised. When alfalfa hay has to be fed to rabbits in a dry period, it is important to avoid this enormous loss of the most digestible and protein-rich part of the hay . The strategy has thus developed of beating the hay and collecting the leaflets separately from the stems. The latter can be used to feed ruminants, while the leaflets can be directly administered in a feeder, or included in mixed feed in the form of molasses blocks or crumbles (figure 11.2.1.).

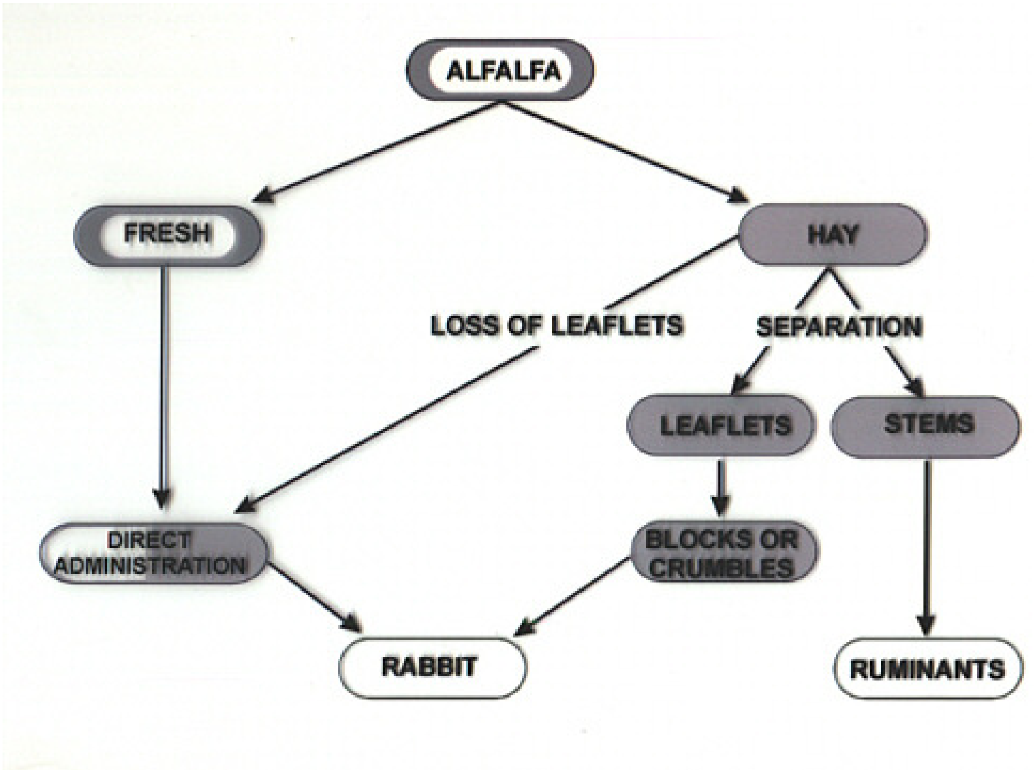

Fig. 11.2.1. Scheme of possible utilisation of alfalfa leaflets to avoid wasting.

Rabbits cannot eat balanced feed in the form of mash, which is physically transformed into pellets in the industrial systems. This is not possible in rural areas. Preparing molasses blocks or crumbles at local level seems to be the only way of producing a balanced feed for rabbits when mills, mixers and pelletizers are not available (figure 11.2.2.). Some solutions are possible, but many problems remain because molasses contains an excessive amount of fermentable carbohydrates (45-50% to form blocks) and alfalfa hay and other ingredients need to be milled to avoid the blocks breaking.

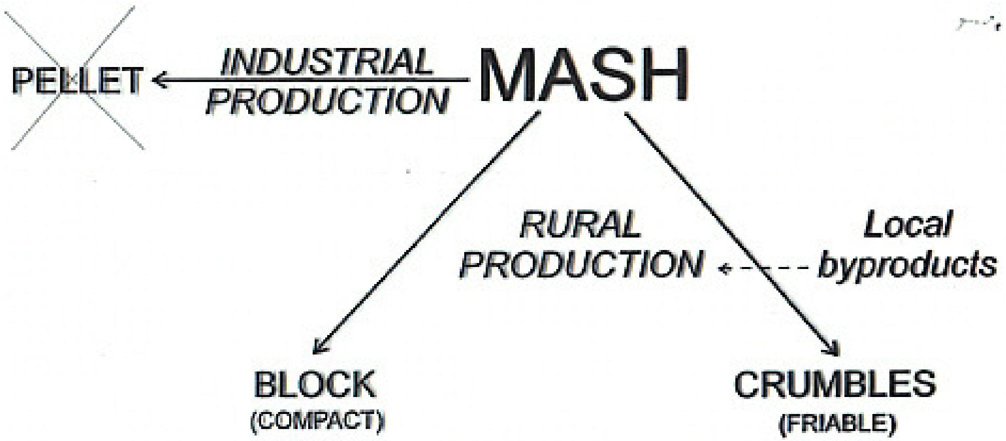

Fig. 11.2.2. When industrial production of pelleted feed is not possible, a solution at rural level is still feasible.

Blocks have many positive traits. It is not necessary to

prepare them in moulds as commonly advised, but blocks are easily formed by wrapping up any available quantity of the molasses mass in a piece of paper. In this way molasses sticks to the paper which stops it running out. Paper becomes an edible cellulose component of the block itself. After drying in the air, which is favoured by a cylindrical shape, blocks are easily stored and transported, if necessary. They do not produce powder and nothing is lost, even when nibbled by rabbits until they are quite small (figure 5.4.4.). In fact the residues can be recovered before they fall under the wooden cage and can be included in a new block. Another advantage is that no feeder is necessary. Blocks appear suitable only if fresh forages are also fed to rabbits. In this case they eat enough roughage and less block, so that the overall amount of molasses ingested is tolerable. Satisfactory growth performances up to 31 g/d can be obtained (Velasco et al., 1994; Finzi and Amici, 1996). But if hay is administered, too many of the more palatable blocks are consumed, and diarrhoea is induced. In case no fresh grasses are available for a long period, it is possible to produce crumbles, which contain only 10-14% of molasses. Crumbles, which differ from blocks, can also be formulated as complete feed and, as shown in figure 11.2.3., efficiency can sensibly be improved compared with feeding alfalfa alone (Finzi et al., 1997). A daily growth of 30 g/d can be obtained. Crumbles, as blocks, do not produce powder, thanks to the sticky molasses component, but they are not homogeneous and they need a feeder. Moreover preparation is more complicated though not difficult. The mass must be wetted until it forms a paste and is then flattened to a thickness of 2-4 cm; after air drying , it can

be crumbled.

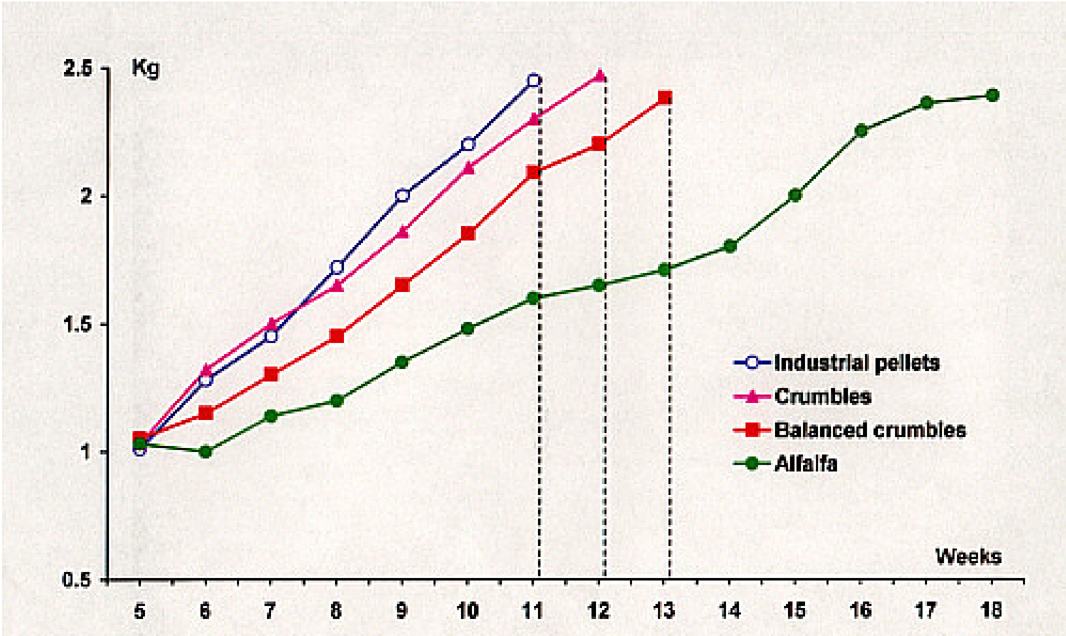

Fig. 11.2.3. Crumbles, when fed together with fresh alfalfa, permit a very satisfactory growth rate in rabbits. Including dried alfalfa leaflets to obtain a balanced feed when no fresh forage is available, provides results commensurate with industrial pellets.

Molasses blocks and crumbles are well suited to compact mashes containing non-milled components such as broken rice or bran or dried alfalfa leaflets. The technology is easy enough and the advantages numerous, so it should be applied whenever possible in the rural medium.

12. Promoting the interest

All the appropriate knowledge that has been developed with reference to species or breeds, housing, technologies, feeding and management becomes valuable only when it is practically applied. Best conditions are certainly realised when the analysis of the systems shows that people are interested and there is potential to rationalise the raising systems. Interventions should aim to reduce losses on the one hand and to increase output on the other, and also to better exploit the local work and feeding resources without any monetary input. But it may happen that technicians, according to previous knowledge or experiences, are able to identify a situation where some activity, though locally new, may profitably be introduced. In this case people must be already be convinced. The importance of ascertaining beforehand the level of acceptance is discussed in Chapter 18 (Analysis, know-how and projects).

When people are not convinced (it is a common cultural effect to refuse what is not known) they may co-operate when some incentive is offered, but immediately go back to the traditional management once the inducement has been removed. The reasons can be many. Factors which were supposed to be present, in reality are lacking or are not working in the right direction. Competition among species can emerge. The new system may require more work or some input which people think should be used in another way, or important socio-cultural aspects

may have been underestimated. Maybe the person involved is firmly convinced that the new system is not working.

> ***In a European country, in two different situations (one case with scarcely literate people, the second with a well informed and clever society) it was observed that people were unsuccessful when using electric fences for sheep. They were so convinced in advance that the fences wouldn't work that they succeeded in making sure they didn't.***

Breeders of a local strain on a Mediterranean island offer another example.

> ***People are convinced that cows don't release milk if not stimulated by the presence of their own calf which is left to suckle one quarter of the udder. When a calf dies at birth, they cover another calf with the skin of the dead one and bring it to the cow while the animal is milked. But it was later shown experimentally that better cows release just as much milk in absence of a calf, while poorer***

ones release a little less milk but only a few cows reduce their milk yield significantly.

This anecdote is interesting because it shows a case in which breeders deceive themselves through the adopted technology. In fact, if the cow reduces its yield, they think they have not deceived the animal, but if the cow releases the milk, as commonly happens, they think they have succeeded in misleading it. However, it is likely that it would have done the same without the presence of the disguised calf. Anyhow the belief, though wrong, is reinforced. The strength of the mistaken belief is such that local breeders refuse to separate calves to feed them artificially. Nevertheless this is the only way to select cows for high milk production and to introduce artificial feeding of calves.

In this way mistaken beliefs and tradition obstruct progress. Action should be taken to overcome these negative factors before any other improvement is suggested. In fact, when something completely new in relation to tradition is proposed, it is sometimes very difficult to persuade people to co-operate and failure is almost certain, no matter how good the project.

In any case, promotion of new ideas can be tried and innovation prudently tested. Three main possibilities can be envisaged: a new species is introduced, existing rearing is intensified, and an integrated system is created through differentiation.

Fig.12.1. shows how well the person promoting the new idea has put the stress on engaging the interest of the person to be convinced. In case A, to enhance rabbit keeping, the figure illustrates how the idea that there will be meat to eat must be developed. In case B, where the meat needs of the family are already being met by their existing animals, the figure shows how the satisfied lady demonstrates to her astonished husband that, in monetary terms, her intensified unit of laying hens is able to produce the same income as his dairy herd.

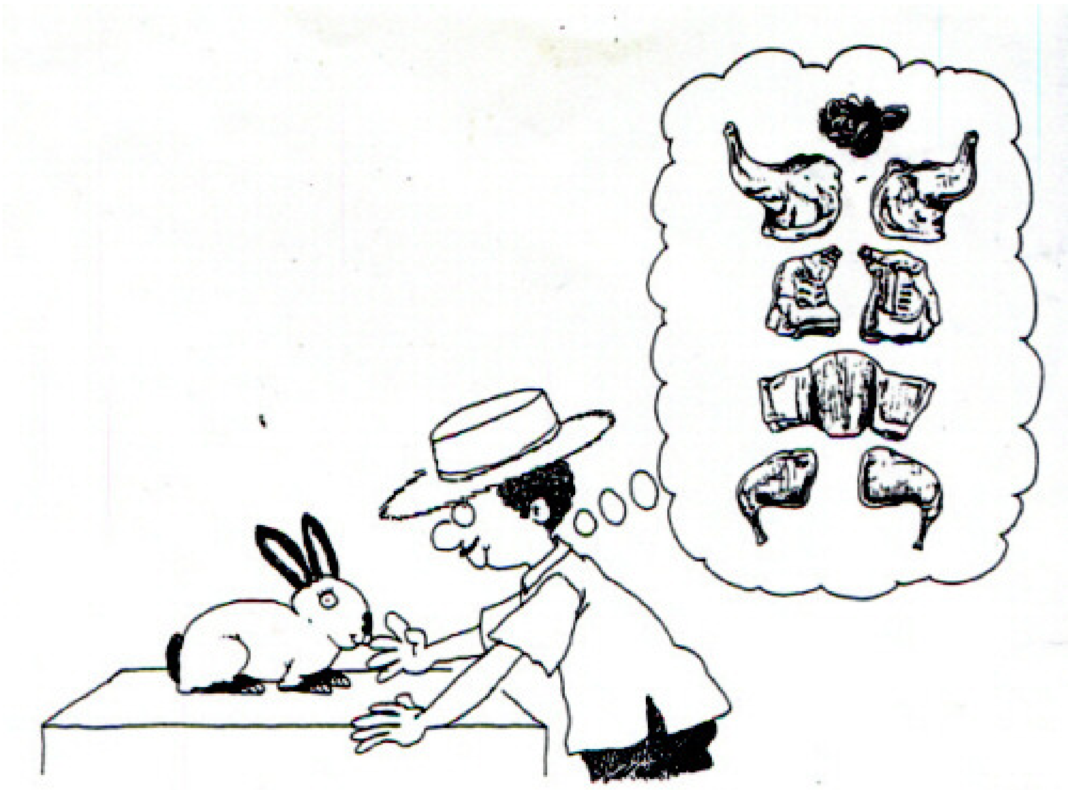

Fig. 12.1. Good example of correct promotion. In case A, the target is promoting production for

self-consumption; in case B the accent is on income (Sirri, 1978).

An excellent example of how promotion should be done is a 162-image filmstrip with a commentary, produced by the Ghanaian Institute for Field Communications and Agricultural Training (IFCAT-URADEP, no date).

The story is told of a villager who is unable to provide meat for his children. A cousin is coming to pay a visit. Both persons are indicated by name and the action has the background of a real African village. This gives to the narration a strong anecdotal aspect with a good realistic effect. The listener has to think that no theoretical aspect is involved. It is reality. The cousin has no problems because he is raising rabbits and he produces enough to eat and sell. The villager is then introduced to a government extension worker. He is taught to build no-cost cages and trained in management. He begins to raise his own rabbits in the backyard, but he makes mistakes in building the hut, in hygienic care and feeding the animals. Little by little the villager improves his knowledge

and, in the end, he is successful.

The tale is very realistic, cultural aspects are involved since the man, who was unable to provide for his children, thinks the spirits forgave him. Only no-cost technologies are suggested, among them an interesting wooden cage with a triangular base (figure 5.4.2.). It is very simple and easy to build and could also be useful to protect chickens during the night. Only a grass-based diet is proposed to make sure the system is sustainable at the level of no financial inputs. The filmstrip is aiming only at a small improvement of the backyard yield and if the technical support at field level is good, real progress is possible even though the breeding of the species is not traditional in the area.

13. The technician or the economist

It is frequently accepted that the analysis of systems is a matter for economists. This is true when macroeconomics are involved. In this case, through an examination of documented data, it is possible to judge the economic impact or productive evolution of the animal raising industry. For instance, if there is an interest in investigating poultry, valuable information can be inferred from the registrations of slaughter houses (payments for number slaughtered), or feed factories (tons of commercial mash), or number of eggs produced by farms with laying hens (commercial invoices of sold trays). A compared cross-reference with the estimated values can check results later. At this level the economists are are quite capable of interpreting the registered data. But when the focus of the research is directed to the smallest microeconomic outputs, the economists find it difficult to understand the logic of the backyard production system.

In national statistics, backyard production is hardly considered. When an official census is performed, small units are mostly omitted, even in developed Countries. Interviewees normally deny having backyard animals and to check them directly takes too much time. To know the situation in a specific area the opinion of the bureaucrats of the central technical offices, and sometimes of the breeders, is asked, and then these opinions are reported as valuable estimations. Field technicians often ask for these estimations, but their experience suggests that the data supplied mostly look very improbable. When at all possible, figures are customarily but sensibly overestimated (keepers want to show they are good breeders). But when the owner is afraid the information will be used to fix a taxation by the Government, the tendency is to lie and even keeping animals is denied (keepers tend to say their animals have a very low production). Sometimes data are biased, simply because they are taken from old official records that continue to be reported unmodified. Records may also refer to very changed situations and in these cases production is underestimated compared with the reality of the improved situation. Some anecdotes can illustrate these problems, which are of only of importance when conditions of peculiar, local animal production systems are analysed. An example of underestimation for historical reasons comes from a Mediterranean island.

In the framework of a project of defence and evaluation of genetic resources, local cattle were considered. Growth rate of calves, indicated by technicians of the Agricultural Regional Service as 250 g per day, was at first registered as true. Later this datum was compared with the daily growth rate of Charolais crosses, which was indicated by the same technicians as 1000 g per day, and it was supposed that at least one of the data was wrong. After an experimental control in the field, it was found that when forages were integrated with concentrates, as is customary for crosses, both groups had the same daily growth of about one kilo per day. The remaining differences were only for the percent of carcasses and first choice meat cuts. The oddity of the first wrong data (only � of real growth) referred to local cattle, and which depended upon a poor datum that was established and recorded in the first decades of the century.

It was a mean that also took into account the long dry summer period, when the animals at pasture could even lose weight. The capability of producing in such conditions had to be evaluated as a positive genetic trait for fitness instead of a negative low production trait.

Frequently, when breeders are asked about their own animals, prudence suggests that they say production is not good suggesting that there have been many problems. Maybe it is true, maybe not. But it also happens that reasons for wrong information are completely unexpected.

In a mid-mountain area of a European country, a study was commissioned to determine the actual situation of the once flourishing sheep breeding industry. An interviewed shepherd was giving information that seemed strange to the production experts. So they amiably began to discuss the information in order to check it. The shepherd was then able to recognise the competence of the technicians, discovering that they belonged to the respected profession of veterinarians. The shepherd then began to present different information whose truth could be checked by cross-questioning. Asked about the reason for giving the wrong information to begin with, he explained that he was testing the knowledge of the interviewers because a few days earlier, a person from the

> ***Economics Institute had come for the same reason. The shepherd recounted, laughing, that perceiving the economist had not the least idea of how the sheep industry worked, he began to tell him the craziest things and he was very amused to see all the information written down as if it was valuable and true.***

This example shows the importance of choosing technicians specifically competent in the system to be analysed, particularly when the interest is in individual problems or to analyse structures, management, yield and marketing of small specific production units.

When inquiring about production of backyard species, the performances indicated by owners are frequently overestimated. This happens mainly when the technician is able establish a friendly relationship and the animal keeper is proud to show he is an informed and good breeder. Sometimes such overestimation is extremely high.

> ***Asking about reproductive traits of rabbits raised in a small North African backyard, the answer was about a hundred per doe per year. Surprised at such an unbelievable figure an explanation was***

invited. The explanation was that the figure came from the fact that a doe can produce ten kittens per litter and can have ten litters in one year. "In this case you are the best producer in the world" we said. "Well, maybe not a hundred, but eighty is quite sure" was the answer. "Still you remain the best producer in the world" the conversation continued. The number went down to the still impossible figure of sixty. It was obvious that any figure could be obtained in that way, but also going down to possible figures, there were no way to know which of them could be considered truthful. The problem was solved later, talking with the housekeeper and asking her when the family had last eaten (or sold) rabbits and how many. The same question was asked of the preceding periods and from the indicated number of rabbits and the does present, it was possible to get an idea of the real output. This was a few head per doe per year, which was in line with similar keepings , considering the environment

and the means of production .

In subsistence systems it is normal to find that productions levels are very low, but they are obtained at no cost. It is sad to note that on many occasions, family members cannot remember when they last ate a product of their own backyard small animal keeping. Production levels considered completely insufficient in any industrialised Country can be reached in a developing Country, and even these only when conditions are favourable. One must be prudent before accepting any kind of figures. The expert interviewer, who is knowledgeable about the real production level of any species in a particular area, should be able to distinguish immediately whether the information that is being given is accurate and truthful. Anyhow, prudence should compare the information with the result of a rough calculation, starting from the number of young animals present (mammals or birds) according to species and season. Confirmation may be possible by asking about the numbers consumed or sold.

The latter is the only chance that might be available, and if correctly performed and repeated, to reduce the risk of tremendous mistakes being made by technicians lacking experience, or economists who imprudently dare to enter the field of specialised experts. Data obtained by simple interview or worse still, by office bureaucrats, should always be discarded as unreliable. Also simple research to ascertain the presence of some species as a component of village production systems can result in completely wrong information. In Chapter 16

(Language), there was a case in which a rigorous investigation was in danger of missing the common presence of guinea pigs in West African villages. Only when the investigators became aware of the local name of the species, did they realise that all the information they had obtained so far was completely wrong.

> ***The head of the small animal section of an important international Organisation stated, when asked, that he was quite sure guinea pigs were not raised in the West African village where his office was located. But, with the help of the local name, thirteen mainly very small units were later identified within two hours, and some of them were visited. One unit was located no more then two hundred metres from the office where the wrong information was obtained.***

The inclination to give a negative answer is very common and should never be accepted as true without checking. These answers are always given with great assurance and sometimes it is difficult not to believe them, when there is no special reason to think they are not true. In an African tropical island a group of villagers was asked about the presence of rabbit keepers. One man answered immediately that rabbits were not raised in that place. When he was questioned if he was sure, he

answered that he was absolutely sure since he lived in that village. When the men left, another villager said that he knew of a small keeping and surprisingly the rabbits were raised in the dwelling right next to them.

In another opportunity, a random test was performed to ascertain the presence of small animals in the backyard of a North African village. The accompanying technician had to put the question in the local language. The first answer was negative, but through a slightly open gate, the expert was able to recognise a typical structure and the technician was asked to put the question again. The answer was still negative. Then the technician was asked to inquire about the structure they could see, to which the answer was that it was used to raise rabbits. The owner explained later he thought he was being asked about animals to be sold but he did not want to sell rabbits. This is another case showing why only expert and well-trained persons must do interviews. The conclusion is that the system analyst should always control the information received but not it's acquisition, which, without knowledge nor experience, will be accepted as good regardless of its quality. Some very different examples of this nature have been reported in Chapter 2.1. (Dynamics of small animal systems). Whatever analysis techniques are used, nothing can be done without common sense.

In an Andean country, where a very efficient milk industry had developed, surpluses (powdered milk) had been produced for over a decade and milk

prices were consequently decreasing towards uneconomic production. Nevertheless a consultant concluded that milk cattle husbandry should be developed. It was a surprise to learn of the real situation, which showed that the system had not been analysed properly. But the lack of common sense was later evident when discussion about a rejected project on guinea pigs, in the frame of a food security programme in the same country, revealed that local people prefer having cows rather than guinea pigs. This is of course true everywhere in the world, but common sense should take into account the marketing perspectives and, above all, whether the people involved have the means (fields of forage) to raise cows. Projects should not be carried out for rich farmers but to help landless people who are happy to get the chance to raise a few no-cost guinea pigs, feeding them with grass or leaves freely gathered from the surroundings. Raising guinea pigs to nourish the family and, when the opportunity arises, to sell them

in the market, is certainly better than producing milk uneconomically. Anyhow, although poor people have little chance of going into milk production, a meaningless answer is easily obtained if people are asked if they prefer raising cows rather than guinea pigs, that is simply a nonsensical question.

Project makers must be convinced that getting reliable data from the outset is essential. Dismissing this problem and avoiding the help of competent field technicians, means that unrealistic projects will be planned, which before long, will come up against hard reality. In Chapter 7.2.2. (Guinea pigs) there was an example about a man who lost all his wealth, setting up a guinea pig farm, because he did not analyse the production and market conditions beforehand. Unfortunately technicians really competent in simple rural backyard systems are very rare. It is common to observe surprise amongst technicians when they are led into the field or enter into backyards. They can discover a reality completely different from the one they supposed to exist. If there is a true will to develop successful food security programmes at the level of poor rural families, field analysts should be properly prepared, training them not by lessons but analysis in the field. And they must be technicians expert in small animal keeping to recognise immediately wrong data and doubtful work hypotheses. If the job is difficult for very specialised technicians, obviously it is no matter for

untrained people, particularly if they intend to make or supervise projects. Candidates who wish to become consultants, advisers and field technicians should always be examined in advance. Asking the candidate to describe how they think they should behave with respect to the terms of reference should be sufficient to verify if they are too closely tied to scholarly knowledge (too doggedly moulded to the demands of high technology-based production) or have sufficiently flexibility conceive practical solutions. They should know that a system analysis is always necessary beforehand, and that account should be taken of the needs and the low-income economics of people in the villages in poorly developed areas. The candidate is expected to propose interventions based on simple technologies or, at least, they should be able to understand that it is difficult to develop sustainable systems by simply importing equipment and introducing exotic breeds. Examples and figures in this manual have been chosen to be useful to train the selected candidates.

13.1. Information about the background

Backyards in a village, or in similar villages of an homogeneous area, constitute a system which is not isolated but is located inside the hyper-system. This system is formed by all local factors which can influence the familial keeping of small animals. As discussed in Chapter 2 (The systems), these factors are very different in nature. Some of them are obvious, but others can be less evident and even unknown to the analyst. In the preliminary work the technician must identify as many of the factors as possible and their positive or

negative influence. The elements can be technical as well as biological, social, economic, cultural or natural, and forgetting to look at the their positive and negative aspects can greatly influence the final result.

But exploring actual conditions to develop projects with compatible factors is not enough. The background must also be analysed because current fashions may also interfere with the work. It is necessary to see whether the system is governed only by tradition and is substantially static or if something new is developing that may interfere with the project. A strong tradition makes it difficult to introduce innovation, but if something is undergoing a spontaneous evolution, factors on which it is based must be analysed. A technological innovation, though simple, can create interest in both the backyard as well as the wider world . And where there is interest there will also be an investment in work, time and resources. Favourable or adverse conditions can be created , so the new perspectives must become factors to be considered in the preliminary phase of projects.

The socio-economic background is the second point to be examined. It is easy to observe that small animal production is more common and better organised in the backyard of a more educated person. They also have a certain wealth and, probably as a consequence, also a higher social rank. More often than not, it is these people who invite consultants to visit . This means that they make most use of the co-operative help available and as a result increase their chances of success. But, from another point of view, this can be considered as an

interference which impairs the possibility of directing help to those most in need of food security . In order for the project to be accepted and the indigent villagers to be given the help they deserve, a tribute may have to be paid to the local authorities. Improving the efficiency of backyards within villages can also give confidence and show that projects can be successful. But taking the easy option of co-operating with the wealthiest should not become the rule. In fact, simple, sustainable and no-cost systems have been developed mainly to help those people who have little food, and for them to reach, or at least to approach, a minimum level of food security.

The background of technical competence is also very important. There are always villagers who are keen on breeding some animal species. To find these people is not easy but identifying them during the system analysis must be recommended. They are more interested in learning and are the most capable of teaching others through the example offered by their own activity. They can easily become "endogenous technicians" capable of sustaining the field work of projects. The analysis of the political background should show that a project for food security is at least accepted, if not supported. If the interest is only to develop industrial systems, conditions are not favourable. Some Governments have supported small animal keeping by families and lasting results have been obtained. This is a very positive situation, but it must remembered that help offered through Governments tends to be expensive. Demonstrative centres are set up and a lot of people have to be paid so that only a very small percent of the funds is actually used to improve animal keeping in the villages. The cost

of the entire project should be always related to the cost of each new animal raised, or to the increase in productivity of each backyard system. Using "endogenous technicians" to expand co-operative programmes, is the cheapest and most efficient way of maintaining a long-lasting action at village level.

During a consultancy related to rabbits on State farms in an equatorial Country in West Africa, it was found that an industrial model had been used. The feed had to be imported so that the system was not economically sustainable right from the beginning . Production was low and two factors were involved. The first was that women who had to take care of the animals had no specific competence. Some of them were coming from a poultry unit and were not even able to sex rabbits. The second was the need to go back to the use of vegetal biomasses. This was economical and correct but small metal cages were not appropriate. Roughage was introduced into the cages, and was spoiled by trampling, faeces and urine. An integrated mash, offered in a bowl, was also immediately lost under the cages.

Though in a wet equatorial Country where no cost vegetation is very abundant its collection to feed some thousand does was not simple. Workers were needed for the

job and lorries for transport. The outcome was an unbelievable complication created by adapting simple rural technologies into an industrial system. When people were interviewed, some of them were found to have a good level of competence in raising rabbits while others knew almost nothing. The ones having competence were very poor, lived in the rural area but did not even have enough money to buy nails to build cages (nails were sold on the black market because the economy had collapsed). The ones without competence had some wealth, sometimes raised rabbits and lived in the urban area.

It was then discovered that the difference had a demographic origin. People having competence were immigrants who had been brought in to work on farms and had learnt from the European colonisers. After decolonization, farmscwere badly run and deteriorated, and the immigrants became very poor. To help them, a prototype bamboo cage, assembled without nails, was designed and built* (figures 7.2.1.9. and 13.1.1.), but it was later discovered that people were not allowed to collect bamboo because it had become State property. Once ascertained that the rabbit keeping system adopted by the colonisers was efficient and sustainable,

the formulation of advice was very simple. It was only necessary to recover the tradition and put the enthusiastic immigrant population onto the job.

Fig. 13.1.1. A bamboo cage built without nails to take account of the problems emerging from an analysis of the background.

As can be seen, when the background was examined, important factors emerged. They were reciprocally interrelated in a very complex web, involving history, demography, sociology, policy, economy, technology and competence. It was necessary to analyse all these points just to understand the true nature of the problem.

It can easily be understood how the work of the consultant had to transcend his specific technical knowledge. To restore the efficiency of the rabbit production system, certainly it was not enough to discuss just breeds and feeding as originally requested in the terms of reference.

14. Analysis of the small systems

The examples considered in the previous Chapters show clearly that it is a vain hope to obtain valuable information simply through co-operative interviews. When questions are posed, it is necessary to continuously check the observed reality to judge the reliability of answers. Many other examples, reported in Chapter 13 (The technician or the economist) and elsewhere, bring us to the same conclusion.

The fact that analysing a system is difficult, even when it is only a matter of a simple backyard, should not discourage its accomplishment. Reported examples have also shown that the analysis, when it identifies bottlenecks, frequently indicates an appropriate solution. And the solution, or at least the possible improvement, may be very different from the proposal of intervention developed in advance. Many of the examples reported in Chapters from 7 to 11 show how many original solutions can be suggested by a correct analysis. Another question is where to perform the analysis.

Generally local technicians have a clear idea of the places where projects should be developed and of the persons who should be involved. This prior decision has a distorting effect. When an expert is called upon to supervise they will often find that peri-urban areas have been preferred and also when the action is developed in rural areas, persons with higher intelligence, social rank and cultural background have mostly been chosen. But interviewing these people cannot give an exact idea of local problems and of how to proceed in trying to improve food security. They are a selected part of the social community. Their economic conditions and their needs are different. To solve their problem is generally easier, but the goal to which this manual is devoted, on behalf of the poorest people in the villages, has a far reaching effect. Sometimes the need to identify homogeneous areas is suggested as a basic procedure before starting to define their characteristic. The aim is to prepare better-oriented projects.

It is hard to make technicians understand that what is "homogeneous" should be defined after the analysis and not before. Practice shows that what was considered homogeneous has, in reality many facets and all of them have to be properly considered. It should be clear from the beginning that only a random survey can identify the individual peculiarities of the system or systems we want to analyse. The best procedure is to consider a random sample of the villages of the area. In each village it should be decided in advance which doors the surveyor will go to (for example: third door on the left). Then the interviews will be performed taking into account the rules specified in Chapter 15 (Rules of conduct) that

ensure the best conditions for collaboration.

In practice, it is sometimes difficult to avoid being persuaded to visit the exceptions. However, the keen expert must use these opportunities to understand how local technicians work, what their goals are and the level of success and sustainability they are able to achieve. Existing projects and the thinking and performance of technicians as they do their job are a dynamic part of the system. An external examination of these aspects is needed to consider whether the prospects for the action are positive. Previous failures or successes in the area where the technicians have operated in the past, are generally good indicators of what can or cannot be done. In simple terms, when a system is examined, all aspects of previous projects must be taken into account. If not, the same mistakes may be made again.

15. Rules of conduct

Dealing with smallholders is not the same as getting information or planning projects with large economic entities . To enter into a village, to approach a house or to get access to a backyard must be done in such a way as to give minimum disturbance and to promote the maximum degree of acceptance. This is the most important phase in achieving a profitable analysis and to get reliable know-how and to develop sound projects. It

is most important right from the outset to establish a good relationship with the people involved and to learn at least the most common words of courtesy and greeting.

A good field technician learns immediately how to say the equivalent of "hello", "may I come in?", "good morning", "how are you?", "good bye", "please" and "thank you". With these expressions good relationships will be maintained, all doors will be willingly opened and there will be the best chance of making a success out of the project . If further expressions, such as "what is your name?" or "what a beautiful child" or similar are learnt, there is a greater chance of success. This is also gratifying for the technician, who will be pleased when people say that they have had many foreign visitors who have shown no interest in their language, but he is the first one that, after so few days, has learnt to speak it so well. Of course you have not learnt to say much and certainly not well, but the social result is the same.

A great success with a little effort. Not to do this before or when beginning a field survey is more then a mistake, it misses a simple means of getting the best results. Trainers should always remember this important point when instructing field technicians. It should be also remembered that the expressions of the western world are often inappropriate.

We say "good morning" or "how do you do", whereas the local people, may say "peace to you" ("salam alekum" in

Arabic). The meaning is quite different, and the way of thinking is too. Just to test the answer a guide was asked the meaning of the words "salam alekum" and the answer was that they mean "good morning". The man was aware that it would be too difficult to explain to a European the deep meaning of wishing peace to the internal soul. So it was translated according to the different way of thinking rather than that of the actual words.

To understand the meaning of words and not only the social equivalent is important. To co-operate, communication is necessary. By giving the right weight to words it is sometimes possible to anticipate the behaviour that become the decisive factor in the success or failure of a project. Two examples are given in the next Chapter. Asking for help, speaking at least some words in the local language and possibly having something to offer as a gift, are the most important things. To know of local traditions and to conform to them is the best. It is not true that indigenous people have to accept us as we are. Trying to assimilate a minimum of the local cultural tradition and to make known that we are aware and respectful of it is the best sign of friendship we can offer and the best way of beginning a project. To do this, it is useful to study in advance the specific history and anthropology of the area

involved. Much useful information can be found in books, even in the literature discussed in Chapter 5.2 (Heterogeneous publications).

It is also necessary to pay attention to things and behaviour we do not understand. It is advisable to immediately ask those around for an explanation and to ask others later as well so that you quickly become acquainted with social and cultural differences. Understanding will help conform socially without mistakes. It must be appreciated that what at first is difficult to understand is not necessarily wrong. It is simply a different cultural and socio-economic system and worth learning as quickly as possible. This as well as technical know-how, is an important part of the competence that the expert must acquire. Pouring some of a proffered drink onto the soil could be interpreted, in the western world, as a way to get rid of something floating on the surface . But it will be favourably and correctly understood as a kind homage to traditional rites by the Animist people of Africa. The gesture means you are offering a drink to the dead ancestors of the family, which still are protective presences. This is also a ritual offering to Pachamama (the Mother-Earth) not only for the Andes native people, but also for the criollo Christians of European origin.

Not only are people happy that their traditions are known and respected, but the technician can also feel accepted when, being offered a drink, can create applause by pouring some of it on the soil, solemnly saying: "With your permission I would like to render homage to the ancestors of this noble family, asking for their protection

on each and every one us". It is a gratifying to feel that we been accepted into the social system of the local population. Offering some gift to the children is also an easy and kind way to express our desire to be considered as a friend and not as a simple visitor asking for information. From small glass coloured balls to tiny dolls, there are a number of simple toys which can give pleasure. They are considered so useful in establishing a friendly relationship with families, that the opportunity of giving them to field technicians and advisers should be regularly considered to make the projects easier and more profitable . It is more difficult to offer gifts to adults. There are never enough gifts to give to all members of the family, nor is it possible to discriminate between them. In addition these gifts are more expensive. It may however be wise to offer something at the beginning of a project to the village chief and, later on, to most of people helping. Money should be avoided, but some can be offered privately as a tip for good co-operative work. The best gift for the family is an instantly developed Polaroid photograph. This is successful not only amongst villagers but also amongst upper class townspeople. Alternatively, photographing anything of technical interest is welcomed including people even when their image is a taboo.

In the villages, after a few photographs have been offered as homage to the most kind and collaborative people, information is very forthcoming. All people who have something of interest to show the technicians ask them to visit their homes to show them what they have or what they do. When beginning a system analysis, the use of Polaroid photographs is

highly recommended. They create very favourable conditions for establishing good communication with the local people. A good way to begin work in a village is to obtain an invitation as a guest. The best opportunities are found in the village markets where it is always useful to get an idea of what species are marketed, the numbers and prices, their variation with time and other information. When a 40-50 year old lady (neither too old nor too young) is seen to be looking after some of the species in which the technician is interested , she can be approached and a discussion started. The technician has the chance of asking questions about the meat or other product, if it is good, if people like it, if it is expensive, if it is eaten frequently, and so on. When the conversation is well under way (people are always glad to chat if they are approached in the right way), the moment comes to ask about cooking and the different traditional dishes that can be prepared. Then the lady is asked what dish she likes most and is able to prepare. Finally, the technician might say that he or she has not had that dish before (even if it is not true) and would like very much to taste it . He can than propose to buy the meat or other products for all the family in exchange for an invitation to lunch or dinner. The trick always works, the lady is very proud to have a foreign guest in her home and better still, to offer a special free meal to all the family. Sitting at table many questions can be posed to the husband and other members of the family, first of all about organisation or possible organisation of the backyard. The technician begins to learn from inside the customs of life and production systems. Little by little he acquires competence. In the meantime the news spreads that there is a very friendly foreigner in the

village whom everyone would like to meet. This is an ideal opportunity to gather information and guarantees a high level of co-operation and success in the project. This is far better than organising a meeting and offering to help by bringing in some exotic technology that purports to solve all problems at a stroke. Before transferring any technology one should be certain that the transfer is useful and that the receiving body will not reject it. Many examples have shown that, when systems are properly analysed, problems and solutions can be found. These are often very different from the ones that were previously supposed to be useful and to be appropriate for the area. An example is given in Chapter 5.5 (Looking for appropriate new techniques) where a consultant was asked about rabbit breeds and feeding, but the analysis of the system gave priority to housing and management.

Fig. 15.1. The buildings that can be seen from afar, relate to a very important person, maybe even a local king (Central Africa).

Before doing anything, it is wise to go there to give greetings and to explain the reason for the visit. Before beginning a visit to the area where a programme for food security is being developed, the social organisation should be known. Local technicians know whether it is necessary to visit village chiefs beforehand to get their permission to move around in the area. But experts should be able to recognise by themselves where to go first (figure 15.1.) or if something is forbidden (figure 15.2.). Another example is reported in figure 17.1.

Fig. 15.2. A local God is present inside this small shelter (Central Africa).

Imprudently the photograph was taken without asking permission because there was no-one around. However a man taking care of sacrifices suddenly appeared protesting that the sacred place had been violated. He was right and it was necessary to present excuses and to pay compensation. But finding out about sacrifices andcdocumenting the information is an important job for the system analyst. This is needed to understand correctly the function of small animals in the religious context of the area. This topic has been illustrated in figure 4.4.

16. Language

It is necessary to have at least a minimum understanding of a number of local languages so that systems may be analysed.. In the case of long term service, the study of local languages should be compulsory. A constant use of interpreters is not practical. Without a reasonable command of the local language, transmission of information is poor and incomplete and misunderstandings are often possible. If preparing a project is considered only as a technical problem, the contribution of local cultural knowledge is lost and the idea of getting participatory work through interpreters is intrinsically difficult if not wrong. Foreigners are frequently seen as aliens promising progress and offering an immediate chance of gaining some advantage or of gaining money working for the projects. Work can be bought, but co-operation needs a continuous interchange of information and the mediating function of language cannot be avoided. This is even more the case when small systems analysis is involved.

The first need is to be accepted and recognised as a friend. The second is to try to understand at least something when conversation is going on through interpreters. Most frequently the interpreters are local technicians and they think they already know what goes on locally. Thus questions are posed with an expected answer in mind. Sometimes they give the answer directly, without even asking. There is a risk of

losing a lot of useful information because the interpreter thinks observations are not important and does not report them while, as a minimum, they are of consequence to the interviewee. This should be sufficient reason to try and find out what the interviewee wanted to say, in order to understand properly their thinking about the matter being discussed. To understand the importance of knowing at least some words, an example is useful to show how knowing just one word of a local language was sufficient to completely reverse the result of a field analysis.

When we had news about the keeping of guinea pigs by families in some West African countries, the first opportunity was taken to find out how common this was and how widely spread they were. The aim was to find out how much they contributed to the nutritional level and whether they contributed to the economy of families. At the beginning the research was a complete failure. When people in the villages were asked, the interpreters, who were also well trained technicians, (but unfortunately biased towards industrial development), they always got a negative response both in anglophone and a francophone countries. Eventually it was possible to talk directly with a villager speaking in French. He explained that there were no guinea pigs (cochons d'Inde) in the

Country, because all of them had been killed by order of the Government. This was rather puzzling, but the misunderstanding was easily explained. It was clear that the villager understood only the word "pig" (cochon) and while the question was about guinea pigs, the answer was about sanitary precautions against a pig disease . Also the expression "small pigs", accompanied by a hand gesture indicating the dimension of the rodent, was unsuccessful. Even "small pigs" (understood as "piglets") had obviously been killed. A possible reason for the negative answer had been identified but the communication gap persisted because the interpreters were clearly not using the local expression for guinea pigs. It was then explained that we were looking for an animal similar to a small, short-eared, tail-less rabbit. In the end a guinea pig was found. The local name "guidibaun" (with a nasal ending sound, similar to the French pronunciation) was immediately noted. From that moment, using the appropriate word, without any help from the interpreters, it was possible to ascertain that raising a few guinea pigs was a quite extensive practice in the villages. No one was found to keep rabbits (local name: "azuin"). However, very different languages were

spoken in the area, changing even over a distance of just a few kilometres. It was then necessary to learn other specific words such as "mbo" which means guinea pig but also "little". The final report would have been that neither rabbits nor guinea pigs were raised in the West African villages visited. At least this would have been the case if the system analysis had not been carried out properly, with the insistence that the local names for the species were identified. The above result was exactly the opposite of the correct situation, which was that guinea pigs were spreading spontaneously in the area explored and local, appropriate, simple technologies to raise them had been developed. Guinea pigs contribute to the protein and nutritional needs of the families and it was also possible to establish that they had a commercial value .

The conclusion was that any project able to favour the spread of guinea pigs and to improve their breeding practice had a great chance of success, because it would be supporting a process that was already in a phase of spreading spontaneously. Rabbit keeping, on the contrary, had little chance of being successful in the villages but their prospects were better in the peri-urban areas. Reasons for this were

discussed in Chapter 7.2.1. (Rabbits).

The example reported shows an extreme case of misunderstanding which would have produced completely wrong results if local names had not been identified and utilised. However a lot of misunderstandings of this nature can occur if the correct importance is not given to local languages. Anyhow people are very pleased when they hear the "foreigner" using local names because this shows an evident sign of interest and respect of their culture. This facilitates acceptance within the community. The "foreigner" becomes a "guest", may be even a "friend". Willingness to explain is increased to allow the guest to participate in the cultural richness of the local community and the analysis has a much better chance of realistic results. To ask for local names is the most practical way to get to know them. But sometimes, as we have seen, it is not easy and great care must be taken to do the job correctly. When good technical reports are prepared the linguistic aspect is considered. In table 16.1, African local names of giant snails are reported. Only by using them can relevant differences be considered. Names also change with changing area and anyone can appreciate how useful a table like this is to facilitate analysing reality and formulating specific projects.

NOMS FRANCAIS DES ESPECES D'ESCARGOTS	NOMS VERNA-CULAIRES REGION DES PLATEAUX	NOMS VERNACU-LAIRES REGION MARITIME	NOMS SCIENTIQUES	POIDS MOYENS DIAMETRES ET LONGUEUR DE LA COQUILLE
Coquille noire (escargots des plaines)	Kpébobo, Bobogoyobo kotoyé (Akébou)	Kpobli, Bobogoyibo	Archachatina sp.	150 à 250 g 6 à 7 cm 10 à 12 cm
Coquille noire + claire (escargots au bord des fleuves)	Klobobo, Kaklibobo Bobogoyibo	Vlibobo, Bobogoyibo	Archachatina sp	150 à 300 g 6 à 7 cm 10 à 12 cm
Coquille rouge striée (escargots des forêts)	Bobogodjin, Ashanti Gahloin, Tepra (au Ghana)	Bobogodjin, Accravi, Ghanavi, Golotoui, Lakpaché (Bénin)	Achatina achatina	150 à 400 voir 500 g 6 à 7 cm 10 à 12 cm
Coquille noire chaire blanche	Bobogoyibo lanhé		Archachatina sp	
Coquille blanche chaire blanche	Bobogonc lanhé	Bobogohé lanhé	Archachatina sp	
Coquille noire (petite de taille) chaire rose	Fulica		Achatina fulica	50 à 80 g 3 à 4 cm 4 à 6 cm

Table 16.1. Local names of giant snails vary according to geographical area, species and variety. Generic words like "snail" or" escargots" are not sufficient to analyse the production system. The clever analyst (Sodjinin, 1998) has prepared this table where names, morphological traits and area where the names are used are specified. There is no need to explain the importance of such a useful document in helping the preliminary field work.

The knowledge of some technical words is helpful but is not enough to create, from the beginning, a rapport with

the local people. Anyhow these words are also useful in knowing whether the interpreters are really discussing the question we are interested in. The importance of knowing the most common words of courtesy and hailing has been discussed in Chapter 15 (Rules of conduct).

17. The role of culture and tradition

Western people have generally become materialistic. Typically they have no religious interests or, if believers, pray just once a week if at all, but it is necessary to get accustomed and to consider as "normal" that there are people who pray five times a day. They have stronger tribal and family ties and call cousins brothers. Many of these people also have a fatalistic attitude. They never worry, their soul is unperturbed, they confide trustfully in the will of God, which is always right.

Some expressions can reveal this attitude which gives strength in times of adversity but it is not easily understood by people of developed Countries. However, it can also produce problems when technical factors are involved, and more so in rural areas where cultural level is generally low and the weight of tradition is high.

In the rural environments of an East African town it was customary to collect grass in the rainy season to sell it in town, where many animals were raised.

To study the botanical composition of the grass, many samples were bought and, in the end, a big heap was available for analysis, which provided a good opportunity for making hay. The hay was good and it was decided to study problems of conservation, in particular the best way to protect it from termites. But at the beginning of the dry season there were some attempts to steal the hay during the night and these were eventually successful.

This was a useful demonstration of the value of hay when pasture became scarce. The man who sold the grass was shown the result , to try and convince him to produce some hay at the end of the wet season. It could be sold at a higher price during the dry season . He could also give better nourishment to his own animals, shortening the period of scarce nutrition. But the man did not want to work any more than the minimum necessary for his subsistence. When he was told that the life of his animals and his own life could be at risk in the case of a long drought, he simply and serenely answered it will be according to the will of God. The man was not bothered about future happenings as western people are; his soul was at peace. There is no reason to consider misery in this happy mood.

It is easy to understand how a fatalistic attitude, if not properly considered, can, in the end, bring failure to projects that have every prospect of being successful and sustainable. Making hay to help feed the animals during the dry season is an example. It can be seen in this case how necessary it is to understand cultural differences and to be respectful of them. If people are not willing to react when some foreseeable emergency is identified, projects must be simplified, avoiding the rigidity imposed by the technology of developed systems.

An expert, who was reviewing the condition of wind pumps during the colonial period, told this very impressive anecdote relating to fatalistic attitudes. He found a pump no longer working in a village and as a result women had again begun to go on a two hour walk to the river to collect water. He asked what had happened and the simple answer was that the pump had broken down. He found that only a small joint had broken, the value of which was just a few dollars. The part could also have been made by a local blacksmith. According to the expert there was no lack of maintenance or technical competence, just a lack of initiative and a resignation that was not

understandable to his western way of thinking, particularly for such an important facility as having water available in the village. But so it was: water had come from an external intervention when no one was expecting or asking for it, and from an external factor water had gone. God had given and God had taken away, let the will of God be done. The "good" traditional way of going to the river with a pot on the head and two smaller ones in the hands was still there. It was a sustainable system, while the one proposed by foreigners, though apparently long lasting and more comfortable, was not.

Tradition is a guarantee of sustainability but sometimes it is also a constraint very difficult to overcome. Who could say in advance, and after much monitoring, that the wind pump was a not sustainable machine? And now a still more extraordinary and surprising anecdote.

In an East African Country all people believed that the presence of cocks was necessary to make hens lay eggs. It was then ascertained that the weight of

cultural tradition was so strong that even educated people having a knowledge of biology, were unwillingly subject to it. The field analysis had shown that small units of about 50 to 150 hens were producing for the market. Chickens were bought unsexed at a State farm and when it was possible to recognise the males, a proportion of 1:10 was left with the hens "to allow them to lay". Since eggs were produced to be sold and not incubated, it was obvious that more then 10% of the feeding mash was wasted to nourish the males. All the trials to convince farmers that cocks could be eliminated were unsuccessful, and even a student of veterinary science, who raised 100 hens, was completely deaf to the argument. Students were then brought to visit an industrial farm of a co-operation project. Hens were kept in cages and it was clear that eggs were laid, no male being present. But it was not enough. They could not understand, and the thing remained mysterious to them and as a miracle of industrial technology. Some

weeks later, visiting a more distant village with two students as interpreters, a small hen keeping was found. It was managed in a very rational way suggested by a veterinarian who had studied in Europe. No cock was present among the hens but, as the students could see, they were able to lay eggs. The woman who fed the hens also owned a few of her own, but she also had a cock. She was asked what the cock was for, and she answered it was to make hens lay eggs. She was then asked how it was possible that the hens she was taking care of were laying eggs without males. The woman had only a second of uncertainty and then answered: "It is because of the sperm they put in the feeding mash the vet brings from town!" The capability of defending the cultural tradition and the ingenuity of the answer were admirable, but when the funny anecdote was told at during a lesson, the student who raised hens felt ashamed and got rid of all the cocks of his keeping except one. Only then, looking at the result, did the farmers of the area

begin to be convinced and, by imitation, in few weeks they also eliminated the males. As a result all the hen keeping units of the region could save about 10% of their feedstuffs.

Another example of how a still more sensible improvement was obtained just by analysing the system, was described at the end of Chapter 5.5 (Looking for appropriate new techniques) and refers to the substitution of sorghum with maize. It is interesting to observe how, in that case, a traditional wrong belief was not involved and the improvement was easily obtained. But in the case mentioned above, overcoming the impairing cultural effect was very difficult indeed, and the hope of being successful was nearly lost. Many local customs can impair the results of projects. There are not only the important religious taboos, such as eating pork or even any meat. Some people do not accept rabbits, or goats milk or similar. In a West African Country eggs are not given to children because they believe it makes them become thieves. In another Country, in East Africa, only the yolk is given and the white is wasted, which if used with added sugar could make sweet and nourishing cakes. In a region of Central Africa people newly married have a taboo against raising ducks until they have at least one boy and one girl (two children of the same sex are not enough). The belief is that ducks, being very fertile (i.e. laying many eggs), can steal fertility from humans. Newly married people can own ducks but some other member of the family must take care of them. The

belief that ducks can effect human fertility certainly impairs any relief project based on the species.

On the contrary, the very widely accepted and probably true belief that guinea pigs can scare away mice, is a very favourable condition upon which to develop projects based on raising these small mammals. The many things that people believe are para-technical factors which, rightly or wrongly, can play an important role and interfere with co-operation. It is not easy to discover these types of factors because they are unexpected and there are no hints that will bring them to the attention of the expert. The examples mentioned above, as the many other quoted in this manual, should convince people that it is not possible to develop sound projects, even at backyard level, without a previous and accurate system analysis led by well trained experts. Religious beliefs are important because they may result in many things being wrongly interpreted. In figure 17.1. the poultry technician can easily recognise a brooding hen. But what is the small heap of earth near the wall? Is it possible to stand on the heap to get a better photograph? Or is it prudent to ask for information first?

Fig. 17.1. Try to analyse the system before you click on the picture to read the legend.

Field technicians know that religious and cultural habits

or taboo must be identified in advance. To live as much as possible with the local population and to pay attention to any peculiarity is the best way to avoid mistakes. It is certain that most local cultural habits that are able to exercise a positive or negative influence on projects, are not described in manuals. May be they are known by a particular technician but not by others. And when the first one leaves the job, no one has a memory of the relevant customs. A good field technician should never forget to ask: "Why do you do that?", "Why don't you do that?", "What is that for", "Why do you not eat that?", "Why do you waste that?" any time that they observe something that does not fit with their own knowledge.

A lot of useful information will be obtained in this way. The time will come when a technician can properly utilise his or her specific knowledge to profit favourably from a belief or avoid planning a project that will be antagonistic towards a local belief or tradition. It would be a wise decision if some international Organisation could prepare a manual of traditions, habits and taboos according to Country, population and religion, to form a base of ethnographic knowledge for project makers, consultants and field technicians. There are many more than the few commonly quoted.

18. Testing success

When all the actions that were considered when the

project was formulated have been carried out and no more inputs are anticipated, the project itself is considered concluded. To evaluate the success of the project many topics are customarily considered as indicators. They are the interest of the local authorities, the number of villages and/or families involved, the number of structures put in place or animals distributed, and so on. But a point must be made clear. The parameters mentioned above are indicators of execution, conformity and perhaps, acceptance, but they are not indicators of success.

Success can and must be checked only after the project is over. The judgement must be about sustainability as a minimum condition, and about self-expanding capability as a more desirable result. Since many projects collapse as soon as the financial support is withdrawn, first monitoring should be about six months after the conclusion of the programme. Projects for food security, according to the meaning of the expression used in this manual, should touch many rural families. Thus the first control should ascertain how many of the original interventions are still working. Certainly not all of them will remain, but rates of 30-50% could be still considered good. Very good over 50-60%. If it is found that some new unit has started by imitation, the project must be considered a great success since something capable of self-expansion has been produced. In this case there is no need for any future monitoring unless as a measure of success of the acquired know-how for inclusion in new projects.

In the other cases, monitoring should continue until the

original structures and equipment have worn out and must be renewed. This is the critical point to judge the sustainability of the intervention. If people are not able to buy or reproduce what they need again, the project must be considered as a failure. Of course if the rule of self-production, utilising local, abundant and no cost or cheap materials has been respected, the chances of sustainability are better. If costly, or worse still, imported equipment has been used , success is doubtful. But some success can be claimed if saving the cost of loans has been taught and put into action.

Any increase in the food resources or income of the families successfully involved in the project should be studied at the end of the projects. The overall effect in terms of macroeconomics should be also determined to evaluate the impact of the financial support. It has been demonstrated that, with the same capital, overall output can be higher where there has been an intervention with many families rather than where one big industrial unit has been set up (figure 3.2.2.). This is because although the yield of the animals raised in the rural medium is lower, the expense of sustaining each of them is also lower. Thus, the higher number of animals within backyards can between them produce more than fewer individuals having a greater output per capita. The duration of monitoring depends, in this case, on the durability of materials but many years may have to pass before it is possible to make a judgement the sustainability of a project, this is not a reason however to avoid the assessment. Monitoring of results is extremely important, because the success of future programmes depends upon what was learnt from previous actions. It is very sad to see that the same mistakes have been repeated and the same failures have been produced because results were not analysed. Some example have been reported for this purpose.(for instance in figure 7.2.2.10.)

Monitoring of projects after they have ended should be always programmed as a part of the projects themselves, and an inventory of factors influencing failure or success should be prepared. This will form a very important knowledge base that can be studied and used by everyone involved to both avoid mistakes and to gain most benefit from any given project. Many factors have been considered within this manual starting from field analysis and going through to project evaluation, but no general rules can be given as a conclusion. When performing the analysis of backyard systems, project makers, experts, consultants and technicians must be very ready to identify favourable factors, constraints and peculiarities. As a consequence they must be flexible when proposing interventions.

On the other hand they must be trustful that, if the system is properly analysed, many appropriate technical solutions can be found, having the common characteristic of being simple and sustainable. Sensible improvements can be obtained which remain within the logic of traditional rural animal keeping, and do not induce an early and dangerous jump towards non-sustainable industrial systems.

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2. The systems

The word "system" corresponds to an intuitive concept, the meaning of which is not always clear. A system is a co-ordinated combination of "elements" which can be, or sometimes should be, in equilibrium, that is to say in a static condition, while sometimes a dynamic or evolving situation is desirable. Very frequently only the technical component is considered as a whole system, supposing that improving the technical component will produce a new and more advanced equilibrium and, of course, if equilibrium is achieved, it will be intrinsically sustainable. This is not always true because socio-economic, cultural and political factors can play a decisive role.

Nowadays the stress is rightly put on sustainability. In fact it was realised that the simple transfer of a technology from one country to another must require particular conditions. If those are lacking, negative effects can be produced, capable of nullifying the intervention. For instance, natural ecosystems are formed in specific areas where soil, flora, fauna and human activity are in equilibrium (static condition). An ecosystem is considered degraded when the original equilibrium is lost and a new static condition is produced through a phase where negative dynamic conditions prevailed. A project to protect an ecosystem should be able to reverse the direction of change, aiming to restore the original condition. Schiere and Grasman (1997) have keenly developed a theoretical approach to this problem.

While analysing systems, it is possible to split them

into subsystems or to assemble them into hyper-systems. For instance, raising animals in backyards is part of the family agricultural production system but it may only be a part of all the income sources (handcraft activities, commerce, and employment) that together form a larger system. This must be taken into account, because the activity in the backyard is conditioned by the other adjacent sub-systems.

Assuming two identically organised backyards, it makes a big difference whether the families have other income sources or not. In fact, if there are other incomes, some factors become favourable (example: disposal of monetary inputs can favour a move to semi-industrial production), but others become negative (example: less time available can impair the care of the animals or reduce the amount of feed harvested to supply them). If an important part of the production is sold, the market must be included in a more extended system analysis. In the market, other products of different origin and nature can compete with the ones produced in the backyard. Thus, the other production systems must also be included in a wider hyper-system. Only the analysis of the hyper-system, including all the systems competing for the market, can give the necessary information. This will avoid the risk of producing something that is incapable of competing with cheaper or better commodities.

A small backyard unit can also be split into subsystems. Species have different characteristics. They may be in competition for feed or space. In other cases, they may usefully integrate. As a consequence, the

keeping of any species must be analysed separately and considered as a subsystem of the backyard system. The same happens with different breeds. They have distinct input requirements and different outputs, and must be considered as subsystems of the same species-keeping system. It is easy to understand that, if local and exotic chickens are kept together in a village, their performance can differ compared with keeping each species in isolation. To forecast the result, the interaction of the two subsystems must be studied relative to the proportion, cost and output of each of them.

Systems also overlap: for example, a plant production system may provide some by-products utilised to feed different animal species. If the by-product finds a more convenient destination, this newly formed system may impair the efficiency of the first one. For instance, chickens and rabbits compete for vegetable wastes from the kitchen. If a piglet to be fattened is introduced into the backyard, feeding of both chickens and rabbits will be impaired because they are competing for the same food. Another possibility is that a newly developed system enters into competition with a previous one and ensures its demise, even if it was previously well integrated and sustainable in its original area.

As an example, it was observed that the introduction of greenhouse enterprises was competing for manpower with the pre-existing animal production on a Mediterranean island. It was impossible to

understand why animal keeping began to be abandoned until it was clear that a new hyper-system had been created including both enterprises as subsystems. They were competing for labour. Since workers gave better returns when used in greenhouses, it was clear that in the newly formed hyper-system, the economic balance between the decreasing animal keeping and the increasing greenhouse horticulture was positive. The latter had to be favoured, and trying to protect animal production was an economic mistake that, in the end, would have been unsuccessful anyway.

Since each system can be classified as a part of a hyper-system and can be analysed at the level of subsystems, which can also overlap, it is obvious that all systems are more or less directly interrelated by a continuous flow of reciprocal influences. This does not refer only to contiguous systems but those that may be quite unconnected. Some important examples of remote influences, and hence beyond any technical possibility of control, are considered later on. A system is thus an abstract concept used to divide reality into discrete units that are easier to study and understand. The more we are able to analyse all the elements, how all of them interact and how they receive inputs and produce outputs, the

more we will be able to interpret and utilise them in a proper manner. Though it is intuitively easy to understand what a system is, it is much more difficult to define it, including all the factors upon which it depends and by which it is influenced. A systems analysis discussion will contribute to clarification of this unavoidable problem.

2.1. Dynamics of animal production systems

The exploitation of animals by man began with their domestication, thousands of years before the historic age. It slowly evolved, favouring the passage from the hunter-gatherer stage to pastoralism and agriculture. In the historic age, when Greeks and Romans began to describe it, animal keeping had already been established for many centuries in its many sustainable forms. Nowadays these forms seem obsolete, but they are not, and must be positively considered in relation to production methods that, in many areas of the world, have not substantially evolved from that age. And when dealing with poor rural areas in developing countries, it is easier to find useful ideas in the old treatises on agriculture by the Romans: Varro, Columella and Pliny the Elder, or the ancient Greeks Polybe and Strabo (Sandford, 1992; Saltini, 1995), than in modern manuals of industrial production.

Two main types of animal keeping have been developed since then. One model presents people moving with their animals in search of pastures and water sources, establishing the complex cultural system of knowledge of geography, seasons, vegetation periods,

grazing and animal exploitation, with the inherent social and economic values pertaining to pastoralism. Large species were involved, forming cattle or camel herds and sheep or goat flocks. The second model developed later near the dwellings and was managed mainly by women keeping a limited number of small species. Large animals also represent a status symbol while small animals mainly contribute to family welfare. The two systems are completely separate and utilise different animal species which, in the beginning, were probably sheep and chickens in the Old World and llamas and guinea pigs in the New World. But, with the development of modern agriculture, surpluses and by-products became locally available in sufficient quantities, allowing the development of the landless industrial animal production of both small and big species. Only small animals are considered here, but it is not always easy to find appropriate and significant examples that refer particularly to small species raised by the households of low-food, no-income people. Therefore, examples are borrowed from all the animal production systems. They help us to understand the logic of static and dynamic, or evolving, systems. They also help us to understand how varied are the factors that can influence the final result of the undertaking. If the aim of a project is to improve local economies, it is necessary to remember that "improving" means changing something inside a system, and this means breaking the previous internal equilibrium. An effort must be made to foresee the secondary internal consequences of the action, as well as the external ones, to evaluate in advance the final balance of positive and negative effects. It happens only too frequently that projects are formulated without

taking into account possible negative results or a possible overall negative balance. Any action that ensures minimal change within the system may provide only small but assured improvements. When profound changes are introduced, it is much more difficult to control all the parameters involved and the risk of negative effects is increased.

Avoiding failures is important because they induce frustration and loss of trust in the people involved in the project as well as those conversant with it. This would impair any future action. On the other hand, small improvements permit rapid correction when something goes wrong. In addition, they can attain an important outcome thanks to the cumulative effects of small consecutive improvements, and the multiplicative effect when these spontaneously spread through hundreds and thousands of families. These points will be considered later in Chapters 3.1 (Backyard conditions and development goals) and 3.2 (Traditional versus industrialised systems). But let us begin by offering some examples to make the above mentioned concepts clearer.

In a South American Country, many small industrial pig units had been developed (50 to 200 sows). They were sound and well established. It was then planned to introduce a unit to provide financial support to a technical school that was also to be used as a teaching model. When analysing the situation, it was realised

that prices had abruptly decreased, the economy had been impaired and some units had even closed. The reason for this was a piggery of European dimensions, provided in the framework of bilateral co-operation. This new large-scale unit had immediately over-saturated the relatively small national market, upsetting the proper equilibrium previously reached. Being financed from abroad, the new plant was able to sell by lowering prices at the expense of the local economy. "Luckily" the farm was not profitable and failed as soon as the external financial inputs stopped. In the end, the local sustainable economy, although badly impaired, recovered and the school had its small profitable didactic unit at the right time.

As can be seen, local pig keeping had the proper technology and management and was perfectly sustainable. All the local units formed a hyper-system which was also sustainable, enriching the national economy. The new industrial farm was not sustainable because it was too big relative to the local market. The new hyper-system had therefore also become unsustainable and the local economy was exposed to the risk of being artificially destroyed by a detrimental

project, undertaken without considering the negative impact on the pre-existing situation.

In this case, the negative effects could have been avoided by a proper system analysis in the same way as the analysis of the new hyper-system avoided the mistake of starting up the small piggery at the school in the wrong local economic climate. But sometimes the influencing factors can come from far a field and are completely beyond one's control, so that their final effect cannot be avoided.

For some decades after the Second World War, Angora rabbit wool production in Europe was a very efficient and well-defined production system. It had its selected animal stocks, housing and management techniques, a specific market and good prospects of continuing to produce profitably for the clothing industry. Some South American countries then became involved in angora wool production and the sector developed, still with good perspectives. But suddenly Asiatic countries entered the international market with an enormous production of wool, lower in quality and still lower in price. In the meantime, industries

developed a technology capable of utilising a low quality product in a sector where high quality set the price. In a few years, European and South American wool production completely collapsed because of the higher production costs.

Fig. 2.1.1. The Angora rabbit (FAO/4223/F.Botts,

1968) was a promising enterprise in South America. Angora wool production was then destroyed by globalisation of the market. Nowadays, it is virtually impossible outside the Asiatic area.

After the takeover of angora wool production by the Asiatic countries, all attempts to sustain or restore production in Europe and South America have failed. (Figure 2.1.1.). This was simply because the technicians appointed to the projects were not able to understand that the parameters of the system had radically changed in relation to the fibre market and spinning technology. A new hyper-system had been created. It was no longer sufficient to produce high quality wool with advanced housing, feeding and management. It was necessary to compete on the world market where Asiatic merchants were able to sell at lower prices. In fact, they were able to buy in the villages at very low prices and only needed to reduce their profits to establish a monopoly and push out of the market all European or South American competition.

The same thing can be said with reference to silkworm production. It is strange then that some Asiatic countries still propose development programmes in South America, based on silkworm production. If nothing new is found, these projects are destined to fail, despite the introduction of appropriate technologies. Competition from synthetic fibres, high production costs and the difficulty of reaching the critical amount that permits entry into the international market all conspire against commercial success. A simple new factor, i.e. the

formation of an international market for animal fibres, which placed all the national production systems in direct competition, caused the closure of all those with higher labour costs. It is easy to see that there is sometimes no way to avoid the undesired result.

The lesson teaches us not to invest in projects simply because they look good and are successfully managed in another country. It also teaches us that factors can come from far away, suddenly increasing the number of elements within the system to be considered. They can have a negative influence, as in the case mentioned above, but they may also act positively, as happened when alfalfa cultivation was introduced to substitute weeds in North African oases. Rabbit keeping was then very much improved, notwithstanding the very adverse environmental conditions.

These examples, though involving great economic effects, are relatively simple. It is surprising how mistakes that could easily be avoided from the beginning, continue to be repeated when experience and analysis should teach more prudent behaviour. But things can be much more complicated when productive economic systems are involved. In these, human, social, cultural, commercial and sometimes political factors, play their roles and create a very intricate balance or imbalance of forces whose result cannot be foreseen in advance, even in cases which look very simple. Raising guinea pigs is a good example of a simple system, much simpler anyhow than raising rabbits. Guinea pigs do not have problems such as pregnancy diagnosis or preparing the nest and, consequently, there is no need to elaborate on husbandry operations. In the most common management form, guinea pigs simply move around in the kitchen, eating vegetable wastes and grass. The owners, who normally are women, have only to catch them when they need something to eat or to sell.

But guinea pigs have a long history in the Andean area, where they were first domesticated. Together with coca and fermented maize (chicha), they are still offered in sacrifice to Pachamama (Mother-Earth) and other ancient Gods; they are used in traditional medicine to cure some sicknesses and to diagnose them; they are elements of magical rites; they receive special affection as small household pets; in children's stories they are the heroes always cheating the stupid fox; they provide excellent meat to offer to important guests or to be served at religious and civil feasts and are the most expensive dish in typical restaurants; they are used as symbolic gifts of thanks for some favour received; they represent, together with spinning wool, the participation of women in the economy of the family; they are frequently the main, and even the only no-cost source of animal protein in the local diet; they are the ready reserve of income for small immediate needs, such as to buy medicines or exercise books for children when school begins.

Trying to substitute rabbits for guinea pigs because they are bigger and more productive is an initiative prone to failure. Besides the many social functions that are lost, there are management complications connected with the new species and monetary inputs, imprudently proposed, to build housing and cages.

It is not surprising that a sociologist was able to write a 167-page essay on the cultural aspects of keeping guinea pigs (Archetti, 1992), and even local and expert specialised technicians should not ignore socio-cultural aspects. The system must be sufficiently analysed, avoiding the prejudice that raising a few guinea pigs in the kitchen is a very simple system that can be understood at a glance.

A clever, prudent and experienced technician never thinks he or she can understand a production system at first glance. They patiently look and look, ask and ask, live as much as possible with the target people, eat with them and possibly work with them according to their own competence and using the same tools. They try to understand the meaning of any small particular aspect that is not clear to them. At the end, something unexpected happens. What looked like a poor, primitive, inefficient production system starts to appear logical and able to deal with specific constraints that initially passed unobserved. In short, it shows its rationality. Then, and only then, is the moment to start thinking if the system can be improved, how, how much and under what conditions.

Raising poultry (as with other species) also has specific socio-cultural traits in the villages, and its function as a financial reserve and beginning of a chain-process of accumulation must be considered (Bonfoh, 1997). The cultural values associated with a few animals raised in the dwellings are nowadays completely lost in the industrialised countries and are not taught in technical schools and universities. Only some fading

aspects are still present in the rural areas. But they are the rule where animals are still in close contact with people. They should not be considered either right or wrong; they must be considered as existing and unavoidable, at least in the short and medium term. They must be respected and, when projects are formulated, considered as part of the system within which they should remain harmoniously included, providing they do not seriously constrain any possible improvement.

Help-to-development programmes aim to interact with pre-existing systems. They aim to improve their efficiency, and not to substitute them with new systems supposed to fit better into the existing socio-economic situation. But two things have to be remembered and carefully taken into consideration before beginning any project:

1 - Local production systems are frequently very old; this shows that they are sustainable, perfectly integrated and in equilibrium with all the other systems in the area. But any change, which is intended to improve the system can also impair it, and the positive or negative effects can increase progressively and become wide-ranging. Anyhow, the situation, even after a small change, will not be as it was before. A change in one part of the system affects the system elsewhere (Schiere and Grasman, 1997; Schiere et al., 1999). To use the words of the Spanish poet Federico Garc�a Lorca: "Still the diminutive banquet of the spider is sufficient to break the equilibrium of the entire world". It looks like a paradox; nevertheless it is the truth, even though no perceivable practical effects can be identified. This concept must

always be considered, because changes produced by development programmes have a far greater impact than a spider eating a fly. Projects should aim at reaching a more advanced equilibrium through modification or substitution of a pre-existing one. Although it is easy to break equilibrium, it may be very difficult to restore it. It is necessary to be as sure as possible in advance that the new system will be profitable, sustainable and will not induce negative effects on the related systems.

2 - The easiest way to foresee negative effects is to look at the market, and try to evaluate in advance the consequences of the project, not only on itself, but also on related or similar enterprises.

To illustrate these points the best example refers to cattle.

In an African country, a fresh milk production system was developed with hundreds of cows owned by rural families around the town, either singly or as a few head. A plant for the hygienic treatment of the milk was then installed. Although technically the plant was accomplishing its functions, payment was delayed and irregular. To get the milk treated, police intervention was necessary. They had to apprehend the producers who tried to enter the town avoiding the controls and

compel them to take the milk to the plant at their own expense.

The keeping of cows could survive, but the meagre income of the families was delayed and reduced. The price to the consumer increased, with negative social consequences. In the meantime, hygienic conditions were not improved. Pasteurisation without a cold-chain was insufficient to conserve the milk, and it needed to be boiled before being consumed. On the other hand, the local procedure was very reliable because milk was conserved in containers made of vegetable fibres. These were sterilised with live charcoal that left a layer of burned milk. This gave a good taste of smoke and produced a mild antiseptic effect, which in actuality reduced the rate of microbial multiplication. Milk was customarily well boiled before drinking and normally drunk whilst very hot so that no harm could come to the population.

All these troubles and mistakes could have been avoided through a proper system

> ***analysis. Anyhow, when the country was offered freepowdered milk as "humanitarian" aid, the local Government began to sell it on the market at very low cost. The milk producing system could not face the competition and collapsed.***

This is the reason why, beginning in the seventies, it became more and more difficult, even impossible, to find fresh milk in many African towns, notwithstanding the many efforts to develop milk production. Only recently has the problem started to be resolved with the progressive introduction of cold-chains.

> ***On the other hand, a South American country in the Andean area now has a well developed milk industry. This is due to producers and technicians at the milk-treatment plant, having properly ascertained the distorting effect of "aid" on the market. As a result they successfully obtained an undertaking from the Government to strictly reject any help in the form of powdered milk. But in this case the cold-chain was already well developed and most people had a refrigerator at home.***

This is a good example of a correct and successful analysis of a system, which also took into account the factors that do not pertain directly to the system itself, but can influence it from outside.

2.2. Technical and para-technical factors

Factors that influence production but are not directly determined or controlled by producers are called here "para-technical". It is very common for them not to be considered in the framework of the analysis of small systems, but it is necessary to remember and identify them in advance. As can be seen from the above-mentioned examples, there are factors that are not intrinsic to the production system, but whose influence is very significant. They can also come from afar, frequently cannot be foreseen and are sometimes very difficult to identify. When analysing a system, it is therefore necessary to distinguish between technical and para-technical factors. Both the idea of installing a milk-treatment plant and of accepting powdered milk as aid is political decisions, but they are different in nature. The milk plant is still a technical factor and can be considered in itself as a system capable of influencing (negatively or positively) the local milk producing system. Powdered milk importation is a para-technical factor, depending only on the decision of politicians. They have to decide if it is convenient to accept humanitarian aid and to distribute the milk freely and directly to populations hit by famine and too poor to have access to the market. In this case, the market should not be negatively affected and help should be utilised properly. But the decision to

use the help to market powdered milk at a very low price is a choice whose destructive effect will be paid for over many years by the local production structures. Unluckily, the wrong decision is also the easiest and the more politically promising.

The technical factors depend strictly on the capability and experience of technicians in analysing systems and projecting appropriate and viable interventions. Para-technical factors are not involved with production, though they are frequently decisive in determining the success of a project. More appropriately, they should be under the control of national and international organisations. Since some para-technical factors can also emerge at local level, and can be identified and taken into account, another example must be considered.

An industrial egg production project was ongoing in an East African country. Since hybrid stocks were utilised, the farm was supported by another farm, which had grandparent stock and incubators. It furnished day-old sexed chicks. When the second enterprise was found to be economically unsustainable and the output of day-old chicks became insufficient, the project managers decided to import day-old hybrids directly from Europe. When the boxes containing the chicks arrived at

the customs office, a dramatic and unforeseeable para-technical factor emerged. The customs officer decided to check if a box actually contained the hundred chicks indicated on the label. He found that, as is customary, there were one hundred and ten to compensate for possible deaths. To ensure that the correct excise duty was paid, he proceeded to open all the boxes counting for hours in the very hot conditions. The chicks suffered terrible stress and began to die and continued to do so for several days, up to a total of several thousand. At the end an extra toll also had to be paid.

Problems with customs are frequent para-technical factors that impair projects. Important equipment can be blocked in customs offices for months, interfering with the development of dependent activities. It is surprising that, after years of co-operation, assisted countries have not removed this constraint. It is therefore imperative that in any cooperative project, the first agreement with the recipient country should be to renounce its import duties and ensure that no superficial problem will be raised by customs or by any other tax office (for instance road tolls). It should be clearly stated that after a short time (say a week), if the problem is not resolved, the project will be considered suspended and the funds

transferred to other projects.

> ***In the past it was possible to avoid paying road tolls by questioning the toll collector. The passenger says: "I won't pay and I'll go back. Please give me your name so I can report you. You are asking money to help your people and are also causing trouble for your government". When the vehicle was seen to be turning around to go back, permission to go through was then freely given.***

Being strong and looking very confident is a way of getting out of trouble. In the case of transporting live animals, for example chicks blocked in the airport for counting, it would probably have been possible to say: "Well, it will be up to you to explain to your Government why all the chicks offered by the international co-operation died during your process of investigation. I expect you will have to pay for the losses. In the meantime, I am going to the police to report the abuse". It is very difficult for an officer to take on such a responsibility if he is not absolutely sure his action will be judged correct. Moreover, he can't be sure that it is correct to deny that 10% of excess chicks is only to guarantee the buyer that he will receive no fewer animals than the ones he has paid for. In many cases, duty payments depend on how the duty officer interprets the law.

2.3. Developing sustainable production systems

Raising small animals in the backyard is an activity based on traditional practices, which is proof of its sustainability. It can be more or less developed, according to the means of production, genetics, nutritional level, sanitary conditions, management and para-technical factors, such as the presence of predators. But it must be efficient and sustainable in some way, otherwise it will not survive.

To improve backyard production is probably possible at any level, but conditions are different according to the objective. Maybe the goal is to produce for self-consumption, or self-consumption and occasional selling, or the main interest may be commercial. In the first case, the interest is the nutritional welfare of the family, in the second the interest is directed towards monetary income. It is obvious that the passage from self-consumption to commerce is possible only when a market is available (figure 2.3.1.).

Fig. 2.3.1. Try to analyse the system before you click on the picture to read the legend.

Another difference is the monetary input which is needed when commercial production requires the use of feed concentrates and can no longer relyon scavenging birds or small mammals fed on freely available roughage . Shelter and cages also become necessary together with other equipment.

The more profoundly an innovation changes the original equilibrium, the more difficult it is to maintain sustainability through a new equilibrium. Maybe this is

the reason that Latin people said: "Quieta non movere" (don't move what is still). But in those times, profound changes were not technically possible. In the move from self-consumption to commercial goals, new factors must be included in the analysis of a widened system. They are: market, monetary inputs and amortisation on the economic side (Table 2.3.1.) and breed efficiency vs. fitness on the biological side. As a general rule, these factors are not present in the villages but they can become favourable in the peri-urban areas where the market is wider and nearly always receptive. People generally have some remunerative activity and can afford the monetary input needed to build structures and to buy feed and medical or prophylactic treatments. Furthermore, the cultural level of townspeople is generally enriched and it is easier to find the management competence to run a more complex production system that can also be based on the exploitation of exotic breeds. The logic of the new system and the need to amortise loans on structures is more easily understood and accepted.

	Local Breeds	Exotic Breeds
Monetary Input	- - -	+ + +
Town Market	- - +	+ + +
Village Market	+ +	+

Table 2.3.1. If biological aspects (fitness) are not decisive, the prevalence of local versus exotic breeds depends upon financial and market

conditions.

Many other elements can emerge during an accurate in situ analysis. They should be properly considered so that the favourable elements are properly exploited and those that appear as constraints treated prudently. A very important factor is the level of acceptance of the project. This point will be discussed in Chapter 12 (Promoting the interest).

To promote development means to modify a production system, which was previously sustained. In the transitional phase, the system becomes vulnerable and care should be taken to avoid problems. Frequently, the characteristics of the market are not considered (figure 2.3.2.). But it may happen that later it will be impossible to sell the products. The market may be too far away or intermediaries may control it; similar products may be cheaper; production costs may become excessive in comparison with selling prices.

Fig. 2.3.2. The local market must always be analysed because selling opportunities depend on its dimension and organisation. Here an Andean town market shows that one must be very prudent before starting with large-scale production.

The opportunity to judge the consequences of ignoring the market in the project formulation stage is shown by the venture of an architect in a South American Country.

The man had retired and had decided to invest his savings in establishing an industrial farm to produce guinea pigs. He already had two thousand does and

wanted to increase this to three thousand. To feed the animals he had rented some fields to produce alfalfa, which was brought daily to the farm. After a quick inquiry into the market for guinea pigs, it was clear that it was not receptive to high production.

The possible income was not even sufficient to cover the cost of feeding, let alone the buildings, one technician and some workers. The owner was selling the excess bucks and the old sires, but despite this never made an economic return. Probably the man was aware the balance was negative because he had obtained a mortgage for his villa and car. Maybe he considered it only as a temporary consequence of increasing his animal stock, since he maintained most of the does produced. When he was asked about the economic perspective, surprisingly he consulted a book on raising guinea pigs and, from some data reported; he quickly calculated the unbelievable quantity of money he was going to make from the enterprise. It was not polite to explain to him that he was losing money on each load of alfalfa brought to the farm and on each guinea pig produced. But he seemed not to understand any allusion to controlling "real" market conditions. Less than one year later he had lost all his

belongings.

This sad anecdote teaches: 1) never forget to analyse the market before starting a commercial enterprise, particularly if it is new to the country; 2) never rely only on books. Look first at what other people do, according to tradition, and test if innovations are sustainable. No technical book will ever say that it is teaching the best way to lose all your money! However, in effect it does do this if it fails to advise that technology alone is not sufficient to be successful, and that other conditioning factors must be considered. This raises the question, how does a poor illiterate woman, raising a few guinea pigs, provide for her family, while the educated architect loses all his money raising thousands? The difference is that the woman collects free grasses and kitchen waste to give to her animals. Whatever she obtains is gratis, except her work. She shares the rationality of sustainable traditions. In the industrial system this is not possible; the system to be analysed becomes wider, including production costs and selling opportunities. Unfortunately, not only architects but also animal husbandry technicians frequently think that technology is all that is needed. But this is not enough to be successful.

Another factor infrequently considered is the capability of people to set aside money to replace the equipment that was originally provided for the project when it begins to break down. Only after some years when no money is available to replace failing equipment doesit become evident that the project had never been viable. Introduction of exotic breeds can also be a

mistake. Generally, these animals are less suited to the environment; they need balanced feed, which can make the costs rise over the market level; animal density is higher and this encourages the spread of disease. Prophylactic treatments are generally introduced initially but may later be unavailable or too expensive.

When a system is made dynamic, it is often forgotten that traditional thinking is not always useful or sufficient and new skills must be acquired. These can be obtained through specific research, but also by looking around for new technologies in equipment or management that have been spontaneously developed. Sometimes clever and easily sustainable systems have been developed locally, which need only to be disseminated. Many examples will be given in the Chapters from 7 to 11.

Fig. 2.3.3. An abandoned rabbit house. It was built by an NGO and it was technically appropriate with only minor faults. However the breeder was not able to acquire the necessary skills. If the financial support had been employed to develop backyard animal keeping, more people could have been involved and the chances of success, through adoption of simplified systems, would have been increased.

The stress is frequently put on housing and controlling disease; managerial aspects are frequently not given enough consideration and may scarcely be understood, even by properly trained people (Fig. 2.3.3.).

Not only is an appropriate culture required, but also the will to learn is needed to avoid common errors such as failure to cull old stock and unproductive animals or avoid wasting feed. The first two are also common mistakes in rural systems, but their consequences are not as harmful as when poor management impairs industrial production. Among the various causes of unsuccessful projects, it must be remembered that many of them rely on inducing co-operation. Collaboration for seasonal works is common, some kind of farmer association is possible, but a true co-operation is seldom lasting when artificially induced, unless supported by subsidies (SFGA, 1998).

3. Food security and backyard systems

Providing food security to the poorest and most marginal section of the community demands that we overcome severe limiting factors. It is sometimes possible to find practical solutions to problems connected with animal keeping in rural areas. These technical solutions can also be applied to peri-urban and urban areas and even permit competition with complex industrialised systems, if conditions are particularly favourable.

The presence of many socio-cultural and technical or economic constraints explains why costly production systems are rarely sustainable in poor economies, while simple and low cost innovations can improve efficiency, even when transferred to wealthier production systems.

As an example, in Chapter 7.2.1. (Rabbits) a simple underground shelter system is described. It was developed to protect the animals from heat stress in tropical countries, but it was then found that the system is also very efficient for raising rabbits to produce organic meat in developed countries.

Unfortunately there is a lack of specific know-how about appropriate technologies for most of the animal keeping situations in the low-income, food-deficit countries. This is because research nowadays is directed exclusively to improve industrial systems, even in the research centres of countries where animal industrial production is still insignificant or non-existent. The latter situation is paradoxical, but the reason is that most people think industrialised systems are the only basis for further development.

The result is that it is difficult to sustain family stock raising systems due to a lack of appropriate knowledge, while it is now clear that industrial animal keeping systems are mostly unsustainable in the less developed areas. Peri-urban areas, where the presence of sufficient infrastructures and favourable marketing conditions make it possible and convenient to introduce commercial activities, represent the main exceptions. However these are frequently completed as a private initiative without the need for any external project support (figure 3.1.).

Fig. 3.1. A nearly perfect shelter for poultry (FAO/12648/F. McDougall, 1985). All the rules illustrated in Chapter 3.1. (Backyard conditions and development goals) are respected here: Cheap local materials have been used (adobe, palm leaves and palm wood) They are available, abundant and made by the user in a simple and efficient way. The floor is higher than the ground level to avoid the rain entering and to keep it dry. Hand crafting of the grille and the door is perfect. The shelter is well shaded and the grille ensures a good circulation of fresh air. Careful hygiene is an important factor for low mortality. The shed was

built utelising local low cost raffia bamboo and the owner was able to exploit a favourable marketting period.

As a matter of fact, if the technical manuals from the beginning of the century are examined, it is possible to observe the abrupt cessation of the slow process of innovation in family keeping systems. These systems, mainly based on tradition, have been rapidly replaced by research-based industrial units. This happened in different places and at different times, according to the species; from the period between the two world wars, for chicken broilers and laying hens in the United States, and in the nineteen eighties for guinea pigs in Peru.

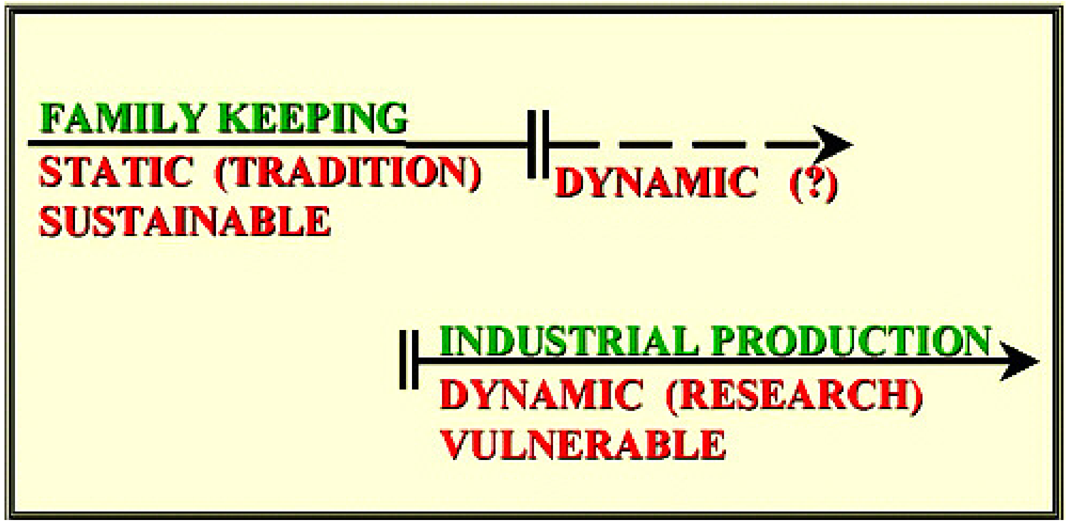


Fig. 3.2. Traditional and sustainable family keeping and research-based industrial production are two historically separate systems*. When the second began, the first stopped developing. Development of industrial production was

something completely new and unconnected with rural tradition. The question is, can a way be found again to develop specific technologies for family animal keeping

The historical situation is illustrated in figure 3.2. There was a sudden jump in the move from extensive to intensive animal raising systems because of the logic of production, which changed radically. One system developed after the other but not from the other. It was completely new. And the know-how related to the rural system remained within that system. As is shown in the figure, it is questionable if rural systems can become dynamic again. The main differences which explain why there cannot be any contiguity between the two systems are illustrated in table 3.1.

SYSTEM	
INDUSTRIAL	FAMILIAR
CAPITALISTIC	SOCIAL
1 (FEW) INVESTORS	MANY SMALL-HOLDERS
PROFIT	FAMILY NEEDS
CONTINUOUS HIGH IMPUTS	LOW IMPUTS TO BEGIN
WORK INTENSIVE	PART-TIME

COMPLEX TECHNOLOGIES	SIMPLE TECHNOLOGIES
QUICK INNOVATION	TRADITION
HYBRIDS	BREEDS
LAND DETACHED	FARM INTEGRATED
CULTIVATED FEEDSTUFFS	NATURAL FEEDSTUFFS
INFRASTRUCTURED	AUTOSUFFICIENT
URBAN MARKET	ANY MARKET
RIGID	FLEXIBLE
RISK EXPOSED	SUSTAINABLE
DEVELOPED COUNTRIES	ANY COUNTRY

Table. 3.1. Industrial and family production systems have no points of contact*

The family system is deeply rooted in tradition; thus it is intrinsically static and resistant to simple innovations, which have proved useful and sustainable in certain situations. This problem should be kept in mind when projects are prepared because it may happen that even simple technologies, or hygiene practices, or nutritional improvements, though not explicitly rejected by the participants, are simply left aside as soon as the project is over. But if they are proved worthwhile and accepted by someone, then other people begin to imitate,

and tradition is less of an impediment to the evolution of the system.

The land-detached capital-intensive industrial production system needs an advanced infrastructure to support the sophisticated exigencies of production, which seldom exist at the same time in a developing country. The industrial units aim to produce a high profit for a few investors, selling to the rich people in towns, and have no relationship with peoples' food security and welfare.

Local breeds represent a peculiar germplasm which is frequently adapted to local environmental conditions and may be suitable for conservation and exploitation. On the other hand, exotic breeds or hybrids, which are the result of advanced genetic work, are more demanding of inputs and need an industrial system to be produced, properly utilised and marketed. Another important difference is that industrial keeping needs mixed balanced feeds, which require specific agricultural or agro-industrial production. Though some vegetable and agricultural by-products could potentially be utilised, in practice they should be concentrated, sufficient in quantity, easily conserved and transported, and available all the year round. The lack of only one of these attributes is the reason why most of the possible feedstuffs, though well known for palatability, chemical composition, digestibility and nutritional value for different species, are not utilised in industrial feed production. They are lost in the fields or, at best, employed as fuel or to produce compost.

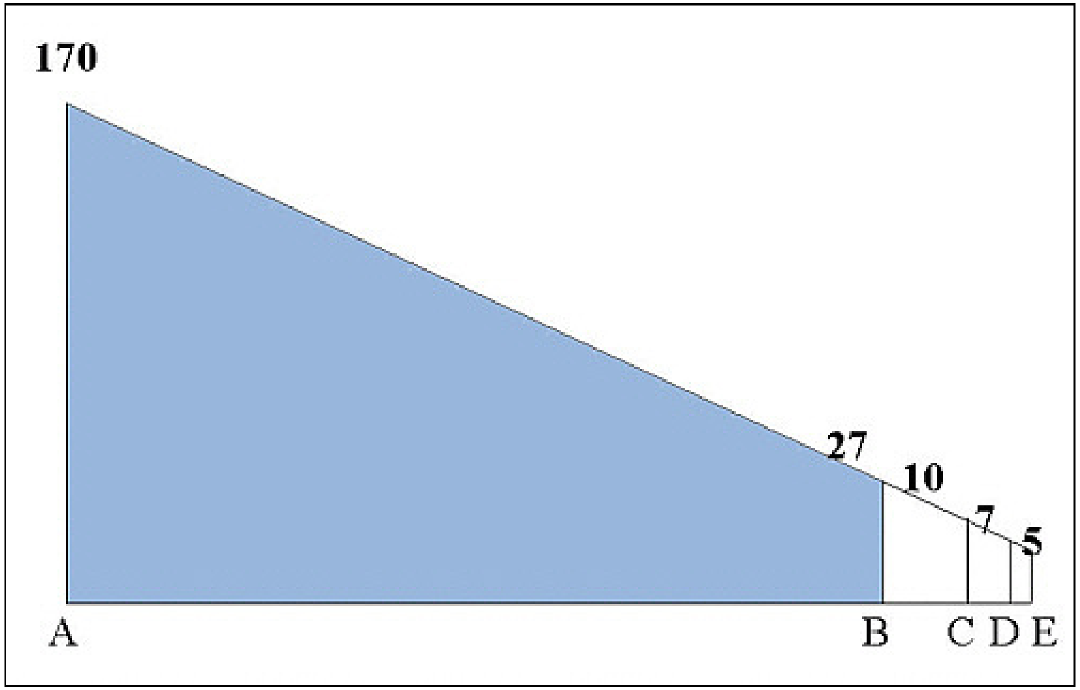


Fig. 3.3. Well studied feedstuffs for rabbits: A - Potentially available. B - Industrially utilised (15.9%). C - Maximum in a single balanced feed (6.8%). D - Mean (4.1%). E - Minimum (2.9%).

Figure 3.3. shows for instance that, from 170 vegetal feedstuffs or by-products well known for their nutritional qualities for rabbits, and many of them available in developing countries, only 27 (15.9%) are utilised by feed mills, a maximum of only 10 (6.8%) are used to prepare a single mash, only7 (4.1%) are used on average while 5 (2.9%) is the minimum number used (Finzi and Gualterio, 1986). As a consequence, more than 84% of well known cultivated plant products or by-products (from point A to point B in the figure), are not being used for industrial purposes. They must be utilised at their

point of origin otherwise they will become lost as nutritional biomass. It should be understood that the figure refers to the number of feedstuffs and not to their output, because some cultivated plants such as alfalfa or some agro-industrial by-products, such as bran or oilseed meals, are available in large quantities compared with other products.

Only the dispersed animals reared in the villages are able to efficiently utilise these plants or by-products where and when they are available, transforming this biomass into low or no cost nutritional resources. This is also true in industrialised countries, but the opportunity is more important in the low-income, food-deficit countries. When projects are prepared, it is necessary to identify the origin, the amount and the seasonal output of all the nutritional sources of the area so that they may be efficiently exploited through the most suitable combination, or by proper integration of diverse animal species. If rural and industrial systems are so clearly separated, and the latter does not represent an evolution of the first but a new independent one, it can be easily understood why transferring modern genetics, technology, feeding and management from the industrial system to the rural, has not had the effect of improving the latter.

It would be radically transformed into one that is only profitable if basic conditions (mainly infrastructures and market) are present, and would be unsustainable if they are not (figure 3.4.).

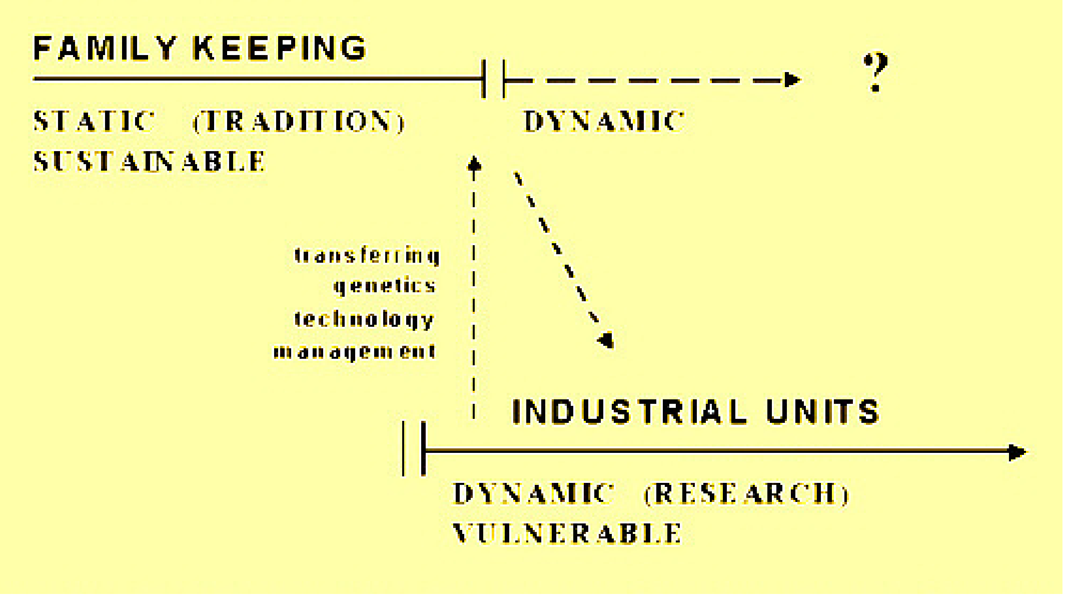


Fig. 3.4. Transferring industrial know-how to family animal keeping may quickly lead to a profitable system, but it does not induce any specific evolution of the previous situation*.

Thus the question if, when and how small animal-based family production systems can undergo a specific and appropriate evolution, without losing their original characteristics, remains open and difficult to answer. Nevertheless, trainers, consultants and field technicians, to whom this manual is dedicated, need some basic ideas, rules and lines of action which aredifferent from the industrial models. They must be provided with realistic means to perform the extremely difficult task of achieving at least some improvement when addressing close to no-input production systems. More difficult still, and as frequently happens, they must do this when environmental conditions are extremelyadverse.

3.1. Backyard conditions and development goals

The strategy to fight food insecurity in the world must face many different social conditions (FIVIMS, 1999). The focus of this manual is directed at the conditions in which backyard animal keeping, though small, can be activated or improved. The hypothesis is to work at the level of rural or peri-urban families, who have at their disposal at least a small free area or backyard, and access to some communal feeding resources which can be freely collected. It must also be hypothesised that the persons who will be the recipients of the action have the characteristics mentioned below:

- are lacking economic resources;

- have a very low cultural level or are even illiterate;

- have extra labour available;

- have a tradition of raising small animals or are seriously interested in beginning such an activity.

The improvements possible include:

- highly efficient management at little or no cost;

- improved utilisation of resources at little or no cost;

- low cost structures or equipment that allows and improves production;

- better utilization of the available inputs through diversification and proper integration of different animal species;

- integration of backyard horticulture with animal keeping;

- properly modifying the management according to scientific knowledge or simple tested technologies.

To build up structures and equipment, the materials utilised must be:

- native to the place;

- in adequate quantities;

- available;

- freely collected or at least very cheap;

- easily used.

Structures or equipment produced must be:

- simple;

- efficient;

- accepted by the people who have to use them;

- where possible, built or constructed directly by the interested parties;

- produced by local carpenters (figure 3.1.1.), blacksmiths and clay pottery workers.

Fig. 3.1.1. If not self-made, equipment can be produced by local carpenters, blacksmiths or clay pottery workers. Providing imported equipment is generally a mistake, both because they reduce local opportunities for work and because the equipment cannot be bought again when it needs replacement.

When these conditions exist and the frequently spontaneous innovation is accepted and properly utilised, it is reasonable to conclude that a simple sustainable improvement to the system has been attained (figure

3.1.2.). Since modification of the system is a small entity, is dispersed in different places and has been obtained at a very low production level, it is very improbable that negative effects can be produced on contiguous or overlapping systems. Nevertheless its repetition by hundreds or thousands of families can bring sensible overall improvements and attain even the macro-economic level (figure 3.2.2.).

Fig. 3.1.2. Try to analyse the system before you click on the picture to read the legend.

This concept seems to be unclear to technicians; also, projects based on the repetition of small backyard activities generally are seen as a relief to family nutritional needs and not as an important quantitative

contribution. This is because the few (mostly less then ten) adult animals of each species raised in a single backyard are compared with the hundreds of the semi-industrial units and the thousands of industrial farms. But backyard production, if widely adopted, generally exceeds the output of any important industrial enterprise.

An interesting example is offered by an Eastern European country that was unable, in the late 1970s, to produce rabbits in competition with the Western industrialised world. On the big state farms, each keeping two to five thousand does, productivity was only a little more than half that of the private Western farms. The latter kept, at that time, generally no more than five hundred does.

Then, in the East European country, the idea was developed of providing a stock of about ten does and one buck to each rural family up to a total of three hundred thousand families. In this way they obtained over three millions does, this number greatly exceeding anything possible in an industrial unit and even the total number of animals on national industrial farms. The no-cost rural production system was placed in competition with the advanced Western industry. The rabbits were brought to

predetermined collection points and sold at relatively low prices on the Western market. This strategy gave a small but constant income to rural families and it provided the country with excellent gains in hard currency through export. But it caused a lot of trouble to the Western rabbit industry until the Eastern state economy collapsed. The collecting system in the rural area ended too, and no private enterprise was able to recover it.

Luckily for industrial production, rural production is dispersed, economically feeble and not organised. As the example shows, when it is well organised, it can manifest its tremendous power. To support this important concept an economics analysis is reported in fig. 3.2.2. in the next Chapter.

3.2. Tradition versus industrialisation

As is shown in figure 3.2.1., when shifting from the traditional to the industrial system, the aim of production changes from the utilisation of plant biomass, to maximising the potential output of the animals. Extensive and intensive systems can both be viable in their own socio-economic and cultural environment.

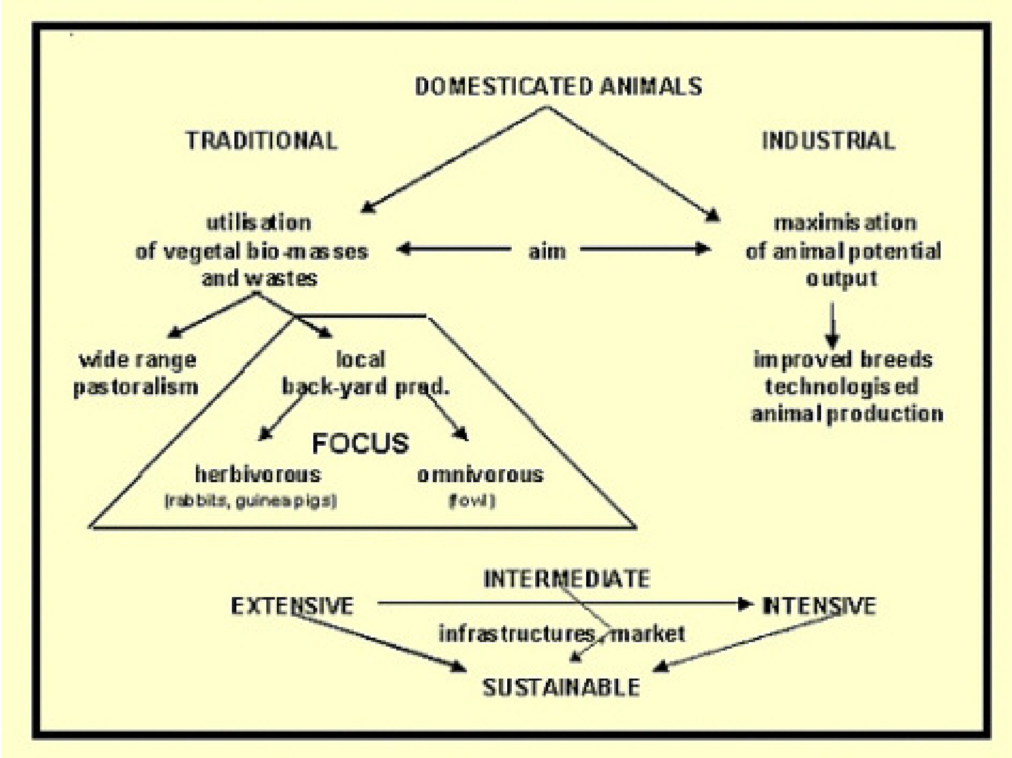


Fig. 3.2.1. Family backyard production is part of the hyper-system, which optimises utilisation of natural, available biomass, as opposed to maximisation of the output of animal genetic potential in the industrial system*.

Many intermediate combinations can also be hypothesised for small animals, which are shown to adapt particularly well to landless enterprises, thus permitting them to grow to the semi-industrial or industrial level. The chances of a successful shift to more evolved higher input technologies are conditioned by a number of factors which will be discussed when dealing with the analysis of the small systems (Chapter 14.). It is

clear that this analysis is necessary because sustainability depends upon the degree of favourable factors which are present, mainly infrastructure and markets. Anyway, as is shown in the figure, the object of this manual remains focused on local backyard production of small mammals and birds as part of the traditional animal keeping system, aimed at the no cost exploitation of available plant biomass. In figure 3.2.2. an industrial rabbit farm is compared with both a single-family rabbit keeping unit, and the total of productive backyard units which can be established with the same financial input.

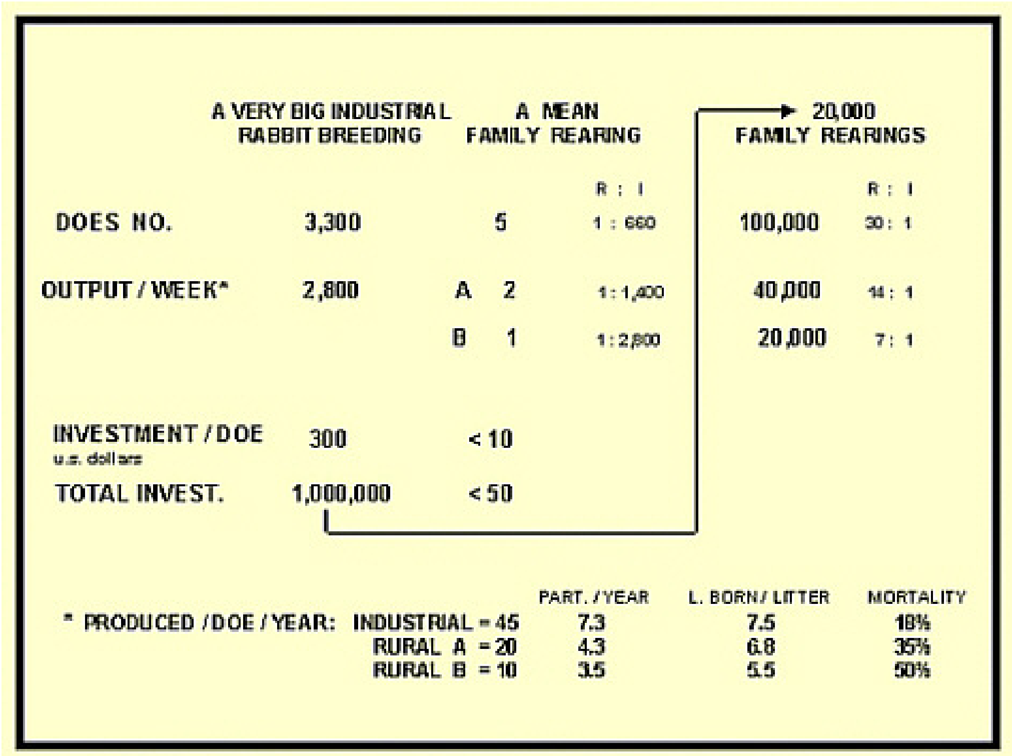


Fig. 3.2.2. Technical and financial comparison

between industrial (I) and rural (R) rabbits raising systems*.

As is shown at the bottom of the figure, in the industrial system (I) a quite common production of 45 rabbits per doe per year is assumed (7.3 parturitions per doe per year; 7.5 live born per litter; 18% mortality). In the rural system (R) two hypotheses are put forward: Rural B, with sufficient management in an exclusively grass-fed unit (3.5 parturitions/year; 5.5 live born/litter; 50% mortality; in total: 10 rabbits/doe/year) and rural A, with a modest improvement in management and some concentrates administered (20 rabbits/doe/year; and figures of 4.3, 6.8 and 35% respectively). Considering the ratio of the rural to the industrial system (R : I) the industrial farm keeps 660 more does and produces 1,440 more rabbits per week, if compared to the rural A, and 2,880 more, if compared with rural B. These figures explain why it is common to think that the economy of a country can develop only through industrialisation. But when the same financial input is directed to develop family rabbit keeping units, it is surprising to see that as many as 20,000 families can be involved. This means that, thanks to the smaller input required for each doe, 30 times more does can be raised and the total output can be up to 14 times (or at least 7 times) higher than that of the single industrial farm. It must also be remembered that the production of 45 rabbits per doe per year, assumed as possible, can only be attained in relatively industrialised countries where sophisticated buildings and equipment, specialised pelleted feed, advanced management and medical care are available. When conditions are not so favourable, mainly in tropical

countries where the hot climate is a very adverse factor, production is much lower, normally less than 30/doe/year, and the advantage of rural keeping is still more evident.

It is now easy to answer the question of whether it is better to utilise financial resources to develop capital-intensive industrial units or to use the same amount to help hundreds and even thousands of low-income food-deficit people. The social impact is evident in the latter case; small keeping units are more easily sustainable, better accepted in the rural cultural context, and do not upset the market. Other positive traits have been previously discussed in Chapter 3 (Food Security and Backyard Systems) and illustrated in table 3.1. No chance must be lost to demonstrate that the output of small family raising units, though scarcely efficient in terms of production per animal, is much more efficient than in industrial systems when production is related to financial investment. Macro-economic dimensions can easily be attained through dissemination of the system. This must be appreciated by everyone, from programmers to field advisers.

The latter must be well aware of the potential of backyard animal keepers to be motivated in their actions. If they believe that improving traditional rural production systems is not worthwhile, and only industrial models of production are able to improve macro-economic parameters, then they will insist on proposing the risky action of transferring genetics, equipment, technology and management from developed countries, with the result illustrated in figure 3.4. That is, they will try to

transform the system to a non-viable industrial model without trying to improve it and maintain its previous intrinsic sustainability. Another possible argument in favour of backyard production systems is to consider the potential contribution of a very small stock of animals to the nutritional needs of a family. For instance, Muscovy duck is able to produce in very harsh tropical climates, where it can give 15 to 35 ducklings/bird/year, depending on whether concentrates are administered or not. It also means that, even in the worst cases, more than one broiler duck a week (about 2 kg live weight) can be available for the family who have a stock of only 4 scavenging ducks and 1 drake. Muscovy duck is native to South America but it is spontaneously spreading in tropical Africa. This is also the case with guinea pigs. This means that, if we are able to recognise the appropriate species, exotic animals can also be introduced to initiate small sustainable units, even in the poorest areas of the most climatically disadvantaged countries. When the situation is analysed, it is evident that the fittest and more successful animals pertain to the species which have been affected least by artificial selection. Improved breeds are more demanding; they need a favourable environment and nutritional and prophylactic inputs. Their potential to improve a system should always be tested beforehand, and an analysis of the situation has shown that if this is successful, there are no major impediments. The more favourable conditions are normally found in the peri-urban areas. It is here where, generally, the first signs of a shift to semi-intensive production can be seen. The introduction of highly productive breeds is then feasible, due to the incipient presence of markets, a good infrastructure and

fewer transport problems.

4. Framework and focus of the action

The framework in which domesticated animals are used has been illustrated in the previous Chapter (figure 3.2.1.). For centuries, the aim has been to effectively exploit the available plant biomasses in the areas which are presently either grazed or lost. Pastoralism has been, and still is, the appropriate technology. Later on, when populations became sedentary, small species also began to be useful to exploit the small amount of biomass available in the areas around dwellings or villages. This gave women the chance to enter into the production process, raising small animals in the open or in closed areas near their homes. Here is the focus of the action, where extensive criteria have been developed to exploit poor local resources.

Here women can be the main protagonists (figure 4.1.), and satisfying the nutritional needs of the family through self-rearing and consumption appears to be the main goal. Historically, the secondary goal, which tends to prevail in the long term, is to obtain some extra financial income.

Fig. 4.1. A women-organised group (Central Africa). Local technicians can be seen in the back row.

Many groups of women have been organised by NGOs, privately and spontaneously in a Central African country, to provide help and training in small animal backyard keeping. These groups are able to contact anyone in the villages. Thus, when helped, they can also give support to the poorest and most helpless people, who are more difficult to reach through development programs. A pivotal help system can be created on account of them. Combining a small amount of money

each week, they have created a common capital from which micro-credit can be given to the members. Management of micro-credit is very rigorous, and micro-credit projects can be very easily managed through these women groups, avoiding costly, bureaucratic structures. Credit can also be given through direct distribution of small animal stock (figure 4.2.). If a few more of the animals received are returned to the project to compensate for possible losses or failures, the programme can become self-sustainable and continue to develop in an unlimited way or even to speed up. If local women-organised groups are involved, all costly, bureaucratic intermediaries can be eliminated. Any interested people can easily ask for micro-credit from persons well aware of local needs, and everything can be managed at village level after the first external input.

Fig. 4.2. Rabbits are distributed through a 1% FAO fund and UNWG co-operation. Organised groups of women are an excellent connection between the helping organisations and the villagers receiving the help.

It must be remembered that thinking of raising small animals as a means ofimproving protein consumption and to get some extra income, is an oversimplification of reality. The way of thinking of project makers from developed/industrialised countries is represented in figure 4.3.

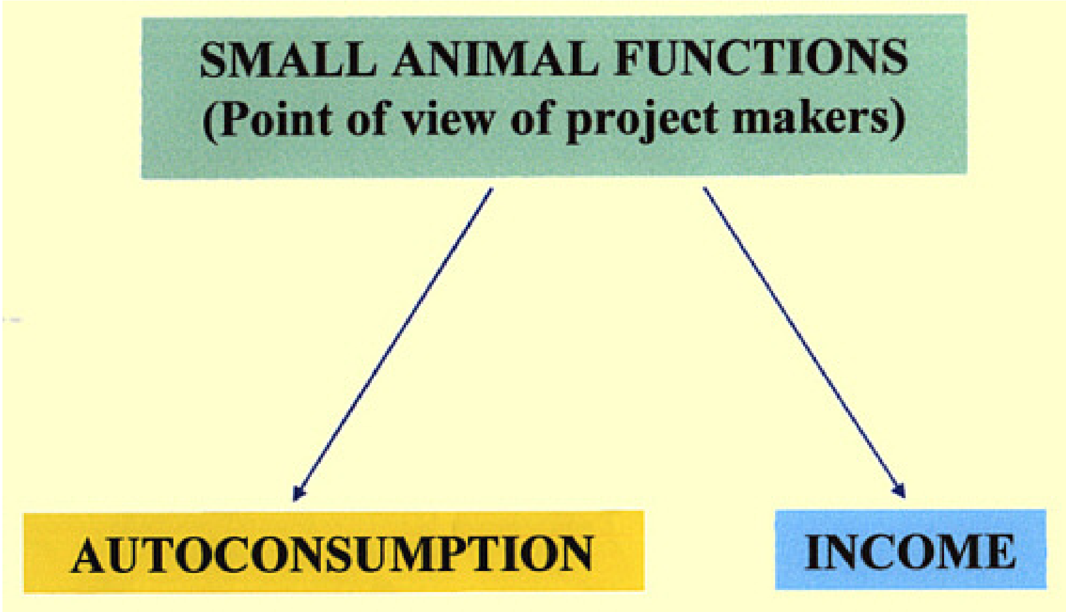


Fig.4.3. Function of small animal keeping in the backyard, according to project makers.

The scheme is very simple. Small animal functions are reduced to two items only: self-consumption and selling. Normally project makers are more interested in inducing evolution towards a commercial system than to improving the nutritional level of the family, the latter being a goal much easier to reach.

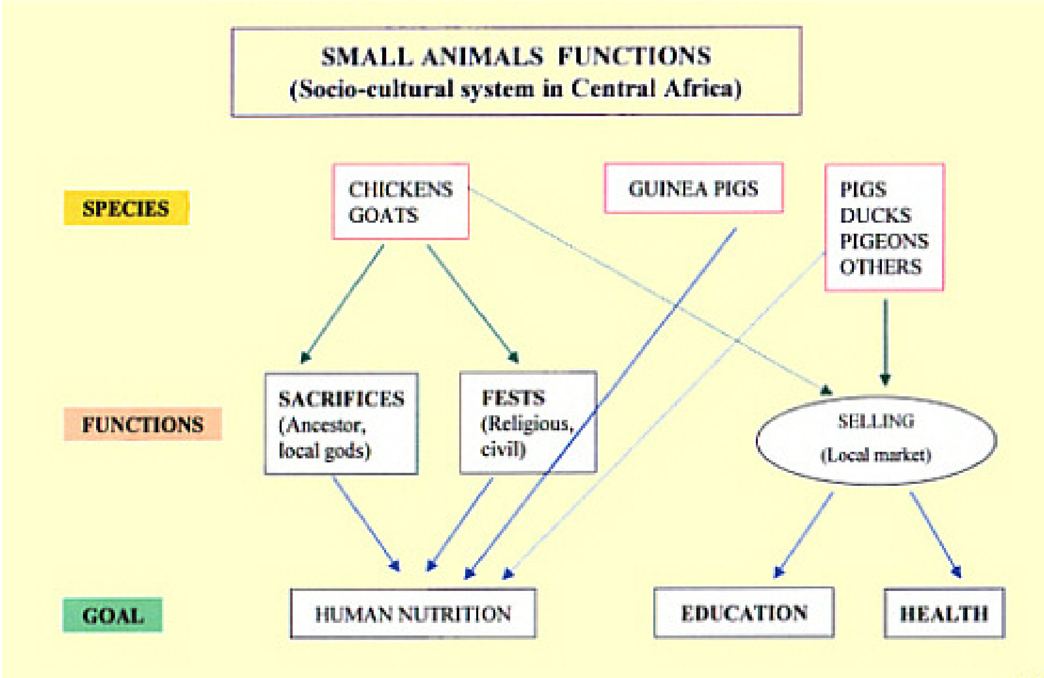


Fig. 4.4. Illustrating the schematic plan of real socio-economic relationships in a Central African country, shows that things are not so simple.

Fig. 4.4. The socio-economic function of small animals raised in the backyard, as observed in Central Africa, is very complex*.Many small variations are possible, but the basic scheme is that chickens and goats are mainly used for sacrifices and feasts. Sacrifices are typical of local religions, but they are also commonly performed in a similar way by believers of monotheistic religions. Feasts are mainly family-based, but can be civil events too. Funerals and birth of twins are the most commonly remembered (figure 4.5.). In the Central African country to which the photograph relates, the importance of twins is such that a day of the local eight-

day-"week" takes its name from them.

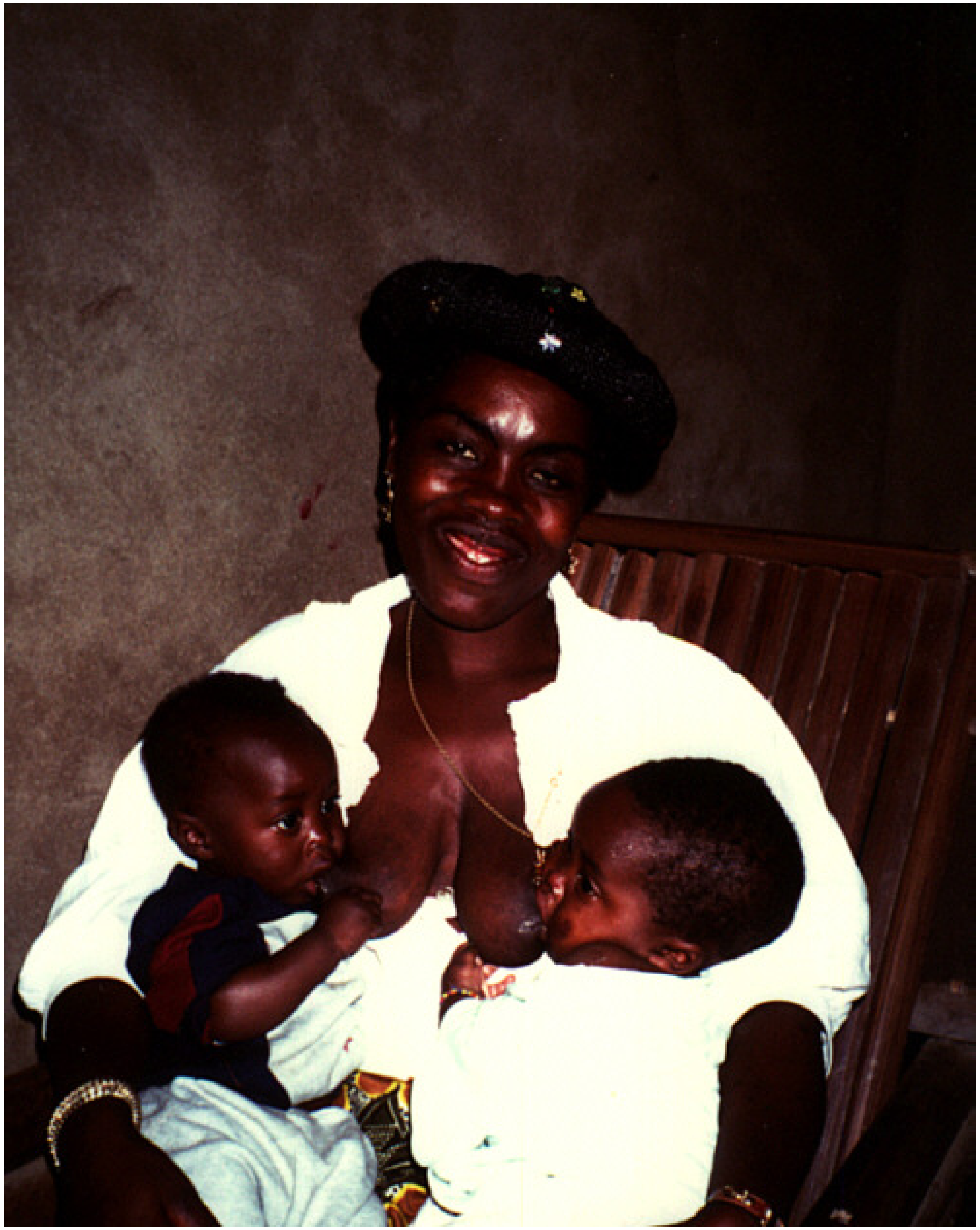


Fig. 4.5. Twins are a symbol of fertility and their birth is celebrated with a feast.

These occasions are seemingly the only opportunities to eat meat. Thus the sacrifice or feast is the aim, and family consumption of the meat is the result. Another social function is the use of chickens and goats to provide ingredients for traditional medicine. The other species, if not used in this way, are in fact only a reserve to exchange for primary needs such as education or medicines. In this case, to sell the animals is simply a means to attain these services and not to earn an extra income, which Westerners are accustomed to in their economic systems.

Small species are frequently offered as gifts to young married couples. Often they are male and female to start the keeping process. Gifts of this nature are also used to express thanks for a favour, to ask a favour in the future or as formal thanks for help during seasonal field works. Apparently the only species that is directly utilised as food in this area is the guinea pig. Some Christian missionaries have been seen to discourage sacrifices. This is dangerous, because unless customary consumption of meat is taught at the same time, there is the risk, mainly for children, of a reduction in the already

low access to animal protein sources.If small animals are not used for socio-cultural reasons they are kept alive. But to keep the animals alive until the moment of their social use depends on a basic condition and has some negative effects. The condition is that the maintenance must be at no cost for it to be sustainable. Scavenging and the use of grasses freely collected or kitchen wastes are thus decisive.

This is a very important point that is often neglected when, to improve production, feed is purchased and its cost is introduced as a new factor. Then the system, instead of developing, is made uneconomic and fails because the animals are not sold at the right time for best economic return. Luckily, regression to the previous equilibrium is easy if other contextually negative factors have not been introduced (for instance hybrid hens unable to brood) on a large scale and artificially sustained for a long time. The negative effects are that animals are less efficiently utilised for human nutritional purposes and the probability of losing them due to sickness, predation or stealing increases. Unfortunately, these problems have to be accepted for the sake of sustainability until profound and sufficient changes in the socio-economic context are able to make the system move towards a sound evolution phase. Small animals raised in the backyard pertain to two main groups: fowls, the omnivorous, mainly granivorous, species, and mammals (guinea pigs, rabbits and some local species). The latter have received less attention until now. This results from the fact that small mammal species are less popular in the industrialised countries, with the exception of those in the North Mediterranean.

Nevertheless, being herbivorous, they can contribute well as they require only small amounts of forage. It will be discussed later how the positive or negative characteristics of each species may influence the choice of specific or integrated animal keeping (Chapters 6 and 7). Bigger animals such as goats and pigs or other species can seldom be found near the dwellings. Normally only a few are fed directly by the owners and not taken to pasture. In this case, they may be considered part of the backyard system. Peculiarities of the small backyard species are rarely considered as elements of a system. Projects try frequently to improve some element of it (for instance, poultry keeping), without considering its effect on the internal system (for example, grain used for human rather than animal nutrition), or external factors (for instance, marketing problems). But it is necessary to consider the backyard not only in itself, as a system, but also as part of a whole, a hyper-system so to speak. This is true both in the phase of analysis and in the phase of planning its improvement.

It must be understood that interventions need to harmonise with the local situation and not conflict with it. And instead of starting with an idea, and trying to set it in motion according to a programme thought out in advance, it is much better to develop a project as suggested by a real and properly analysed situation. Programmes developed *in situ* may become very different from the original idea; they will be differentiated and flexible, according to situations, and become more likely to succeed. The intervention in the backyard is considered here only from the point of view of beginning

or improving production systems. But making contact with the families offers the best chance to develop other programmes for family welfare (hygiene, human nutrition, education, etc.). Backyard production is only a part of family welfare, maybe the first, because to produce food is a primary function. But any opportunity should be taken to develop a combined action and obtain a more general and valuable result according to the scheme illustrated in figure 4.6.

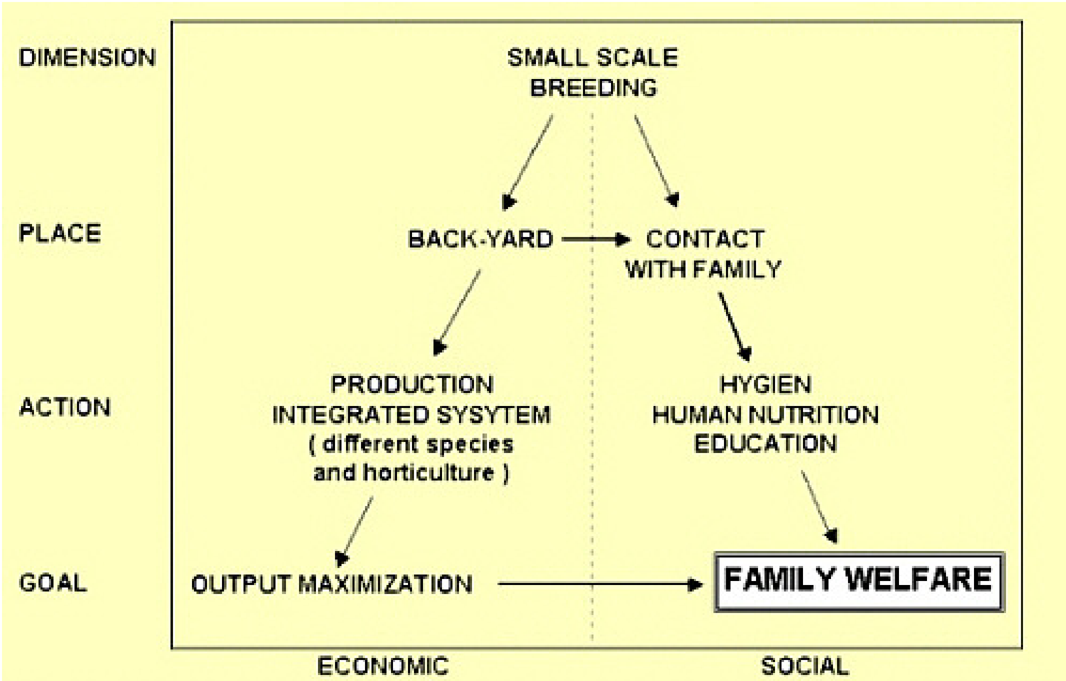


Fig. 4.6. The action of improving backyard production optimises the opportunities for improving other aspects of family welfare*.

5. Sources of appropriate know-how

Many simple structures, equipment or management technologies were developed in the past centuries, but became obsolete in developed countries. This happened mainly because they depend on part-time work and other factors that are less efficient in relation to industrialised production. Some are still, though rarely, in use and some have been completely forgotten and lost. Simple equipment and management could however still be valuable when actual socio-economic conditions in developing countries are similar to the times when they were used in the countries now developed. To find out how and when they are still used and to read the manuals produced at the beginning of the century could provide technicians with useful ideas. Looking at local systems also allows us to discover technologies that have been spontaneously developed, and are worthy of being properly disseminated. Traditional technologies cannot always be recovered, though they are still well known. Milk can be produced in small amounts and locally transformed into cheese, or wool can be spun, using very ancient, simple and no cost technologies, giving a commercial value to the primary product. However, when industrial production takes over, if tradition is not preserved, small quantities lose any value. This is because their quality may not be acceptable to the industry, it becomes difficult to collect the necessary amounts, transport costs are too high, or for other reasons. When these conditions prevail, traditional

production systems become obsolete, small farms die, rural populations migrate to towns looking for employment, and potential marginal production leaves the market and disappears.

If no suitable ideas can be derived from the traditional production systems, they can be found elsewhere, or something new must be projected, tested and introduced after a proper analysis of the production system in which they operate. Useful information to improve simple, rural production systems can be obtained from:

- old technical literature;

- any kind of historic, ethnographic and even literary publications;

- careful observation of ongoing systems in developing countries;

- interviewing people from developed countries (old colonisers, missionaries) who have been settled in low-income, food-deficit areas for a long time;

- asking for ideas from any person involved or interested in specific problems;

- projecting and testing simple innovations after a thorough analysis of the system.

5.1. Old Technical Literature

No opportunity should be lost by project-makers, trainers

and extension workers to get information and ideas from old technical manuals. It was explained in Chapter 3 (Food Security and Backyard Systems) how, in different times, according to different species, small animals suddenly began to be raised industrially and the know-how of rural keeping stopped developing. As a consequence, useful information about sustainable systems can be found mainly in old manuals while, only rarely, some good idea can come from modern books.

The older books are normally not specific. Any kind of information about any kind of plant or animal production can be found in these publications. Useful ideas for raising chickens or rabbits can be found in books generically entitled: "Modern agriculture" (it was modern when it was published, better if before 1920-1930), as well as in books entitled: "How to raise your chickens" (or your rabbits). Such books can be easily found in any ancient university or research centre libraries, and also in town libraries of developing or developed countries, because the subject was very popular only a few generations ago.

Maybe the books will be a little dusty, since most people are now urbanised and do not care about agriculture any more. These old books are also worthwhile for rural people in developed countries, as they contain valuable information about housing and equipment, which is not always found in modern texts. They teach you about construction methods used prior to industrial production. Sometimes illustrations are of very good quality and are easily understood.

Nutritional aspects, on the contrary, have become a little obsolete. Lists of feedstuffs eaten by the animals are reported, generally without any order. The same is true for feedstuffs containing toxic substances. Luckily, plants are frequently well illustrated and this is very useful for persons who have no knowledge of botany. Nowadays, the composition of these plants is better known, thus technicians should undertake the work of reorganisation, putting together the species able to provide protein, fibre, energy, minerals or a combination of these. After that, a rough indication could be given on how to use different plants to improve the balance of nutrients.

Anyhow, it is not an easy job to make these concepts understood. Rural people in developing countries are generally not accustomed to abstract concepts. Let us stop a moment for an example:

In a rural school of a South American country, pupils had been taught geometry and were able to calculate the surfaces of all the most common figures. But when they were taken into the field to measure its width and length, they were unable to calculate its surface area. It may be difficult to believe, but the students could not recognise that the parallelogram drawn on the black-board was nothing else than a generalisation of any cultivated field, and that the surface of this could be

calculated in exactly the same way as shown on the black-board. "Ground measuring" is in fact the origin of the Greek word "geometry". The same happened with solid figures. When the students had learnt to calculate volumes, they were unable to determine the capacity of a gasoline tank whose diameter and height they had measured.

This example should teach us not to use abstract concepts such as "protein" or "leguminous". But when an old book or its photocopy is at our disposal, instead of introducing these concepts, something more concrete must be found. For instance, it is easy to explain that plants that make pods (the word "leguminous" is avoided) contain substances used to form meat, or milk, or eggs (the word "protein" is avoided). As a consequence these plants must comprise part of the feedstuffs administered.

Showing the figures, it is easy to convey which plants we are speaking of. Technicians, describing other feed resources present in the area, can indicate the exact quantities needed to provide a properly balanced diet.. In this way the information from old books can be efficiently integrated with modern keeping systems.

Other aspects can be also used. For instance, old therapeutic methods are sometimes described. Reporting

them in newer publications to be used in developing countries can be very useful (figure 5.1.1.). Certainly they are less efficient than modern medicines, but they can still be used in a poor economy, where modern drugs are too expensive and difficult to find.

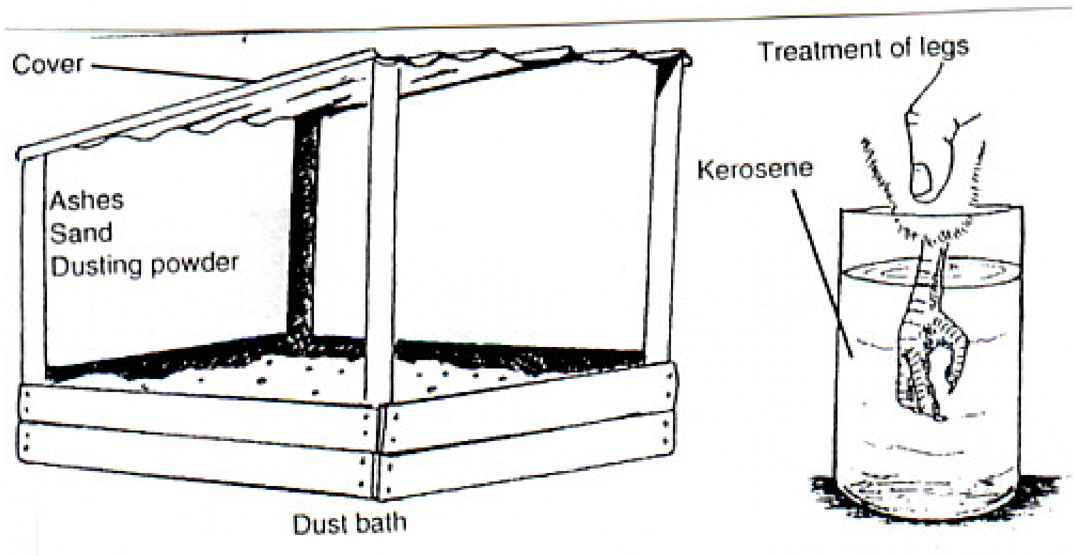


Fig. 5.1.1. Preparing a dust bath to help birds rid themselves of external parasites is a very old technology. Similarly, the use of petrol or kerosene to fight scaly leg mites is a well-established technique. Both are reported in a publication (PAHCW/FAO/1994) which describes simple sanitary means.

5.2. Heterogeneous publications

Useful information about practical problems may be

found from numerous sources. Unfortunately no rule can be given for specific problems, but technicians should always be ready to pick up suggestions about a current problem from any source.

The mulberry is a tree which can also be kept as a bush. Its leaves are the elective food of silkworms, but their high output and protein-rich composition have caught the interest of technicians as a possible source of fodder for ruminants (AGROFOR1, 1998). First results have also indicated their potential for small backyard mammals and poultry. If one could know in advance where the plant is indigenous, then performing trials in an inappropriate location could be avoided.

A lot of information is available in the novel "Los r�os profundos" by a celebrated South American author (Arguedas, 1995). In his biography the author mentions that, in his youth, a Korean had come to an Andean country to start a silkworm farm. He planted mulberries and began production, but unfortunately the enterprise failed (the reasons are explained in Chapter 2.1. - Dynamics of animal production systems), but mulberries propagated everywhere and became high and wide trees, rich in fruits and leaves that shaded the patios.

What could be better than trying to improve backyard production of chickens and guinea pigs, by feeding them the mulberry leaves that are already available in the Andean patios of the locality? The fruits are very rich for human consumption and enjoyed by children. An integrated project for food security based on this information has a very good chance of success. In fact mulberry, though exotic in its origin, is nowadays a tree adapted to local natural environments in many countries.

As another example, many references to the socio-cultural importance of guinea pigs in domestic welfare may be found in the novels of South American authors (Lara, 1987; Paredes Candia, 1988; Guzm�n, 1989) of the so-called "Costumbrismo" movement that is deeply rooted in the local way of life. The small mammal is quoted and described much more carefully than any other domestic animal, as an element of everyday life. Reading from these sources is very useful because it makes the foreign technician aware of its socio-economic importance and that things are not exactly as described in university books.

This information is confirmed in an ethnographic paper on popular songs of Peruvian women (Harrison, 1985). In one song it is said that to raise guinea pigs and to take care of laying hens is the way a

woman can help her husband in producing something for family welfare. And no other feminine activity is mentioned. To underline the importance of references to guinea pigs, historical books can also be found describing the social reality of these animals immediately after the Spanish conquerors entered the country (Inca de la Vega, 1609).

As it is impossible to know in advance where useful information can be found, the best way is to read extensively any publication regarding the country in which the technician is interested. Ideas can be picked up here and there, and frequently the technician cannot avoid the feeling that he or she has simply been lucky in their wide-ranging review. When keenly looking around (either into literature, or when viewing local markets, villages or backyards), something useful may always be found. But perhaps technicians might consider themselves unlucky if, though searching, they were unable to find something useful. But just by searching they will have gained a better general knowledge of the local reality and the many facets that form the background in which they must operate.

In the introduction to a novel by a writer from the Horn of Africa is written (Faarax, 1984): "The Author's interest in political history is equalled by his feeling for authentic period detail and social history.

He is very carefully accurate in providing information about methods of transport and communication, about clothes, habitations and dietary habits, and about survival techniques as well as about various supernatural beliefs".

Transport and communications are important marketing factors, dietary habits depend upon animal production systems and survival techniques can offer simple emergency suggestions. Though not mentioned in the introduction, information is also given about camel pastoralism and techniques to make fences that could be used to enclose backyards. But any cultural aspect is useful and pertinent. It makes the technician keener to identify specific social or technical aspects and to interpret them correctly. This is the generic aspect of the competence that must be acquired to operate in a foreign country and to behave as harmoniously as possible within the local context. No-one can co-operate well at village level, without any knowledge of local customs and without a minimum of integration with them.

5.3. Old techniques still utilised

It is quite common that predators are mentioned in papers and official reports as one of the main causes of stock losses (figure 5.3.1.), but strangely this problem is frequently by-passed, while other minor ones are taken into consideration when projects are formulated. In fact the housing systems proposed to protect the animals are

more modern but often no more efficient than the traditional ones.

Fig. 5.3.1. A guinea pig rearing unit destroyed in few minutes by a pack of dogs when the gate was forgetfully left open.

A very simple old system to protect small animals, eggs, grains and feeding mashes from mice, rats, wild cats, foxes, mongooses, snakes and other predators is still utilised by some people. Cages or containers are suspended on poles at least 1.0 m high, according to a technology commonly adopted in developing Countries. Tin cones are fixed as baffles near the top of the poles with the concavity towards the ground (figure 5.3.2.).

Climbing animals enter the cone and have no chance of bypassing it to reach the top.

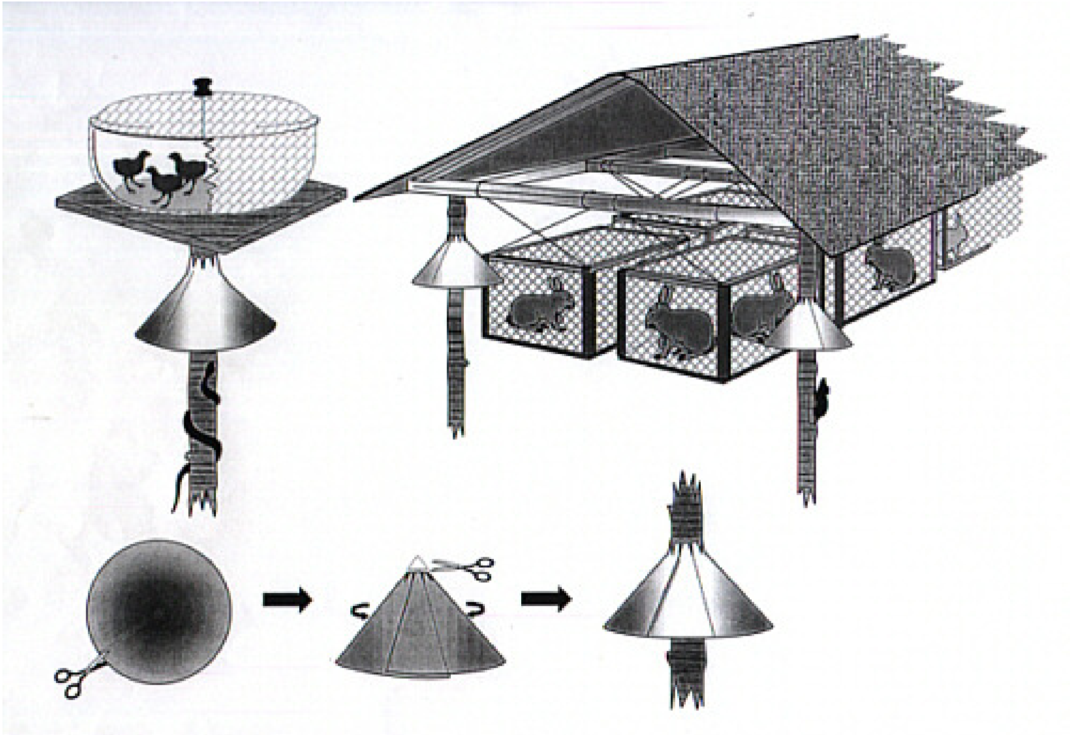


Fig. 5.3.2. Metal cones are a simple technology to protect the animals from climbing predators.

Sailors used this system for centuries to stop rats climbing the ropes and getting on board. All advisers should know this simple appropriate technology, because, though the system is still in use, it is surprising how infrequently it is adopted. When a sheet of tin is not available technicians can learn to usethe small rectangular surfaces of two or more old tin cans, which when joined together, provide a sufficient surface area. When concentrates are used, ants entering the feeders

can constitute a major problem. In this case the legs of structures can be placed in containers filled with used machine oil. Of course the structures in this case become less stable; they must be lower and need at least three feet. An alternative is to cover the legs of structures with naturally occurring glue and to repeat the treatment when necessary.

These techniques are not always found in old books. Probably these problems, as is the case now, did not get the attention they needed. To pay systematic attention to what other people do, increases the chances of finding that the solution to some practical problem isalready utilised locally (figures 5.3.3. and 5.3.4.) and has, perhaps, an ancient origin.

Fig. 5.3.3. A shelter adopting combined local building technologies can be appropriate, cheap and easily prepared.

Fig. 5.3.4. Don’t think only of wire-net fences. Very good fences can be made with local materials, according to traditional techniques. They are more beautiful and harmonise well with the environment. They can be easily be repaired or remade, while wire-net is difficult and expensive to restore.

Also in villages and markets of developing countries some useful old technologies are still being used and can be learnt. For example stratifying rows of eggs and damp

clothes as a method of conserving eggs to be marketed during the hot season. Or feeding young pigeons by introducing their beak into the mouth of the keeper and blowing grains directly into their crop. Figure 7.1.1.12. shows how, near the sea in an East African country, the easily rusted metal window bars have been properly substituted by sticks, adopting a simple, old Arab technology.

Sometimes old techniques are reported by authors of simple advisory booklets. They are frequently published by development or co-operation organisations. It is always useful to look at these publications and not to think that they are too simple and unscientific. They can be very useful indeed.

5.4. Re-adapted techniques

When the area within which the animals are reared is fenced, it is easier to protect the entire area rather than each individual structure. A technique widely used in developed countries is to provide a wire-net fence with an upper part turned outwards (figure 5.4.1a). This technique can be adapted according to needs. A possible solution for fences made of tree branches, common in African countries, is drawn in figure 5.4.1b. Another possibility, adapted to adobe walls common in South American countries, is shown in figure 5.4.1c. Flat roof tiles can be set on the top of the walls or, to be more economical, simple hand-made clay boards or, if available, even the opened and flattened lateral surface of tin boxes can be utilised*. The tree branch fence can be reinforced at its base by old metal gasoline tank lids,

according to a technique spontaneously developed by an African breeder to better protect his small poultry house.

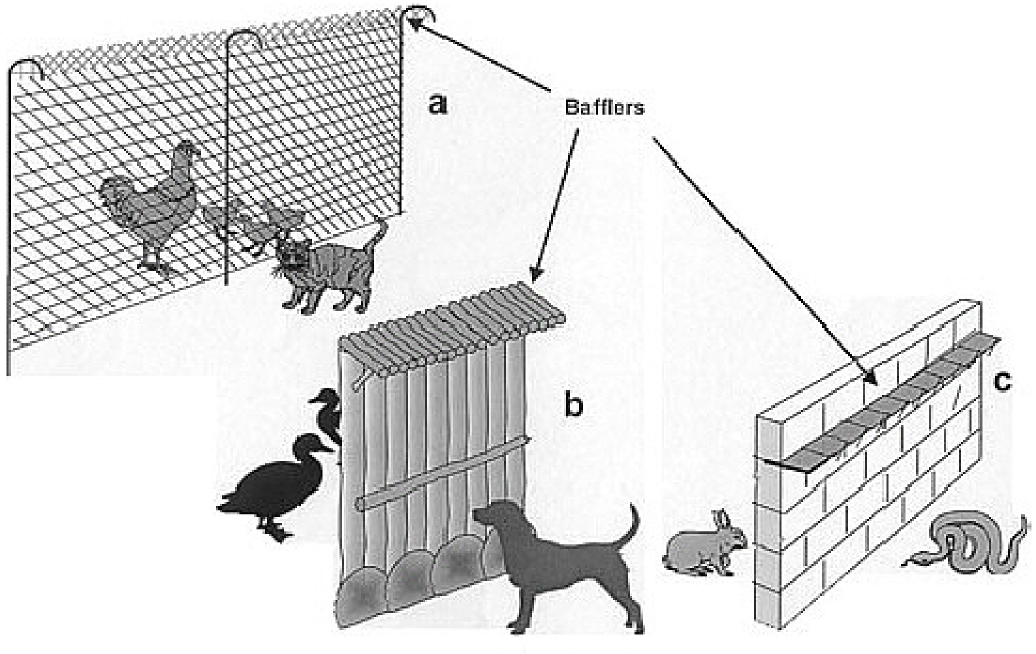


Fig 5.4.1. The upper barrier of a wire-net fence (a) prevents predators from entering the yards. It is commonly used in developed countries and can be easily adapted to wooden fences (b) or adobe or brick walls (c).

In these cases, since technology cannot be transferred as such (wire-net being too expensive for poor economies), it is possible to transfer only the idea, as it has been shown. The principle to be remembered is that fences or walls need some protruding upper part to prevent animals climbing over them. Then it is possible to find some practical solution for this complementary goal, that uses local materials to improve traditional structures.

The idea can be applied to many different situations and with the inverse function of avoiding the escape of reared animals. A similar protruding device can be utilised on the inside of nets fencing open-air snail keeping units (Various Authors, 1998).

In this Chapter, Chapter 5.3. (Old techniques still utilised), Chapter 5.5. (Looking for appropriate new techniques) and in many of the Chapters devoted to single species, the major and frequent problem of protecting the animal from predators has been considered. This is a problem that is proposed continuously but it is not without solution. Sometimes, as in this case, solutions are many and can be found in the old, in the re-adapted and in the newly proposed simple technologies. Advisers must be convinced that "Where there is a will, there is a way", as the British proverb says. Simple no cost equipment, structures and systems can be provided and shown to be efficient. It is not always wise to adopt industrial technology when these simple solutions exist.

Settlers from developed countries were probably the people who were obliged to adapt their own techniques to the local conditions. Farmers and missionaries generally have a backyard of some sort. They know a lot of practical things and it is always useful to pay them a visit to look at what they do, keeping in mind some specific problem you need to solve, and to ask their advice in case they have a useful idea to propose.

As an example, a missionary, in equatorial

West Africa, built a rabbit house leaving gaps between each brick to improve ventilation. The many holes in the walls allowed a continuous air stream, so relieving the condition of heat stress in the animals. In fact the environment was very comfortable, considering the climate. The missionary explained that it was simply an adaptation of a structure used to dry maize in his country.

Figure 5.4.2. shows how the design of traditional cages can be simplified to a three foot structure which is more easily self-built, requires fewer materials, but remains perfectly functional.

Fig. 5.4.2. An original design for a simple cage in Central Africa. It is a good example of readapted technology (IFCAT-URADEP, undated).

At a higher technical level, figure 5.4.3. shows how a small incubator for quail eggs can be self-produced with local materials, simply re-adapting the elements necessary to make it to work.

Fig. 5.4.3. Re-adapted technology. When a technology is known, it is possible to utilise cheaper materials to self-build some useful equipment. Polystyrene, tin, a heater and a thermometer are sufficient to construct a simple incubator for quail eggs.

Alfalfa is a widely dispersed protein-providing plant that is customarily administered fresh to both backyard birds and mammals. In developed countries it is used in a

dehydrated form as a component of balanced mashes. This is frequently impossible at rural level because there is no means of milling the hay. Feeding as hay is also inefficient because the crop leaflets detach very easily from the stems and get lost.

Fig.5.4.4. Molasses blocks may have a different composition. Rabbits nibble them down and nothing is lost if the remainder of the old blocks is included in the new before they are so small that they fall under the cages.

A practical solution is to beat the hay to make the leaflets detach and break down into small particles. Stems can easily be collected and fed to ruminants. Remaining broken leaflets can be introduced to homemade mashes for birds or to molasses blocks for small mammals*. The topic is discussed in Chapter 11.2. (Feeding and simple technologies). Molasses blocks are a re-adapted technology, without added urea, derived from the ones used for ruminants. Blocks are licked by ruminants but are nibbled by rabbits. It is possible to control the hardness of the blocks by adding a small amount of cement. This can reduce ingestion and avoid intestinal troubles depending on the high molasses component (Filippi Balestra et al., 1992; Amici and Finzi, 1995). Local by-products can be included and roughly balanced. An advantage offered by the block technology is that there is practically no waste, unlike with pellets in the industrial system. Residues of blocks can be recycled* by adding them to the prepared mash before they become so small that they fall under the cages (figure 5.4.4.).

5.5 Looking for appropriate new techniques

It is common for specific equipment to be requested for raising small animals, to improve their hygiene conditions, allow better utilisation of feedstuffs or protect them more efficiently. However, it must be remembered that the socio-economic conditions of target people are likely to have been very unfair, and therefore resources will be very limited. It may be that simple, low cost technical solutions to specific problems are not known. Or that solutions depend upon

expensive technologies that poor people cannot afford, or, worse still, that need to be imported. In any case something novel must be invented, because providing new equipment at the beginning of relief projects normally fails in the long run. This is because people are unable to amortise loans on the equipment received, both for economic and cultural reasons. The import of expensive equipment should not even be proposed in no-income socio-economic conditions, unless favourable market conditions will allow amortisation to take place. The alternative of proposing and testing simple innovation is always possible.

It is useful to examine how new simple technologies have been suggested or produced. The aim here is not to publicize appropriate know-how, because a more specific publication would be needed, but to examine how practical solutions to specific constraints can be found. This should give confidence that, when a problem is identified, a thorough discussion among open minded consultants, field technicians and breeders can lead to a viable solution. Of course all the identified constraints must be individually considered, and any possible action to reduce or to nullify their effects should be examined. Some examples can clarify these concepts.

A common question when rearing small free-range animals is how to protect young poultry or rabbits from birds of prey. Until now it has been an unresolved problem but a proposed solution is to stretch some nylon threads above the area where the animals are being raised. When the raptor has identified its prey it descends at high speed with its wings closed. As it opens

its wings on landing or spreads them to fly off again, they get caught in the threads, causing pain, which dissuades the bird from trying again. The probability of success depends upon the spacing of the threads but, since the aim is to keep predators away, the most important thing is to ensure that the bird hits the threads at some point in its attack.

The system has not yet been tested. The idea was found by extensive questioning of people involved with the raising of small animals. In the end, the idea came from a zoologist. This is not strange because zoologists are more interested than breeders in animal behaviour. The conclusion is that, to invent something new, which must also be simple and cheap, the technician must believe that there is a solution. If he or she is unable to find one, they would be wise to keep asking around in case someone has a viable idea. When there is a problem, a positive attitude is needed to solve it in a simple way with locally available materials. To guarantee sustainability, this should be carried out within the constraints discussed in Chapter 3.1 (Backyard conditions and development goals) . A series of examples are reported here to demonstrate that the route to innovation is not closed, and the rural technologies, that remained frozen when industrial production began, can start to develop again. This will be possible as long as technicians, working on behalf of low-feed no-income populations, strongly believe that it is possible to develop an original and sustainable know-how, appropriate to small animal keeping systems, and not related to the simple transference of technologies from developed Countries. Analysing how guinea pigs are kept

in South America, it was observed that, even in industrial units, forages were fed directly onto the floor, as is traditional in all rural raising systems. In spite of the evidence against this with other species, technicians still think that this is the only way to administer feedstuffs to guinea pigs. If not, they would have looked for some practical solution to the problem. When fodder is administered in the traditional way, a part is wasted and hygiene is impaired by the fact that the animals cannot avoid trampling on the forages and dirtying them with faeces and urine. It is easy to verify that about 16% percent are wasted in this way. An obvious improvement is to make wire-net baskets that are suspended within reach of the animals (figure 5.5.1.). This technology was proposed, in fact, in an early technical publication (Aliaga y Pe�a, 1985), but apparently it was never applied. As much as 15% of the forage can be saved by using wire-net baskets (Finzi et al., 1994). Wire netting with 1-inch (cm 2.54) holes is the cheapest, and the easiest for the animal*. It is functional and can easily be hung over the guinea pig boxes by two sticks propped on the box walls.

Fig.5.5.1. A wire-net basket to feed forages to guinea pigs.

This saves 15% of the forage (93% of the wasted part) or raises 15% more animals and is an improvement difficult to obtain with simple equipment in the economy of poor countries. Also the improved hygienic conditions, though not quantifiable, are certainly an important factor where environmental conditions are unreliable and the use of pharmaceutical drugs is nearly impossible. An objection may be that very poor people have neither the will nor the means to buy even a small piece of wire netting, and this is true. A no-cost technique was therefore invented. It is described in Chapter 7.2.2. (Guinea pigs)and shown in figure 7.2.2.7.

During a technical consultancy in North Africa it was ascertained that the limiting factors to improving rabbit keeping were neither nutritional nor genetic, as indicated in the terms of reference. The real constraint was the high temperature that stressed the animals, preventing reproduction for nearly four months. The only way to avoid this problem, was to permit them to shelter underground according to their natural ethological traits (Finzi, 1987). Some concrete cells were built, covered with soil and connected through a tube to external cages (figure 5.5.2.). The system* worked perfectly and local technicians substituted the concrete cells with cheaper clay pots produced by local manufacturers. The underground cell system was also successfully adopted in an Asian country (Nguyen et al., 1996). Compared with cages, 60% more were weaned because there was a 39% increase in births and a 16% reduction in mortality. Thanks to its efficiency the new housing system can be utilised in developed countries to produce organic meat. It is only necessary to spread the system more widely.

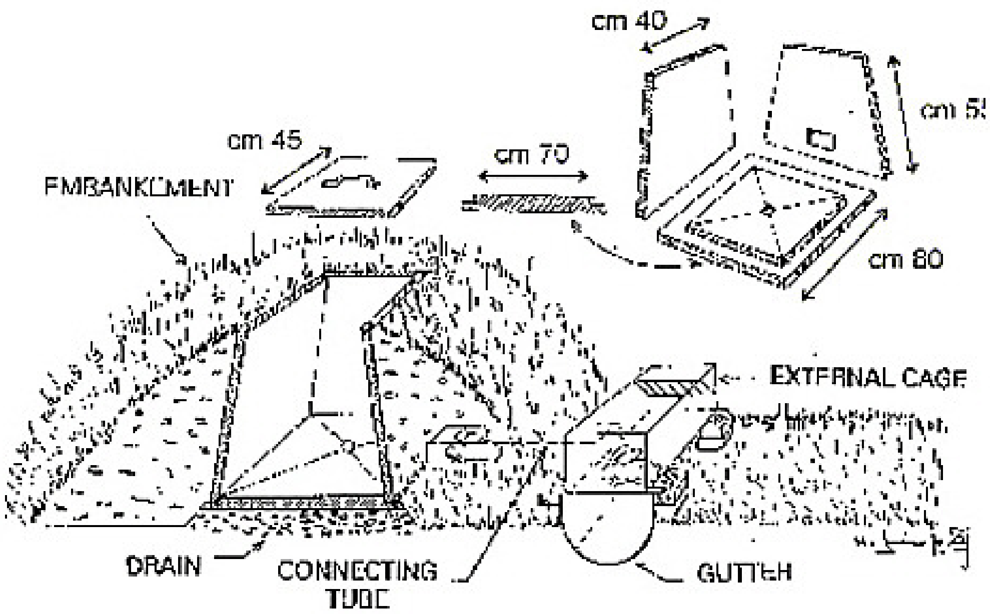


Fig.5.5.2. Scheme of a rabbit underground shelter*.

In comparison with the traditional system, where rabbits dig freely in the backyard, the underground-cell system permits the individual control of does. It is built directly by the user with a variety of cheap local materials which var in shape and dimensions and it is modular, allowing the unit to grow gradually according to needs. The superior efficiency of the system compared with both the cage keeping and the traditional free colony was quickly established.

When it was necessary to build cages without using scarce wood supplies, a reed frame was proposed. To make the

frame stronger three reeds were to be tied together, but the farmer used only one. Nevertheless the frame was very strong and durable (figure 5.5 3.) and remained unbroken after two years. When a proper base was found, lateral walls were protected by a cheap wire-net, which prevented the rabbits gnawing the reeds. It was also clear that strong lateral walls were unnecessary and this can reduce the cost. As rabbits cannot escape from the top of the chamber, alarger wire-net was used to allow quick and easy feeding of forage from above . The animal takes the forage easily and it remains clean as with the wire net basket.

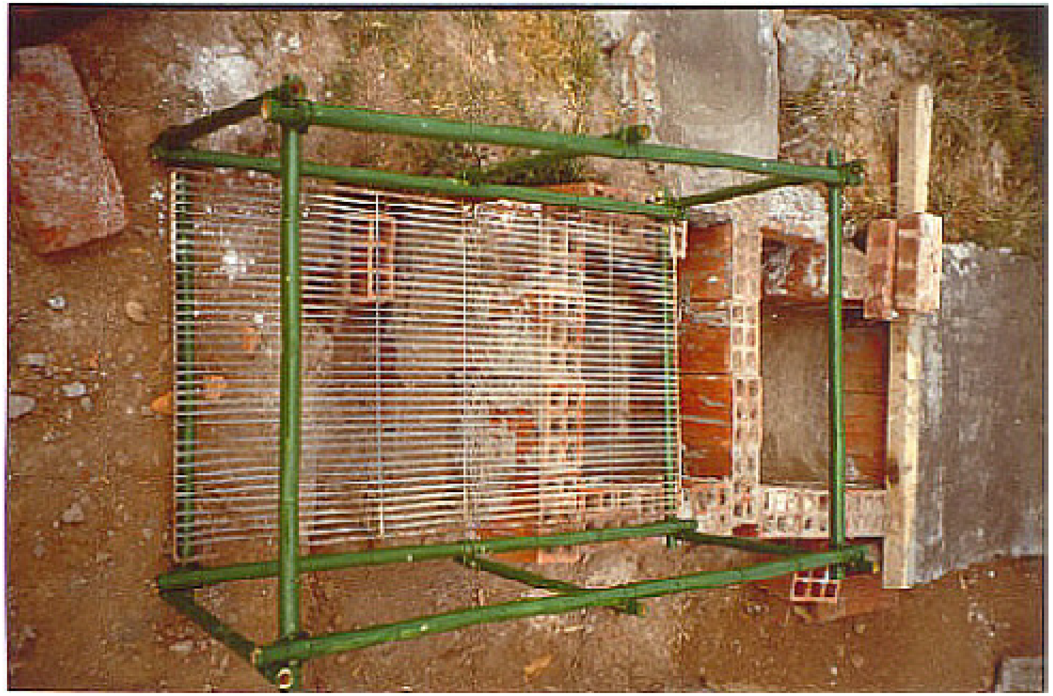


Fig. 5.5.3. A reed frame as a low cost self-made cage. On the bottom a brick underground cell is prepared*.

When a local farmer develops a new technology it frequently goes unnoticed and even if it gets attention, it takes a long time to become known and adopted. It is therefore the duty of the field consultant to pay attention to anything new he or she perceives. If it is a useful innovation it must studied and tested. If successful, it will become part of the technician's knowledge to be taught whenever possible. The reference to local technologies is frequent in this book and some innovation is reported. Here are some more examples.

Among the different local systems that allow rabbits to dig in the ground, an interesting one was adopted by a North African population on the edge of the Sahara desert. They knew that it was practically impossible, in such a hot environment, for rabbits to reproduce in summertime if kept in cages. But these people were able to dig 1.5 m or more deep pits in the hard sandy soil and a pair of does and a buck were put in the bottom from where they had access to their burrows. At the bottom of the pit, a temperature 9.6�C lower than a shaded area at the surface was registered.

This particular local technology (figure 5.5.4.) was found a few years after the underground cell system was invented. It confirms that the principle of bringing back rabbits to their underground natural conditions is a functional way to protect them from heat stress. The pit system is less efficient because the control of the animals and litters is difficult, but it shows how keen the people were to develop a new appropriate technology in such extreme climatic conditions.

Fig. 5.5.4. A rabbit colony at the bottom of a pit system on the edge of the Sahara desert.

A further system had to be invented to solve an emerging problem created by a new need. Figure 5.5.5. shows a new drinker, cleverly invented by a North African breeder, simply by applying a drip nipple to a plastic container. The idea was very successful and useful because, when there are a larger number of animals, the inverted bottle siphon doesnot provide enough water and the pots normally used as containers are not as hygienic as the proposed model.

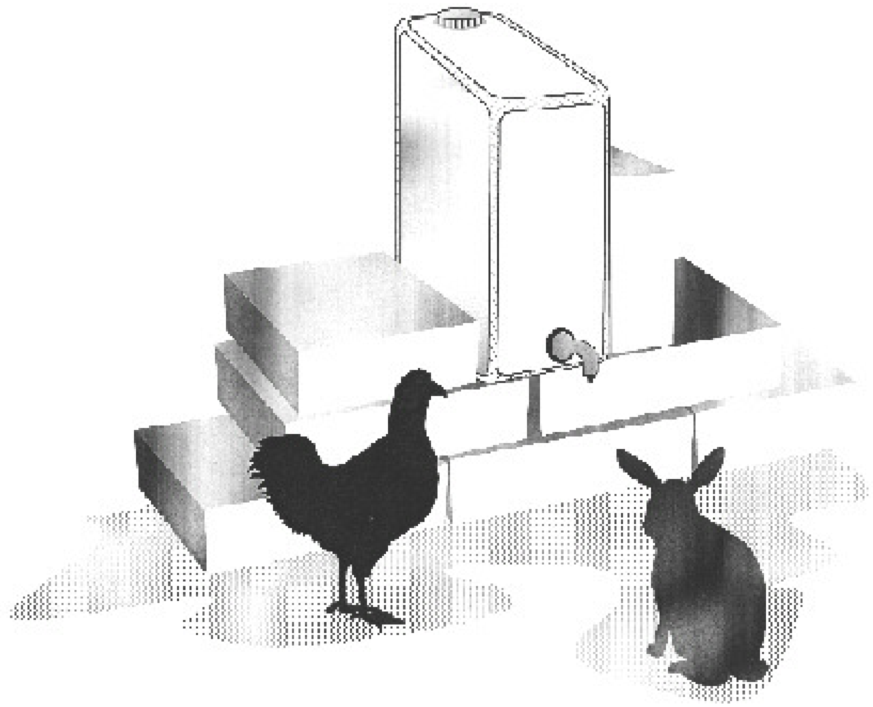


Fig.5.5.5. This very good drinker was invented by a North African breeder.

He simply applied a drip nipple to a plastic container.

A similar problem arose when, in an East African country, it was observed that feeders of industrial origin were not properly utilised as drinkers in a small unit of laying hens. Clay siphons were easily prepared (figure 5.5.6.) They can be made to any suitable dimension and contain 3 to 5 litres or more.

Fig.5.5.6. An experimental self-made earthwork siphon-drinker dispensing clean and fresh water*.

Clay drinkers are very stable and can be moulded to different shapes. When clay pots are not glazed, they remain permeable to air, and water seeps out. To avoid this, it is sufficient to treat both surfaces with a thin layer of cement made liquid by adding sufficient water (Finzi and Good, 1987). Due to evaporation at the pot surface, the drinker dispenses water 10 �C cooler than from other containers. In hot climates this is a positive feature. At the end of the trial (figure.5.5.7.) the breeder decided to substitute the industrial equipment, which had been improperly used with the new simple clay siphons.

Fig.5.5.7..Clay drinkers are compared with industrial plastic feeders not properly utilised as water containers for hens. The rounded shape (in the centre) is best because it prevents hens sitting on it.

The next example refers to management. When domestic rabbits are free range, a practical problem is how to catch them.

A North African man raised a few rabbits under a bush outside his house. The system was unfenced. Rabbits did not escape both because of their territorial

attitude and a vast barren land all around. Only some animals were lost from time to time due to the presence of small desert foxes. The man had dug a shallow square-section hole in the ground near the bush and fed the animals in it. When he wanted to catch a rabbit he had only to offer some alfalfa and then trap it in the hole, covering it with a lid.

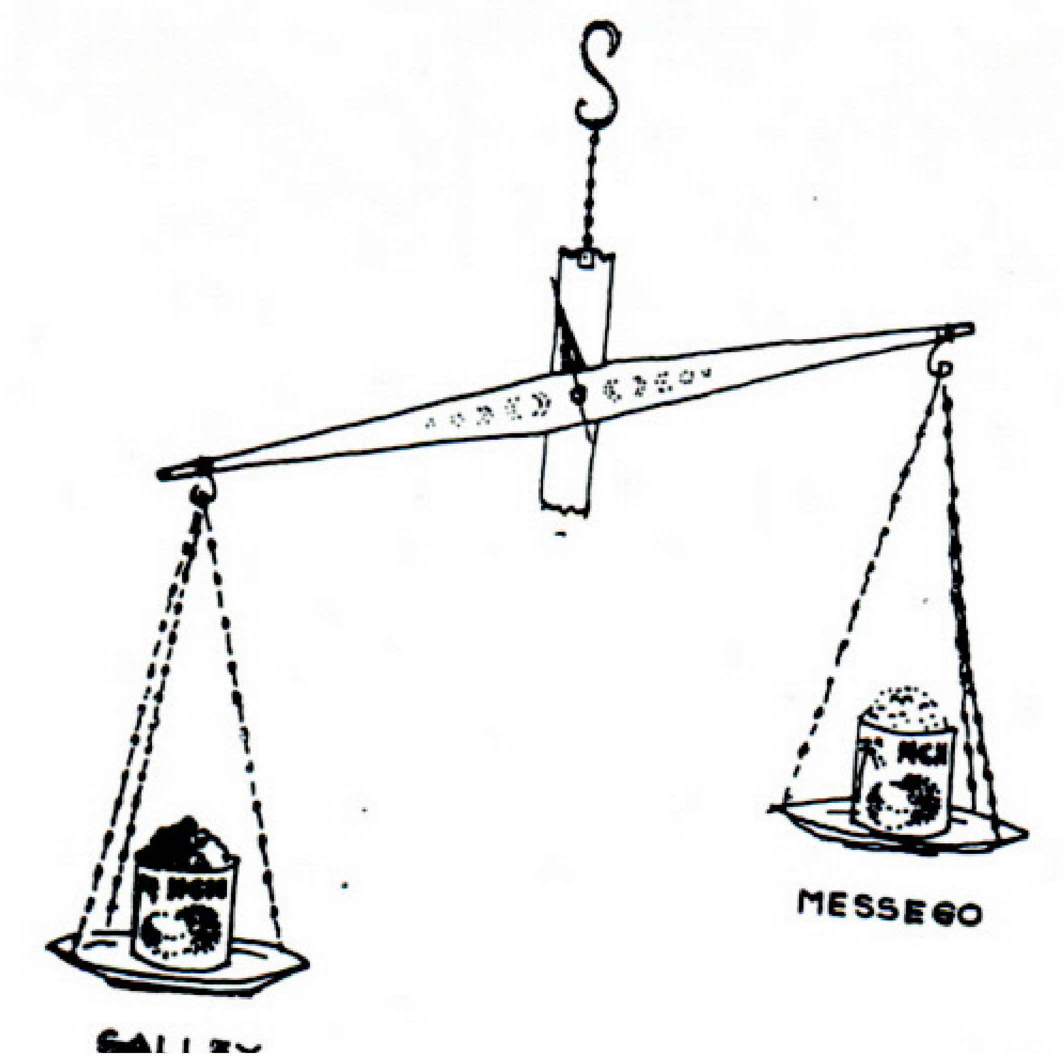
This example demonstrates how a resourceful man can easily solve problems. In European warrens, rabbits are normally hunted and neither control nor management is possible. A self-catching system for improved warrens is described in Chapter 7.2.1. (Rabbits). Though very simple, it required two years of trials to be properly developed. The ease and smartness with which the African man had solved the same problem was widely admired.

The last example shows that a careful analysis of all aspects of a production system is sometimes sufficient to find out how it may be improved, and to a greater extent than one might expect. And this was achieved by doing practically nothing.

It is enough to look at farmer's behaviour.

To teach some students the technique of field analysis, the African farmer mentioned above was followed while carrying out his job. When he went to the market to buy grains to make up the mash for his hens, he bought sorghum by volume, according to local custom. A volume of each grain available in the market was then bought and the price recorded. The grains were later weighed to allow the students to "discover" by themselves what was immediately obvious. Sorghum (messego) was 7.1% lighter and 16.6% more expensive than maize. In a manual on nutrition, it was stated that by weight,sorghum and maize were comparable because the higher protein content of sorghum was matched by the lower digestibility of maize. To help the students understand the difficult abstract concept of specific weight, figure 5.5.8. was prepared to show the different weight of the same volume of the two different grains (Finzi et al., 1985). In a few weeks, without any extension work, and only as a result of talking to each

other , all the breeders in the area began to feed their hens with maize instead of the traditional sorghum. The improvement in efficiency was: 7.1 + 16.6 = 23.7%. And this was achieved only by analysing the system!



Hal koombo oo galley ah wey ka culeys badan tahay (gr. 750) waana ka raqiisan tahay (12 Sh.So.) hal koombo oo maseggo ah (Gr. 700; Sh.So. 14). Markaa waxaa loo baahan yahay in laga taxadaro in raashinka digaagga lagu cabiro koombo, sababtoo ah waxay keeni kartaa qiimaha cabirka nafaqada cuntada oo qaldama.

Fig. 5.5.8. This drawing was used to illustrate, in the local language, that feeding hens with sorghum (messego) is wrong when maize (galley) has a higher specific weight and lower cost.

It was later observed that the farmer used white maize instead of the red variety that was also present in the market at the same price. Red maize is rich in carotene and the farmer was taught to prefer it because of the growth promoting and anti-infective action of the pro-vitamin A content. This is of considerable importance in poor economies where the pharmacological control of pathogens is difficult, and even impossible for many reasons, primarily because of the availability and cost of medicines.

Switching to red maize was also very

rapid among the keepers of laying hens. Improvement in sanitary conditions was difficult to evaluate, but its importance can be deduced from the fact that industrial poultry mashes always have vitamin A added.

Anyhow the 23.7% no cost improvement in efficiency calculated above, and obtained only by analysing the system, is more than enough to satisfy any field technician, who knows how difficult it is to obtain even a small improvement in the animal backyard keeping units of the poor rural areas.

In Chapter 5.3. (Old techniques still utilised) the problem of predation by mice has been considered. If hutches are kept in the open air some defence is still possible (figure 5.3.2.), but when rabbits are kept in a small room, as frequently happens, defence is almost impossible. Mice climb the walls and then jump onto the hutches where they easily find a way to reach the newly born litter. Mice eat kittens when they are defenceless.

A young woman in a village of Central Africa through clever management was able to solve the problem. She knew that does naturally feed their kittens once a day.

Thus she planned to put each litter in a

box, immediately after parturition. Each morning she put the does in the boxes with their own young. After feeding, the does were returned to their hutches and the young kept safe in the closed boxes where the mice could not reach them.

This management system, though different in aim, is similar to the modern technique of programmed milking on industrial farms. In this case nest-boxes are opened once a day to permit the does to enter. With the African woman's management system, the difference is that the does must be brought to the nests and put back by the breeder.

We can conclude that there are many simple solutions to practical problems regarding housing, equipment, nutrition, health and management. And there are many ways to discover them. The only unsuitable way is to try and transfer an advanced technology without thoroughly analysing the system we intend to replace. In favourable conditions, advanced technologies are sometimes suitable for animal keeping in Developing Countries. But mostly they are expensive and unsustainable and used only as a means of avoiding a search for more appropriat simple technologies.

6. Diversification and integration

Production systems can overlap or develop in sequence to balance the advantages and disadvantages of each activity, or to exploit wastes from a previous activity as a positive input for the next. These activities may or may not take place at the same time. An example of a functional sequence is when polluting duck droppings (negative trait) become useful to fertilize fish ponds (positive trait) or horticulture wastes (negative) are utilized to feed rabbits (positive).

A variety of possible combinations of animal rearing and plant production systems have already shown that they can be useful and are commonly practised. Not all of them are well known, nor have they been properly analysed to optimise the contributions of the components of the integrated system under field conditions, or with respect to seasonal variations. Many new combinations should be tested. Any good field technician should be able to identify empirically the elements that can be introduced or more efficiently balanced in order to improve the system. This should be don to avoid new inputs or to reduce inputs in comparison with each separate activity. It is often possible to integrate different components that are currently unconnected with the system, but to which they could contribute. This is a very difficult subject to treat theoretically, and it is better to give a number of both simple and more complex examples before attempting to draw general conclusions. A good example has recently been reported (Watkins, 1998).

The technician describes how he was

successfully raising chickens in portable, bottomless pens, placed over high quality legume-based forage. The pens are moved daily to fresh forage. The forage helps to supplement the grain fed and the chickens help to fertilize the pasture and eradicate insect pests, particularly larvae that pupate in the soil.

When chickens follow cows in rotation, they scratch apart the cow dung and eat parasites and fly larvae (no-cost protein component of ingesta), helping to break the parasite cycle (no-cost biological removal of insects). When chickens follow vegetables, they help to eliminate such persistent pests as cucumber beetles and squash bugs.

After being exploited by chickens the pasture grows quickly, and then it is grazed again by cows. The following season, vegetables are planted which receive all or most of their nutrients from the livestock excreta. The health of both animals and plants is satisfactory.

It is obvious that moving the chicken pens every day makes a great deal of extra work. This is not a problem since the initial hypothesis is to act inside poor economies, where part-time work is commonly available and can be carried out by unemployed people, excess

labour on very small farms or by women engaged in primitive housekeeping. This simple no-input integrated production system seems ideal for developing countries and it may appear surprising that the example above comes from a certified organic, paddock-based, intensive grazing farm.

This is the second example showing that what is suitable for production in developing countries is also suitable for improving produce quality in developed countries. In fact the underground rabbit shelters described in figure 5.5.2., designed to alleviate heat stress in tropical countries, can also be utilized to improve animal welfare when a better standard of husbandry is required. While it is difficult to transfer technologies from the industrialized systems to the backyard without infrastructure, it is easy to do the opposite. This allows industrial production to be achieved in less artificial conditions, with lower economic inputs although maybe needing more labour to supply good organic products to a very demanding market, which is prepared to pay extra for them.

This is possible because efficient, sustainable systems in developing countries are necessarily less intensive and more environmentally friendly, rightly, according to the increasing demands of rich consumers. The extra money they are prepared to pay for organic products pays for the expensive extra work required in this case.

To physically separate species is a condition necessary but not sufficient by itself to achieve integration. Diversification in itself can be useful in providing

different self-consumption or income needs of the family, but it can also lead to a meaningless mix up of species. An example of this is given in figure 6.1.where hens and ducks are simply put together in a dirty room where they will only compete for the mash fed.

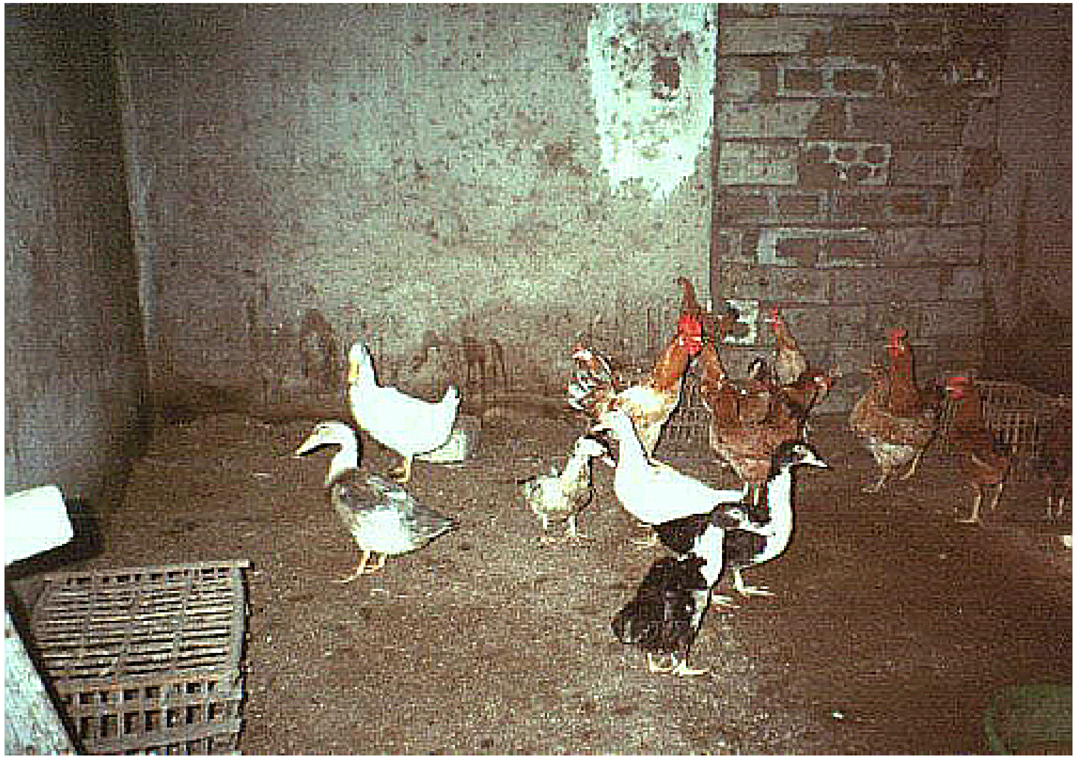


Fig. 6.1. A very bad mix of species, obliged to compete for the mash fed.

A more ordered use of different species is shown in figure 6.2. In this case, dwarf goats are not put out to pasture, but are kept permanently inside the closed area, thus becoming part of the backyard system. They are fed with palm leaves, guinea grass or elephant grass.

Rabbits are raised in the cages hung on the wall. Hens' nests are placed under the cages. There is space and cleanliness. Faeces can easily be collected to provide manure for the orchard and horticulture on the outskirts, from where plant wastes are collected to feed the rabbits. The system looks sound and profitable.

Fig. 6.2. Permanent backyard keeping of dwarf goats is not uncommon in West Africa. Here they are raised together with rabbits (in the cages

hung on the wall) and hens (a low set of nests for laying or brooding hens can be seen under the cages).

A still better, and nearly perfect, example of differentiation is shown in figure 6.3. Six different species are raised in the clean and well-managed backyard.

Fig. 6.3.

Sometimes diversification can lead only to competition among species, as is shown in figure 6.1. with reference to fowl. The same can be frequently observed (figure

6.4.) with herbivorous mammals.

Fig. 6.4. Rabbits are competing for feed with a goat. It is not clear if diversification here gives any particular advantage.

But an unexpected possibility of integration between mammals was found when analysing a grass-cutter-breeding unit.

It was observed that elephant grass and guinea grass, very common fodder used for herbivorous mammals in West Africa, are not completely consumed by grass-

cutters or rabbits (figure 6.5.). The cages or boxes where grass-cutters are raised are full of leaves that the animals carefully discard, stripping them to eat only the stems (figure 7.2.3.1.). On the contrary, rabbits choose the leaves and waste the stems. The question was then discussed with local technicians and they agreed that an integration of the two species is desirable to get complete exploitation of the grass. It was established that the logical order is to feed the local grasses to rabbits first and then it is easy to collect the stems to feed them to grass-cutters.

Fig. 6.5. Advantages of integration. Both rabbits and grass-cutters eat guinea grass and elephant

grass. When a single species is raised, part of the forage is lost due to specific feeding habits. If both species are kept, the grass can be completely utilized and the system perfectly integrated*.

But forms of integration can be generated spontaneously. They remain generally unnoticed but they are of extreme interest because they show how to improve efficiency and sustainability of backyard systems. It is quite common to observe that Muscovy ducks sit or wander and scavenge most of the time under the cages where rabbits are raised (figure 6.6.).

Fig 6.6. A good spontaneous integration. Ducks are used to living under rabbit cages as a chosen

habitat. There they feed on insects, eggs and worms found among the faeces.

Ducks can profit from the fallen pelleted rabbit feed, avoiding waste, and they can also find insects, eggs and worms which represent a very rich source of protein which would be difficult to supply otherwise. Again, ducks utilize any kind of animal slaughtering wastes very well (Finzi and Amici, 1989) and this is another reason to keep them as a part of integrated systems (figure 6.7.).

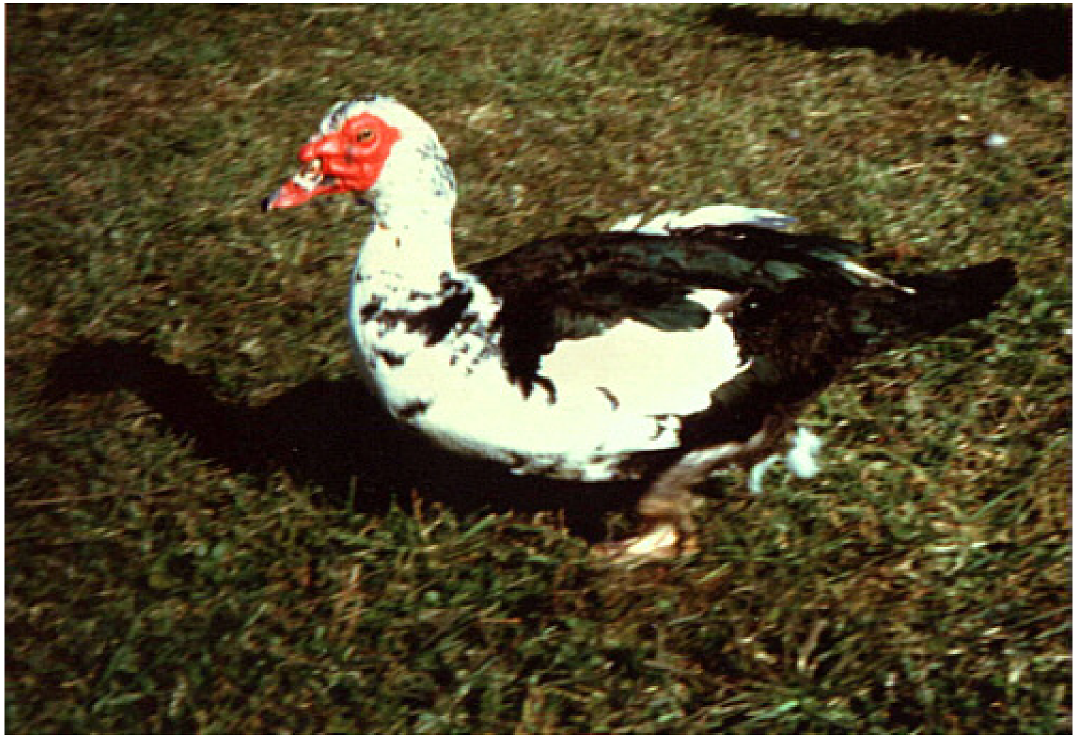


Fig 6.7. Rabbit offal is chopped before feeding to Muscovy ducks. This species is able to exploit any slaughtering waste. A wooden rabbit cage can be

seen at the bottom.

Very useful ideas can be obtained by project makers and field technicians by carefully analysing how species interact. Development of systems based on spontaneous animal integration has a good chance of success (figure 6.8.).

Fig. 6.8. Try to analyse the system before you click on the picture to read the legend.

In the trial illustrated in figure 6.8, 5 rabbit does and 1 buck were raised in an area measuring 6 x 2.5 m. Rabbits received pelleted feed and each doe produced a mean of 39 rabbits in one year. This corresponds to nearly 4 rabbits a week (10 kg live weight). When no feed was administered to ducks, an area corresponding to 6 adult rabbits was necessary to permit 1 duck to feed on insects and fallen rabbit pellets, but only when grass was also fed or pasture was available to the rabbits. Every 12 weeks, a mean of 2.5 kg body weight of Muscovy duck was produced. From the shaded arbour, 45 kg of pumpkins were harvested. Also a few strawberries were collected from the area around the underground part of the rabbit house.

The potential to achieve such diverse and valuable production from a backyard of only 15 m^2, well protected from predators and thieves, is an important object lesson for field technicians and project

makers. The integrated scheme is very complex because pumpkins give shade that is an important factor for rabbit production in tropical countries. Leaves, stalks and the external part of pumpkins are protein rich fodder for rabbits. Also they can be easily dried and maintained as a very palatable feedstuff to be used when green grass is scarce. The pumpkin is a tasty fruit to nourish the family, and the seeds, dried and salted, are loved by children, providing a food which is vitamin, protein and energy rich. It must also be remembered that the pumpkin seeds are a traditional medicine, which is active against intestinal worms. Other climbing plants can also be used, such as beans or grape vines.

From a 5 x 15 m Kiwi fruit arbour, covering 40 rabbit cages, 318 kg of fruits were obtained. No chemical manure was necessary. Leaves, stems and unripe fruits were a very palatable feed for rabbits*.

Rabbits are excellent meat producers and their droppings, before becoming manure for pumpkins and other vegetables, attract insects that are eaten by ducks, together with insect eggs and larvae. Muscovy ducks produce excellent meat and eggs. Compared to common ducks, the meat of Muscovy ducks is dark and lean. The whole system represents a very attractive enterprise for the housekeeper, who can take care of the animals without leaving her home. It must be noted that animals compete not only for food but also for space. Space is limited in backyards, and it is very important to obtain

different integrated products from the same area, as in the example reported above. Backyard systems are also still very common in rural areas of developed countries. Centuries of practice guarantee their sustainability. They normally show a more or less good degree of integration. The same may be observed in developing countries. This is a field where a lot of good work can be done through the action of well-performed co-operation. The examples mentioned above might give an idea of what can be done. In the next chapters single species are described, taking into account the traits that favour or impair integration. The information is useful to put together the more favourable combinations of species, according to the specific traits identified when analysing the local systems.

7. Backyard small species

Though the word "backyard" is frequently used, it is a generic term and conditions are very variable in practice. In the village, there may be a fence or a wall around the dwelling or group of dwellings. In many other instances, such an area is not defined and animals range and mix freely. Small animals are also raised inside the house due to the lack of external space, tradition or for better protection.

In reality, a lot of factors can be found which determine differences even between one backyard and the next. These are described in Chapter 14 (Analysis of small systems). The species that are raised depend upon the

general conditions, but many exceptions can be easily found.

In unfenced backyards, normally only two species are found. These are small local chickens and Muscovy ducks. A third species that is spontaneously spreading is the guinea pig. This is not always acknowledged because small mammals are kept inside the home and are not seen going around like chickens and Muscovy ducks. Many technicians are absolutely sure that guinea pigs are not present in certain areas, even when it is very easy to find them by analysing the system properly.

When the property is a farm, the number of species raised grows to the maximum. Practically all the important domestic small species and many breeds can be observed here and there. Sometimes a lot of them can be seen all together on only one farm.

On a West African farm, for instance, the species and breeds observed were: small local chickens, crosses with exotic chickens, Muscovy ducks, Rouen ducks, Peking ducks, geese, turkeys, pigeons, rabbits, catfish and bees. Fish were produced in three ponds and the integration with web-footed birds was rational. All the animals received supplementary feed.

The possibilities of keeping different species diminish in peri-urban areas. Lack of space becomes a limiting factor and scavenging is impossible. Local chickens and Muscovy ducks tend to be replaced by mash-fed exotic chickens and improved breeds of duck; rabbit keeping also becomes important. In urban areas, where there is no backyard, generally only rabbits remain. They are raised in any available place, and fed on kitchen wastes and grass collected in the fields surrounding the towns. In North Africa and South America, raising rabbits is a traditional activity that can profit from development. The same can be said about pigeons (see Chapters 7.2.1 (Rabbits) and 7.1.3 (Pigeons). If extension workers and technicians wish to promote more small animal species in integrated projects, they need to know about the general traits and methods of improvement of each species.

7.1. Fowl

When environmental conditions are hard and nutritional resources are insufficient, poultry seen in rural areas are mainly small and generally have an elongated shape. It is obvious that this morphological type is best suited to the environment. Unfortunately, their genetic potential for production is low but this, by reducing energy use, enhances survival capabilities.

At the lowest production level, fowl must rely only on scavenging. Different fowl species have scavenging capabilities that overlap only partially. Ducks are able to feed in ponds and pigeons are able to fly far from the backyard, finding nutritional resources that chickens

cannot reach. Thus, raising a mixture of different bird species is generally more effective than raising a single one.

A common way of thinking, when the aim is to improve poultry production in low-food no-income systems, is that local fowl are not very efficient, and introducing more efficient, exotic breeds can solve the problem. Only after careful analysis of the system can one evaluate whether this assessment is sound, uncertain, or wrong.

Rural and peri-urban areas are generally considered homogeneous, but they are not. In peri-urban areas, marketing of products from small semi-industrial units is normally easier and some people are willing to risk a small amount of capital. Thus the idea of introducing exotic breeds is more likely to be successful and lead to dissemination by imitation. But, in rural areas, it is advisable to maintain local strains and try only to protect them from predation, look for possible nutritional resources nearby and reduce the number of birds in proportion to the resources.

This can frequently be achieved by a more rational use of males, which are nearly always in excess. Excess of males can be explained in some situations but not in others. A negative example is illustrated in figure 7.1.1.1. in the next Chapter, where the topic is discussed further.

7.1.1. Chickens

In standard conditions of low-food no-income households, only a few scavenging chickens are raised.

When environmental and sanitary conditions are also adverse, it is hard to raise output above the minimum. Nevertheless chickens must be considered as the best potential converter of available feed resources. If feed is scarce, animals may not consume enough nutrients to allow even minimal production. If no concentrates are available, it is better to reduce the number of birds than having all the flock undernourished. It will then be possible to obtain some egg or meat production. Otherwise poultry would simply survive undernourished, until the more feeble subjects die. Scavenging feed resources, when utilised by fewer animals, can again reach the level that allows some production.

Only about 40 small eggs (<40g) are laid by local hens per year. But, as a consequence of losses during incubation and high post-hatching mortality, only 10 to 15 birds reach market weight. Nevertheless output can also be dramatically lower. Feed is rarely and scarcely supplemented, water is seldom sufficient, and predation is common due to lack of sufficient housing (Bonfoh, 1997). Infective diseases (mainly Newcastle disease) and parasitism cause heavy losses when animals, as is the rule in marginal areas, are neither vaccinated nor treated against worms.

Nevertheless, nearly all families keep scavenging poultry in some areas (Bonfoh, 1997). In a random survey in North African villages (Finzi et al., 1988), sixty percent of families were found to keep chickens. In East, West and Central African villages, representative samples (about a hundred observations each time) showed that the female: male sex ratio was constantly 1:2.5-3.0*. This

probably results from the small number (3-4) of scavenging birds that are kept by each owner, but also on traditional believing or ritual use. For instance there is a strongly rooted belief in East Africa that hens cannot lay eggs if a cock is not present. Also in many parts of Africa, only the cock can be used for sacrifices and its market price is higher. In any case, a cock must be kept when only 2-3 hens are present because all or most of the eggs are brooded (Finzi, 1998). The small number of birds normally observed is probably related to the amount of scavenged nutrients that can be found around the dwellings. Even after the end of projects which try to improve the number of chickens raised by administering extra mash, it is frequently observed that the number of birds soon decreases compared with the original number. This is because birds within the breeding systems must return to scavenging, if marketing problems make it unprofitable to feed more. This could be the case illustrated in figure 7.1.1.1. Some other points are considered in the analysis.

Fig. 7.1.1.1. Try to analyse the system before you click on the picture to read the legend.

Another very interesting case is shown in figure 7.1.1.2.

Fig. 7.1.1.2. Try to analyse the system before you click on the picture to read the legend.

Is the analysis of the scene correct? This is the moment to ask and ask again, because to understand what happened can help to avoid future mistakes. Sometimes other reasons can explain what the technician sees. Before checking, it is necessary for the technician to develop some ideas to explain what is seen, to put forward the appropriate questions and to arrive at reliable conclusions. These will become a precious knowledge base upon which future sound projects can be developed. The use of small shelters is common to protect the animals from predators. A number of different materials and shapes are adopted (figure 7.1.1.3).

Even though protection at night is effective, cleaning the shelters is difficult so that the spread of parasites and infectious diseases is increased. Recycled metal containers, bricks or cement-based products are preferred to wood because they are easily disinfected with fire.

Fig. 7.1.1.3. Try to analyse the system before you click on the picture to read the legend.

Building a shelter is often considered an improvement, and is certainly better than nothing. But from this point of view it is probably better to plant a shade tree by the house. This will not only improve the environment, but it should permit the birds to perch on the branches

according to their natural behaviour. In these conditions it is more difficult for predators or thieves to catch the birds, which can easily fly from one branch to another. Open air reduces microbial concentration and this, together with lower bird density, will reduce the spread of infectious diseases.

The construction of wooden feeders (carved or framed) is described in many manuals.At least for this purpose, industrial equipment is no longer proposed. Home feeders are also used in semi-industrial units (figure 7.1.1.4) . At the rural level, tin or clay is also used.

Fig. 7.1.1.4 The owner of a semi-industrial broiler and egg farm found it more convenient to prepare wooden feeders than to buy industrial mechanised models (West Africa).

Mistakes about drinkers are more common. Wide containers or tin boxes are frequently used. Tin boxes, if not secured, are easily overturned while wide drinkers quickly get dirty because birds walk in them, and sometimes cool their legs by immersion. Anyway, it must be remembered that metal quickly rusts. Expensive industrial drinkers are often found in semi-industrial units and this can be considered correct if justified by the economics (figure 7.1.1.5). Industrial equipment is frequently found in peri-urban, semi-industrial units. It is usually recycled material from industrial farms. These were built according to private or State projects without any previous appropriate system analysis. When the project fails equipment is unofficially sold or even stolen.

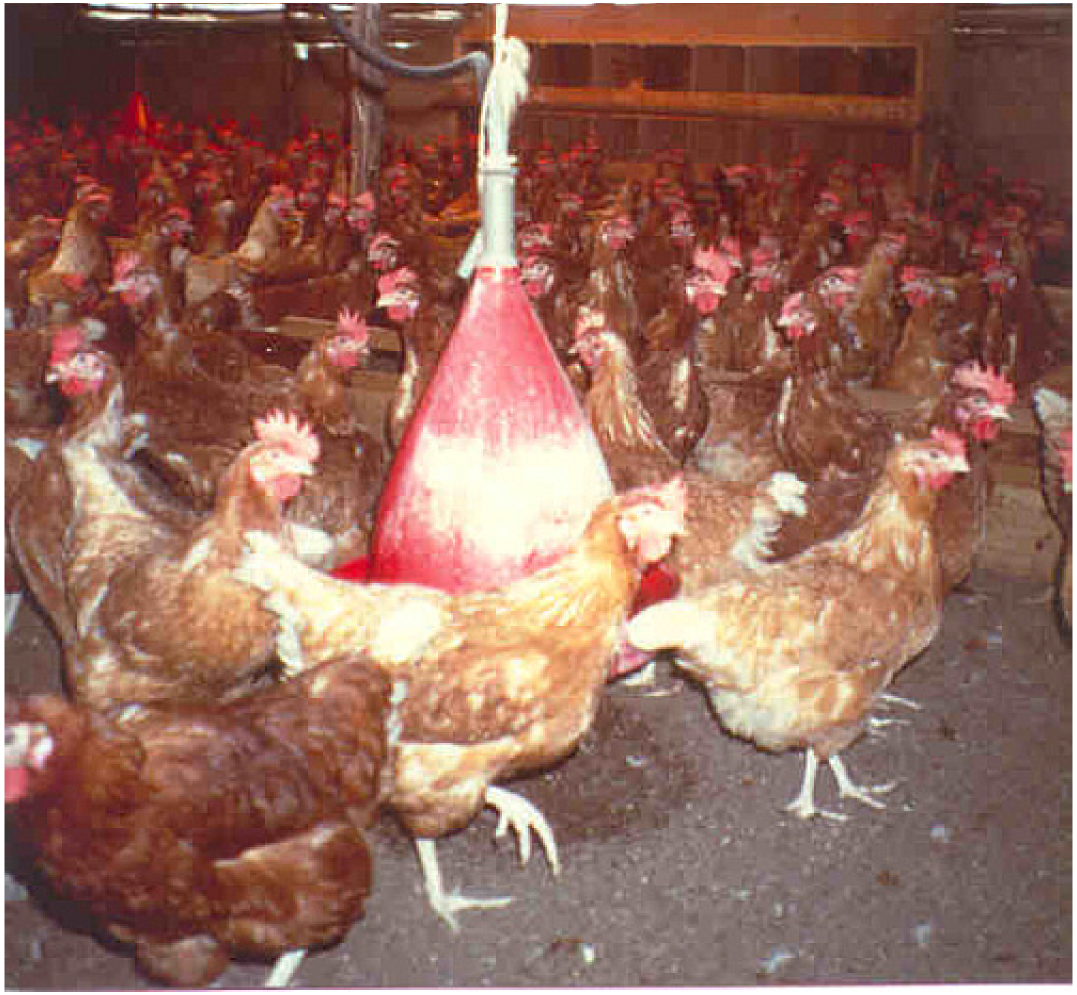


Fig. 7.1.1.5. Try to analyse the system before you click on the picture to read the legend.

The example shows that a private initiative can reduce investment costs and relies on simple local technologies. This normally avoids the most common mistakes that lead to failure, such as too many people being employed, lack of competence in both setting of direction and management, marketing problems with production

surpluses, and lack of necessary infrastructure. Equipment recycled is not always available and some alternative technology must be developed. Adapting cheap earthenware pots bought in the local market can easily produce good clay siphon drinkers. Properly shaped handmade containers can also be made into siphon drinkers of different sizes according to needs. They are easily produced from moulded clay cooked in an oven. They cool the water by half a degree centigrade and this has some importance in warm climates as a way for the hens to lose endogenous heat (Finzi and Good, 1988). Clay siphons are described in Chapter 5.5 (Looking for appropriate technologies) and illustrated in figures 5.5.5 and 5.5.7.

Most rural clay handicraft is permeable so water in the drinker is lost. It is necessary to glaze the clay. A simple way to get the same result is to deposit a thin cement-based plaster on both sides of the clay container* (Finzi and Good, 1987).

When feeders and drinkers are available to scavenging birds, the containers are frequently exposed to the sun. This makes the water hot and the mash ferments. It is important to set the containers in the shade. Stalls to lay eggs are frequently fixed structures. These are not the best when disinfection is difficult and costly, and for this reason, even cleaning is abandoned. In figure 7.1.1.6 proper mobile nests are shown. They are also good for brooding and can easily be cleaned, washed and exposed to the sun's UV rays for complete natural disinfection. Earthenware pots offer no place for parasites to hide. Anyway, they can also be put in the fire and easily

disinfected in this way.

Fig. 7.1.1.6. Clay pots utilised as mobile nests for brooding hens. A good, simple, cheap, local technology (FAO/12653/F.Mc Dougall, 1985). A good technician should be able to see that the hen on the left is sick (compare the comb and the eye with the hen on the right). A hint that the sanitary conditions of the unit need attention.

The importance of egg production changes according to market conditions. In rural areas, nearly all the eggs are brooded and the presence of eggs for direct consumption in rural markets is rare. The situation can change where there are bigger markets and in peri-urban areas. When eggs for direct consumption can be marketed, keeping

laying hens can become profitable, and the introduction of improved exotic breeds becomes advisable. It is very important to analyse the market before developing projects involving exotic laying hens. An example is discussed in Chapter 8. (Local and exotic breeds). The storage of eggs to be marketed is a problem that must be properly considered. A wooden container or preferably a clay pot into which layers of egg are alternated in cloth (jute sacks are better) is the best local technique. The cloth must be kept wet to cool the container by evaporation. The technique can be slightly improved by placing clean sand among the eggs to increase the contact area and extend the drying period. Conditions of storage can be tested by simply immersing the eggs in a pot of water. If eggs lay transversally, they are very fresh. As they get older they begin to incline, with the bigger pole higher than the pointed one. When eggs are completely vertical a lot of moisture has been lost to form the air chamber and this is the limit at which the eggs can still be considered edible. When the eggs float, they should be considered inedible. If many eggs are found floating it means that turnover is slow, selling eggs is difficult and it is wrong to start projects to produce them. After hatching, chickens must be protected from predators and a proper environment and correct temperature maintained. Good cheap, home-made local technology is shown in figure 7.1.1.7.

Fig. 7.1.1.7<

Try to analyse the system before you click on the picture to read the legend.

Prophylactic and therapeutic interventions are frequently considered as a basic need to allow improvement of rural poultry production. Nevertheless, it must be remembered that poultry have been kept profitably for centuries before the development of modern medical knowledge. In rural areas prophylactics and therapy are practically impossible to obtain due to cost, lack of specific drugs, lack of availability of small doses for a few animals, as well as storage problems. Low density, matching of animals to feed resources to avoid under-nourishment, utilisation of movable, easy to clean equipment should always be remembered. Old techniques should be recovered. Shelters made up of waste metal containers can be well disinfected by fire. When wood is used, smoke can be effective. Petrol and sulphur diluted in oil or, preferably, in waste car lubricant, can cheaply substitute expensive drugs used against external mites (figure 5.1.1).

Cooperative work in rural areas reveals many conditions that seem to relate to a very low level of technology. Nevertheless a careful analysis frequently shows that possible improvements introduce a cost factor without increasing outputs. Figures 7.1.1.8 to 7.1.1.10 show some examples.

Fig. 7.1.1.8 Poor economies have developed their own rough but efficient equipment. Here a simple drinking trough carved in wood is shown (Horn of Africa).

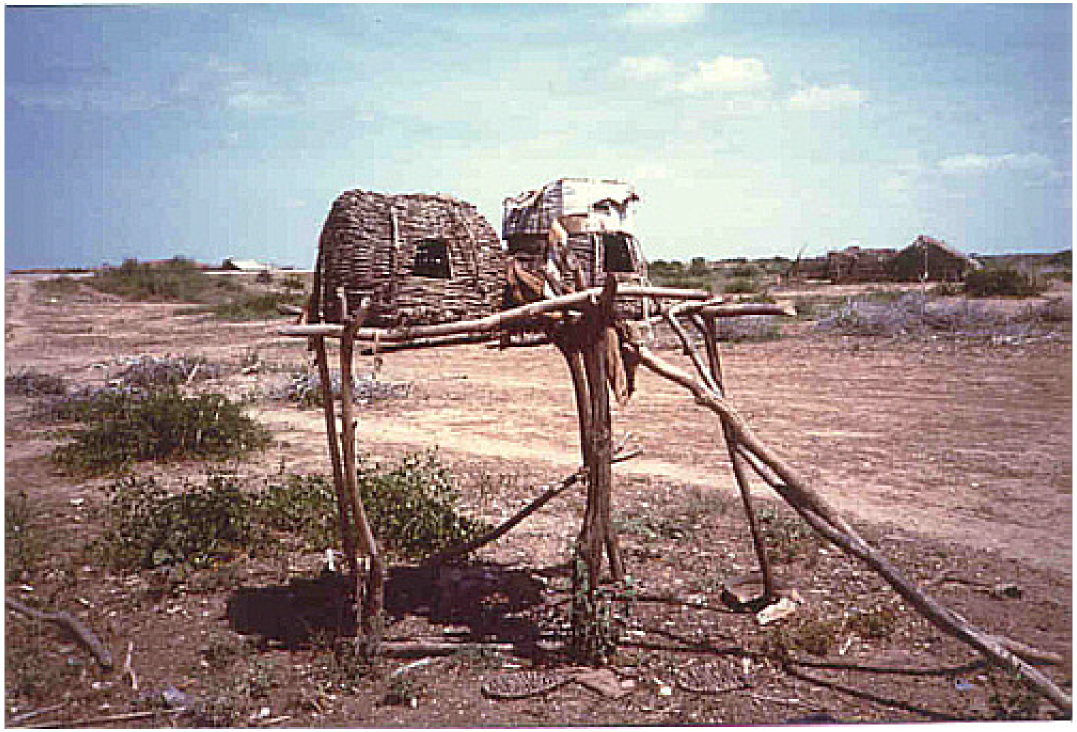


Fig. 7.1.1.9 Coops to protect chickens during the night are placed on forked branches out of reach of predators. The structure is not fixed and can be moved with the migration of pastoral people (Horn of Africa).

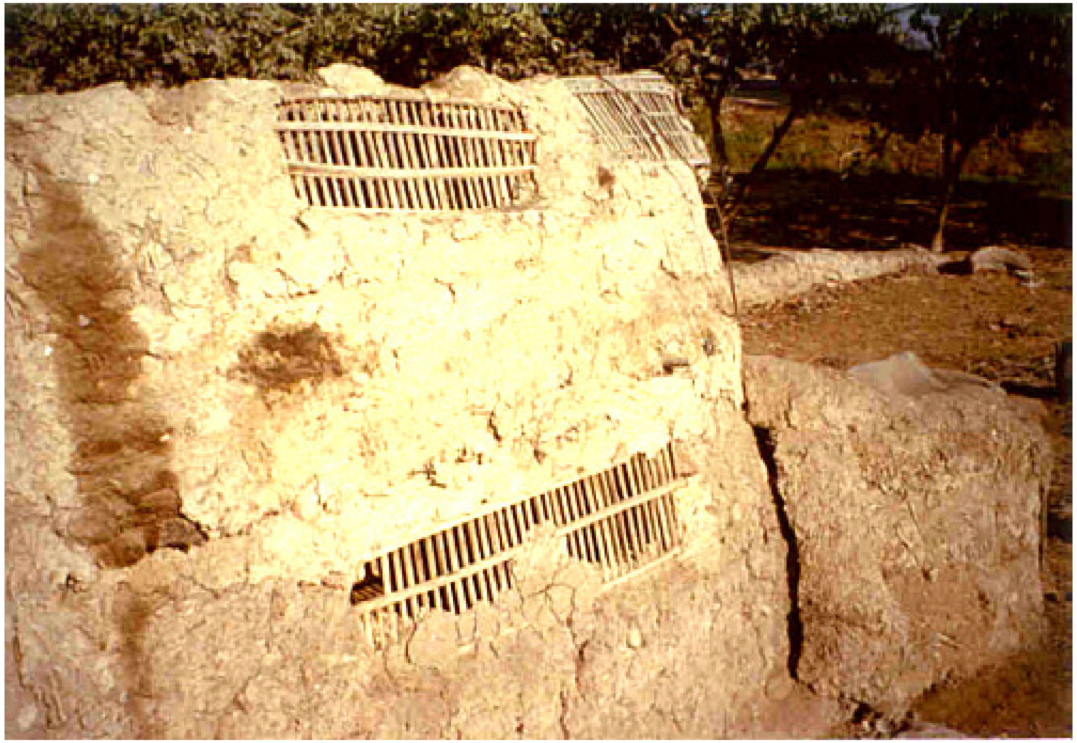
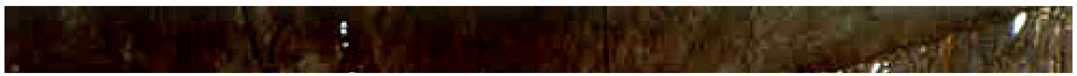


Fig. 7.1.1.10 Two superimposed mud shelters for chickens. They are cheap and efficient. The grilles to give air to the animals are made from sticks of palm leaf stems (North Africa).

As can be deduced from the dimensions of the very simple equipment, only a few chickens can be raised in the situation illustrated in the figures above. This is because the number of chickens is related to the available feed that can be obtained by scavenging. If the number is increased, the feed is insufficient and some animals die. This is the rule in small villages but, when dwellings are more spread out, flock sizes can increase. Anyway, no mash can be offered because it will introduce a cost factor not compatible with the system.

Finding chickens searching for food on manure is very common. Insects deposit their eggs there, earthworms develop spontaneously and birds find something to eat.

A heap of manure can be considered as a source of protein for chickens scratching about. This should not be allowed too close to dwellings. If the yard is fenced, the best way is to accumulate the manure outside the yard and permit the birds to get out during the day and close them again in their shelter during the night. In this way some grass could grow inside the yard, without being immediately destroyed by birds scratching about the ground for food. Turf can be laid to stop the dust and dirt blowing around inside the house and on the food. The presence of grass should improve the hygienic conditions of the environment and can be eaten by poultry if they are allowed to use it for limited periods. This is an example of a possible intervention to favour family welfare according to the scheme illustrated in figure 4.6. A manual on local equipment and raising customs, focused on very simple sustainable hen keeping systems has been published in the Somali language (Finzi et al., 1985). If marketing conditions are favourable, production can be increased by improving breed, feeding, management and by developing simple appropriate equipment. The latter must be home-made from local cheap materials to maintain low costs (figure 7.1.1.11).



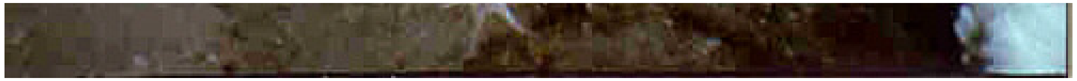


Fig. 7.1.1.11 Healthy and productive laying hens are raised in an apparently rough poultry house made from thin branches (Horn of Africa). The system was very profitable. When disinfectants are not available and cleaning is difficult, wood can be burnt as an alternative method of disinfection.

Right and wrong points can be found when a system is analysed, therefore it is nearly always possible to suggest improvements. Sometimes something very useful can be learnt by the technician if he is able to look and ask for explanations (figure 7.1.1.12).

Fig. 7.1.1.12 This room was adapted to raise hens in a town by the Indian Ocean. As was explained, wire netting was avoided because it rusts easily. Window grilles were formed from wooden sticks, according to an old Arab technology (correct). A Leghorn derived breed was chosen, being more fit to resist the hot environment and able to produce eggs at a lower cost (correct). New chickens were bought at the end of any egg laying cycle, thus cockerels were eliminated (correct) notwithstanding the widespread custom of keeping them. Disused industrial feeders were improperly used as drinkers (wrong).

It was then possible to recognise a common mistake in the area, that is the use of wire netting where the constant winds bring salt spray from the Ocean. The netting, weakened by rust, soon breaks. It was then found that barbed wire fences, though the wire is thicker, also have a very short lifespan. It was clear that traditional wooden grilles, live tree fences and fences built up with branches of thorn acacia are very appropriate and are to be preferred to expensive metal grilles or fences in those conditions.

Much about poultry breeding has been discussed in an electronic conference organised by FAO (1999) and problems of rural keeping were considered.

In any developing countries, scavenging chickens are frequently found together with ducks. Even though authors do not normally specify (except in Asiatic countries) the reference is always to Muscovy ducks. Apparently chickens are in competition with ducks, since they scavenge in the same environment by the dwellings. Nevertheless they are frequently found together so competition cannot be too extreme, even where there are no ponds and even where water is scarce. Possibly the strong beaks of Muscovy ducks enable them to exploit resources present in the ground (roots, insects and worms) more efficiently, which is scratched only superficially by chickens.

This is not certain and it is worthwhile to investigate the question of whether chickens and ducks are able to give a higher output together than each of them separately.

7.1.2. Ducks

Ducks belong to the genera Anas and Chairina. Though the first is considered more productive and favoured by projects, its spread into Developing Countries outside the original Asiatic area seems to be difficult. They can be seen mainly by ponds or canals (figure7.1.2.1). Ducks of the genus Anas are more demanding and need appropriate environmental conditions. Nevertheless, they are considered less susceptible to sickness than chickens, mainly in primitive domestic conditions (Pagot,

1985).

Fig. 7.1.2.1. Ducks by a small pond in a rural area (West Africa).

If ducks of genus Anas are found out of Asia, which is rather uncommon,they are generally found in the yard of rich people who keep them, together with geese or other birds, mainly as a sport or status symbol. Some information on raising ducks in a simple way can be found in a specific booklet (FAO, 1991).

The genus Chairina or Muscovy duck (figure 7.1.1.1.) originated from South America. When scavenging ducks are mentioned in Africa, the reference is nearly always to Muscovy ducks. These birds are spontaneously

spreading into poor environments in rural areas where they can survive and produce under very marginal conditions. This is a sure indicator of sustainability. Projects for low-food no-income people should take into consideration this species which appears to give a guarantee of success.

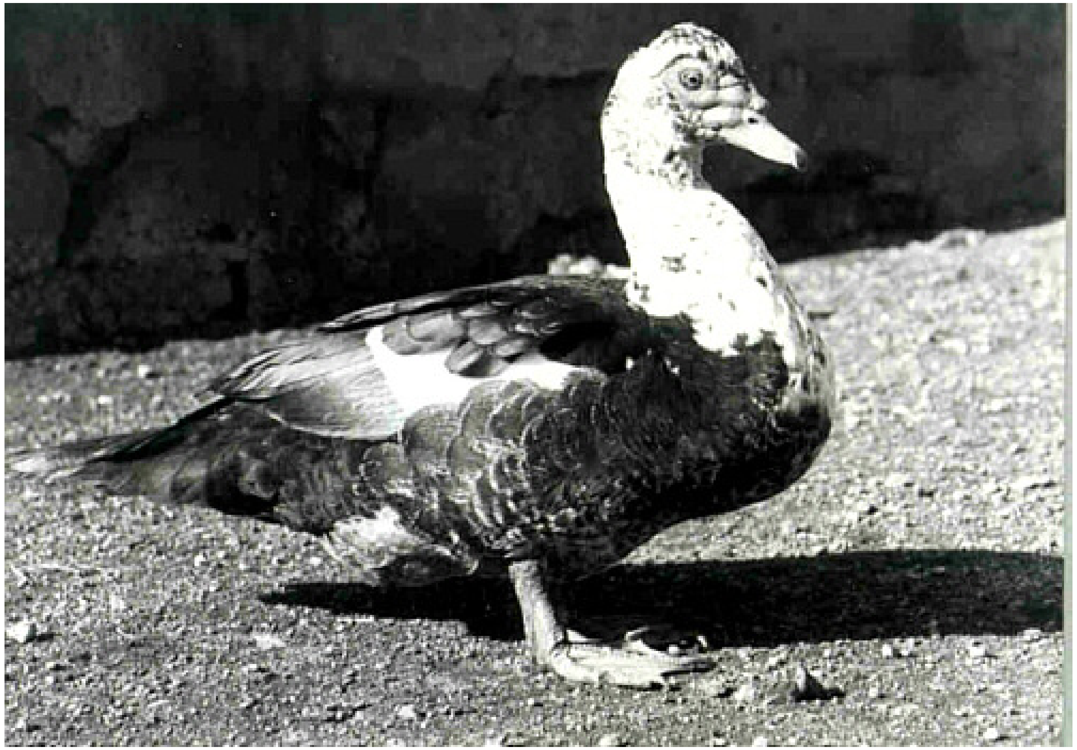


Fig. 7.1.2.2. A Muscovy drake. The species is distinguished by the red carbuncles around the beak and eye. When menaced, instead of a call it emits in reply a kind of hiss or whistle. It is very hardy and suitable for use when environmental conditions are harsh.

7.1.2.1 Muscovy ducks

The Muscovy duck is a rustic and hardy species. Though it is a web-footed bird it needs only a minimum of drinking water. It is able to scavenge and to profit from pasture. Its meat is dark, lean and tasty. Adaptability, resistance to sickness and ability to incubate eggs of other species are other positive traits. The capability to spread spontaneously far from South America, where it originated, into very hard tropical areas demonstrates its exceptional fitness (figure 7.1.2.1.1).

Fig. 7.1.2.1.1. Muscovy ducks going around

undisturbed to scavenge in a rural market (Central Africa).

Muscovy ducks are efficient predators on mice and snakes. They also feed on insects so they can contribute to the protection of the house and improve hygiene and safety of the environment.

In a local West African dialect all ducks are called "qu�-qu�". As the Muscovy duck has no call, it is clear that the onomatopoeic word originally indicated the common duck. The Muscovy duck was introduced into Africa no earlier than the 17th century, after the discovery of America, and much later than ducks of the Anas genus. It was given the same name, due to similarities, but in this case, it is obviously inappropriate. ***The Muscovy duck nowadays is distinguished as "local qu�-qu�". Being found in all villages, it is thought of as original, while common ducks, despite being introduced much earlier, are still felt to be exotic.***

This is another example of the help that can come from language (Chapter 16). What fits the environment is considered as local. As a matter of fact the Muscovy duck is the only web-footed bird that is spontaneously spreading everywhere in Africa. This is a sure indication

that any project based on raising the bird will be sustainable whatever the environmental conditions. Of course it is essential that the number of birds does not exceed the amount of natural resources available for scavenging. Despite the fact that it lays fewer eggs than ducks of the genus Anas, the Muscovy duck is much appreciated when breeding conditions are difficult.

Farmers consider the Muscovy as being very productive in developing countries, when some integration is added to scavenging. If all eggs are incubated, a production of about 335 ducklings per year can be obtained. Ducklings are generally bought and sold at a satisfactory price. The fact that two ducks per week (about 4 kg live weight in total) can be obtained for family consumption or selling, from only three mothers is interesting. If we also take into account the fact that a quarter of such production (one kilo of live weight per week as a mean) is still possible, even when no concentrates are offered to the birds, the species looks extremely promising for food-deficit people. Normally all eggs are incubated, but at least some could also be consumed. If they are collected immediately after laying, production increases and brooding could be extended. The eggs are very rich and nourishing. The shell is very thick and resistant, favourable to storage and transport. If eggs are consumed, the shell can be recycled as a calcium source for any bird species. Muscovy ducks need only simple shelters and the keeper only has to provide a dry place to let them lay their eggs. Incubation time is longer (35 days) than in the common duck (28 days). Ducklings must be protected, but adult birds are heavy, strong and aggressive enough to defend themselves from predators.

Viverrids (small mammals) are their most dangerous predators because they are able to bite the ducks on the neck, sitting on their backs, so that the birds have no defence. These predators usually drink only the blood and many birds can be killed.

The Muscovy duck is one of the best species that must be considered in the context of diversification to improve food security. A certain degree of competition with chickens is probable, but it must not be too great a problem since the presence of both species is common in poor rural areas. Anyway, the Muscovy duck is very efficient at exploiting green plant resources. This could be a problem because small horticulture, that is a very important component of backyard systems, must be protected (figure 7.1.2.1.2.). Enclosing the animals to avoid the problem is not simple because the fowl must be fed in some way. And it is not easy to do it at no cost when the animals are not permitted to scavenge. If the yard is fenced, the best way is to make the ducks scavenge outside the yard. If possible, they should have access to a heap of manure to find animal protein resources, as mentioned with reference to chickens. Ducks should be readmitted to the yard only to be protected in their shelter during the night.

Fig. 7.1.2.1.2. The villager shows how his crop has been heavily damaged by a Muscovy duck freely scavenging.

To maximise the efficiency of a backyard system Muscovy ducks may integrate very well with rabbit keeping. It is a frequent observation in the field that ducks choose to sit under rabbit cages as their preferred habitat (figures 7.1.2.1. and 6.6.). If they leave the place from time to time in order to feed on grass or go for a drink, they always come back to the heap of faeces under the cages. There they find a rich protein source from insects, worms, larvae, eggs and earthworms on which they feed very willingly.

Fig. 7.1.2.1.3. Muscovy ducks choose to stay under rabbit cages as a preferred habitat. There they find a rich protein source by eating insects, larvae and worms. The insects are attracted by rabbit faeces, giving origin to rich pickings for the birds.

The importance of Muscovy ducks to develop advanced models of integration with rabbits has been underlined in Chapter 6 (Differentiation and Integration). Figures 6.7. and 6.8. illustrate the topic.

> ***According to a development project in the area of the Nile River, rabbits and ducks were very properly offered to young married people to favour their settling in newly irrigated desert areas (Finzi, 1987).***

In peri-urban areas where it is more likely that rabbits are fed on pelleted feed, the pellets that fall under the cages are not wasted, but utilised by ducks*.

Approximately one broiler Muscovy duck can be freely produced with each five does fed on pellets (Gualterio et al., 1988). A negative aspect of raising ducks in peri-urban areas is that the birds make the place dirty, and hygienic conditions of the backyard are compromised. Animal wastes in the form of rabbit offal are also a potential feed source for ducks and can be fed ad libitum. Only half the weight of the administered specific mash is offered as corn, and their growth is higher than with the

mash alone (Finzi and Amici, 1989). Any protein-rich waste, as well as duck offal, can be recycled in this way. If ducks are integrated with a fishpond, they can fertilise the pond with their faeces while the birds are able to feed on small aquatic animals and algae, and are also able to properly utilise all the wastes produced when fish are cleaned before cooking. With regard to the use of animal wastes such as protein-rich feed resources, ducks compete with pigs, and pigs are normally preferred. But where pork is taboo, ducks can be considered as the pig of the poor, or the pig of the people not consuming pork.

In some areas of Central Africa, raising ducks is also a general taboo for newly married people until they have produced at least a boy and a girl. The belief is that, since birds are very fertile, they can steal fertility from others. The taboo itself is indirect proof that Muscovy ducks are very efficient egg producers. This taboo can limit the involvement of young married people in projects.

7.1.3. Pigeons

Keeping pigeons is an activity that is unevenly distributed in developing countries. Its origin goes back to Roman times and is still very popular in the area of the ancient Roman Empire, mainly around the Mediterranean. Pigeons nest in natural or artificial holes present in rocks, caves, towers, castles and other buildings. Squabs, about four or five weeks old, can therefore be freely harvested from their nests before they are able to fly. At this time they weigh about 400 grams and to catch them at this age is convenient because, when they begin to fly,

their live weight decreases measurably.

It is obvious that, if an appropriate shelter is offered, any family can raise pigeons. The cost can be only that of a few grains offered to the bird in the short period during which they are confined, in order to make them choose their nests and get accustomed to the place. A clutch of two eggs is laid each time and, if no feed is administered, pigeons can brood five to six times in one year. Thus 10 pairs can produce eight no-cost squabs (in total about 3.0 kg live weight) per month (Figure 7.1.3.1.).

Fig. 7.1.3.1. This dovecote is perfectly functional, even though made with no-cost recycled materials (West Africa).

Pigeons can be raised industrially in closed structures and fed with grain or balanced feeds provided by the owner But this aspect is not considered here, because the technology is known, specific manuals can be found and an industrial enterprise can be easily begun whenever commercial conditions are favourable. Exotic breeds can be raised and both production and weight at slaughter time can be higher than the values mentioned above. Sexual maturity begins in male and females at seven and six months of age respectively in rural systems, or earlier in industrial conditions. Brooding begins after the second egg is laid, generally two days after the first. Incubation lasts 18-20 days and both sexes sit on the eggs; the male sits for a shorter period of about five hours in the middle of the day to permit the female to fly away for feed. The squabs are fed with a special substance produced in the crop ("crop milk") and later with food regurgitated by both parents.

In the industrialised systems females are able to lay two new eggs when the squabs are still present in the previous nest. This is the reason why a two-nest structure is considered necessary. Each nest generally measures 30 x 30 to 40 x 40 cm, with a height of 25 to 30 cm and a small rim to stop the eggs rolling out. It can be made of any material from earthenware to plastic. But in simple systems, two nesting shelves for each breeding pair are only provided if feed can be supplied to obtain a higher production. Birds simply choose the nesting place in the shelter prepared by the owner and, in case they need it, they can choose a second hole. They may also nest at ground level, mainly in a corner, and when holes are free in the walls (Figure 7.1.3.2.).

Fig. 7.1.3.2. The pigeon nest is very meagre. Nevertheless, conditions are sufficient to allow production.

The best system for building pigeon houses is probably the one developed in the delta area of the Nile. It is based on elongated earthenware pots, about 60 cm long with a diameter of 25 to 30 cm. They are specifically produced by a local earthenware handicraft industry (Figure 7.1.3.3.).

Fig. 7.1.3.3. Small pots are produced by a local North African earthenware handicraft industry.

They are very cheap and practical because they serve both as a nest and as light, structural elements of the building, permitting it to grow up into the shape of a high tower. On the top, an open piece can be seen. Its function is to permit the passage of pigeons.

The clay pots are placed horizontally in the body of a circular wall with the mouth open towards the inside. (Figure 7.1.3.4.).

7.1.3.4. A tower is being built to raise pigeons. It can house some hundred breeding pairs, still maintaining the characteristics of a simple local technology.

The top of the towers is generally conical in shape. They are provided with external ledges pointing outwards where pigeons can sit before entering the building through the clay tubes (figure 7.1.3.5.).

Fig. 7.1.3.5. An impressive tower to shelter pigeons. A typical scene in the Nile Delta. The tower can be compared with the minaret. Notice the analogy in the shape of the religious and utilitarian building.

A simple staircase, fixed internally to the walls, permits the owner to explore the nests up to the top of the building (figure 7.1.3.6.).

Fig. 7.1.3.6. Internal view of a pigeon tower. Breeding pairs can choose freely the holes in which to prepare their nest. The wooden structure is a stair which permits the owner to explore the building and to harvest the squabs.

The basic unit is the nest-pot and it can be repeated as many times as necessary. In this way the building can grow while maintaining the character of a simple, local, cheap, sustainable and functional technology. This is possibly the only example of a simple technology that permits hundreds of birds to be raised without moving to an industrial model. Sometimes the dimensions of the buildings are really impressive. Probably no industrial farm was ever able to house so many birds as the unit shown in figure 7.1.3.7. This is another opportunity to reflect over the efficiency of simple technologies and how they can compete even with industrial production systems.

Fig. 7.1.3.7. Buildings to raise pigeons can reach huge dimensions (compare the size of the cattle under the tree) and shelter thousands of pairs. Local materials are used and the technologies are simple and low cost. It is possible to see the holes through which birds enter to nest or to leave the house to fly far away for feed (courtesy: S: Galal).

Small units can be found in many parts of South America and Africa (figure 7.1.3.8.), nearly always as a cultural effect of the settling of Mediterranean people who have the traditional habit of consuming pigeon meat.

Fig. 7.1.3.8.

Remember that the analysis of what the technician is able to observe is useful in providing clues to appropriate questions and to check the value of the answers. In some regions, for instance in the Nile Delta, buildings to raise pigeons are widely distributed in the rural settlements, villages, peri-urban and even urban areas. The tower buildings are most common in the rich rural area, while the three or four wall shelters set on the roof are more common in poor rural areas (figure 7.1.3.8.) and in towns (figure 7.1.3.9.). Pigeons naturally nest in high places in order to better protect their eggs and squabs from predators. At least in rural areas, sheltering the birds in a structure on the roof helps to optimise space utilisation and it is also a way to make stealing the animals more difficult.

Fig. 7.1.3.9. Normally dovecotes are located on the roof. This helps to optimise space utilisation and makes keeping pigeons suitable even in urban areas. This is a very important opportunity for people living in towns in developing countries (courtesy of S. Galal).

The frequency with which these typical pigeon houses can be observed hints at the economic importance of raising pigeons in the area. A survey in the market will immediately confirm this. Socio-cultural aspects will become clear as soon as the technician succeeds in getting an invitation to lunch or dinner as suggested in Chapter 15 (Rules of conduct). Pigeon will be offered to him/her as a special dish to honour the guest wherever raising pigeons is considered important.

In a small town in South America it was also found that it was traditional to eat pigeons at some local feasts. The bird was the most important meal in both big and small restaurants and also in local kiosks in the market area. Many visitors came, even from afar, with the specific purpose of eating pigeon. The unsolved and very puzzling problem was why pigeon raising was not found in nearby, similar areas.

If a small tower is built in a corner of a backyard, faeces and eggshells fall to the bottom of the buildings and this is a very favourable place, shadowed and sufficiently wet, to permit a deep litter formation and production of a good compost. Adding faeces of any other species (for instance rabbits) and vegetal wastes makes the quantity of manure produced easy to integrate into a small animal keeping with backyard horticulture. The fact that pigeons can represent an important element of differentiation and contribution to the nourishment and/or income of the family is seldom considered. But many factors play a role in favour of pigeon keeping, mainly as a component of backyard integrated systems. Pigeons do not compete with other species for space or for feed. In fact dovecotes are normally located on the roof where they are also better protected from predators and theft. The birds, if fed by the owners, tend to remain in the surroundings, but, if they have to look for their own feed, they are able to fly in a radius of 15 kilometres or more

to find feeding resources from natural or cultivated grasses. Other information on the species can be found in a manual from the American National Research Council (1991). When different poultry species are present in the backyard, it is obvious that, while chickens, ducks and others birds are scavenging in the same area, pigeons can fly far away, not competing with them and they can also profit from the different vegetation cycle of the plants present on a vast area. It is supposed that the species is not known well enough by project makers. This seems to be the only possible explanation why a species which is easy to raise and able to produce at a very low cost is very rarely considered. But the pigeon component should always be considered, at least in an earlier phase, when food security programmes are being prepared. The characteristics of the species make it a precious element of the small integrated systems. Its adaptability to very small or very big units, without changing the basic keeping conditions, plays a positive role favouring the possible move from subsistence to commercial dimensions, whenever the market makes it possible and convenient. It is not easy to find local housing and managing systems where keeping pigeons is uncommon. It must be remembered that birds flock frequently to market areas where they find wastage to eat (figure 7.1.3.10.).

Fig. 7.1.3.10. The best place to find whether pigeons are kept in a village is to go and look at the market place. It is likely that pigeons will be there searching for feed. Then it is easy to ask for the owner and visit their unit to get information on local technology. The interesting system shown in the next figure was found in this way.

The breeder's place can easily be found by asking who is the owner of the pigeons that can be seen scavenging around or sold in the market. Some simple pigeon keeping systems can be found, such as the one shown in figure.7.1.3.11. A visit can help to analyse the local

technology and to discuss the matter properly before drafting an appropriate project for food security, which should also consider pigeons as an important species useful for integrating into small animals keeping systems.

Fig. 7.1.3.11. A very good example of easy, cheap and efficient technology to raise pigeons has been spontaneously developed in a village of Central Africa. The clever owner has simply nailed on the wall some boxes in which a small passage has been cut. The boxes are well protected by the roof and are chosen by pigeons to nest.

The young man, who invented the original pigeon keeping system shown in the figure, came from a village far away. He had been taught how to raise pigeons by a male relation. When he moved to his new home, he began his profitable activity. Due to lack of time it was not possible to check if his example had favoured the starting of other units by simple imitation.

The above example is interesting because it shows how a new, local, simple, cheap and sustainable technology can be spontaneously developed. In cases like this the technician should always profit from the opportunity to study the system to see if it can be disseminated among other people and villages and which are the local factors that can favour or impair it. This is also an example of the way that the know-how competence of the technician can be enriched.

7.1.4. Other birds

Local chickens, Muscovy ducks and pigeons are the only birds which adapt to any keeping condition, and also to environments which are harsh and where they must rely on scarce nutritional resources to provide for themselves. Any project to improve human welfare in a scarce-food, no-income area, must rely on these species. This does not mean that other species or breeds cannot be usefully utilised in these conditions. In previous

chapters, consideration has been given to identifying when improved chicken, pigeon or duck breeds can be utilised. But to find scavenging ducks of the genus Anas, geese and even guinea fowl in rural areas is rather exceptional, except in some districts. For instance waterfowl can be found where there are permanent water courses or artificial canals (figure 7.1.4.1.).

Fig 7.1.4.1. Scavenging ducks coming back home in the late afternoon from the canal where they swim and feed during the day (North Africa).

Sometimes geese can be found in the yards of rich people who keep them as a status symbol to show their wealth. In a random survey there is little chance of finding geese

in poor rural areas. The good habit of paying a visit to local authorities (Chapter 15. - Rules of conduct) before beginning the field survey allowed the photograph showing the birds in figure 7.1.4.2 to be taken.

Fig 7.1.4.2. Two geese in the yard of a local king (Central Africa). The yard is well shaded by the terminalia tree. The birds never provided any food, but they are beautiful and, in this context, must be considered as sporting fowl.

Figure 7.1.4.3. shows a flock of geese raised by a rich farmer. It is very doubtful that these birds will be profitable, unless they are sold for reproduction to the many people that wrongly believe they can get money

from keeping such species. This is not uncommon, and to sell exotic birds for reproduction is sometimes very easy and profitable, but only if there are people who can afford to buy them.

Fig. 7.1.4.3. A flock of geese raised by a rich farmer in Central Africa. Normally similar units are profitable only when owners are able to sell their stock for reproduction.

Scavenging turkeys can be found in South and Central America where they originated, but practically nowhere else. Improved turkeys are uncommon in the rural areas

in other parts of the world. If they are found, they are always owned by wealthy people (figure 7.1.4.4.).

Fig. 7.1.4.4. Improved turkeys in a North African village. A rich villager, who is obliged to feed the animal with an expensive mash, raises them without the prospect of any profit. But the birds represent a status symbol and the owner is proud to show he can consume expensive meat. Note the naked neck and the skin fold that help to dissipate heat in hot climates.

In Africa, guinea fowl are more common than other fowl species, except poultry, Muscovy ducks and pigeons, but they are nevertheless rare in rural areas. Quail are also

rare. In this context, the word rare suggests that the birds in question are unlikely to be found by random searching, but there will be some in the area. When there is a market for guinea fowl meat or quail eggs, then semi-industrial raising of these species is convenient and advisable. A manual on quail production systems has been published by FAO (Shanaway, 1994). Ostrich is also considered as a species of some interest for animal production, but this big bird is unsuitable for sustainable projects aimed at food security. A good manual by Carbajo Garc�a (1997) provides the basic knowledge needed to start a keeping should marketing conditions become favourable.

7.2. Mammals

The only important species of mammals to be raised in backyards are rabbits and guinea pigs. Grass-cutter and giant rats are also considered to be of local importance in Western Africa, and pacas, hut�as and other rodents in Southern America. But if the backyard where animals are kept permanently is near the house, other species can only occasionally be considered. Sometimes a sow for reproduction or a few piglets for fattening are raised close to village dwellings. They are given kitchen wastes and some extra feed and in this case must be considered as a part of the backyard system (figure 7.2.1.).

Fig. 7.2.1. An adobe pen, shaded by reeds, is an economical structure in which to raise a sow in the backyard (South America).

Dwarf goats kept and fed permanently in backyards have also been observed many times in West African Countries (Chapter 6. - Differentiation and integration; figures 6.2. to 6.4.). They were fed with locally abundant palm leaves or with other roughage. Even single Holstein-Friesian cows have been found as the result of a positive project in a North African Country. They were fed with alfalfa collected in the oases. With the exception of pigs, which are omnivorous, all other more important species of mammals are herbivorous. Unless specific circumstances

allow (abundant vegetal and other resources) the traditional and obvious way to feed ruminants is to take them to graze, and only small mammals should be considered appropriate as backyard animals.

For many years stress has been put on the efficiency of feed conversion, and this has limited the interest in small herbivores. It is true that the feed conversion of rabbits and guinea pigs is lower when compared to chickens, but they are still more efficient than big ruminants. Interest in small mammals is certainly increasing, and they are frequently considered as a valuable means to support food security projects, particularly when food security is a family welfare issue. Their importance as backyard animals is now assured. They give women an opportunity to work without leaving their home and represent a valuable animal protein for the nutritional needs of the family. They are also able to utilise small amounts of vegetal bio-masse combined, if necessary with concentrates. As a consequence, rabbits and guinea pigs are not competing with man for food and this important point favours their spread to support rural development in food deficient areas. Unfortunately, the importance of these species as useful components of integrated backyard systems remains largely unrecognised.

7.2.1. Rabbits

Rabbits originated in the West Mediterranean where they are still very popular. Rabbit keeping remains common in the areas where it has always been traditional, such as Asia, the Western part of North Africa, the Nile delta and some South American countries, mainly Mexico and the

Caribbean islands. Where breeding is not traditional it is not easy to introduce, because of problems of producing cages, management and the low thermo-tolerance of the species. Nevertheless, rabbits must be considered as an interesting species for food security because they quickly thrive when some vegetal resources are available. The fact that the species is not competitive with man for food is another advantage, as well as its exploitation of all the vegetal kitchen wastes. The most common, traditional way to keep rabbits is to leave them to dig their burrows in the yards or from some room in the house (figure 7.2.1.1.). Sometimes small stone shelters are prepared. Rabbits will always spend some time below ground and new burrows are usually dug by does to prepare their nest. These breeding systems, though quite common in traditional rabbit-keeping areas are practically unknown to western technicians, and are not mentioned in specific literature.

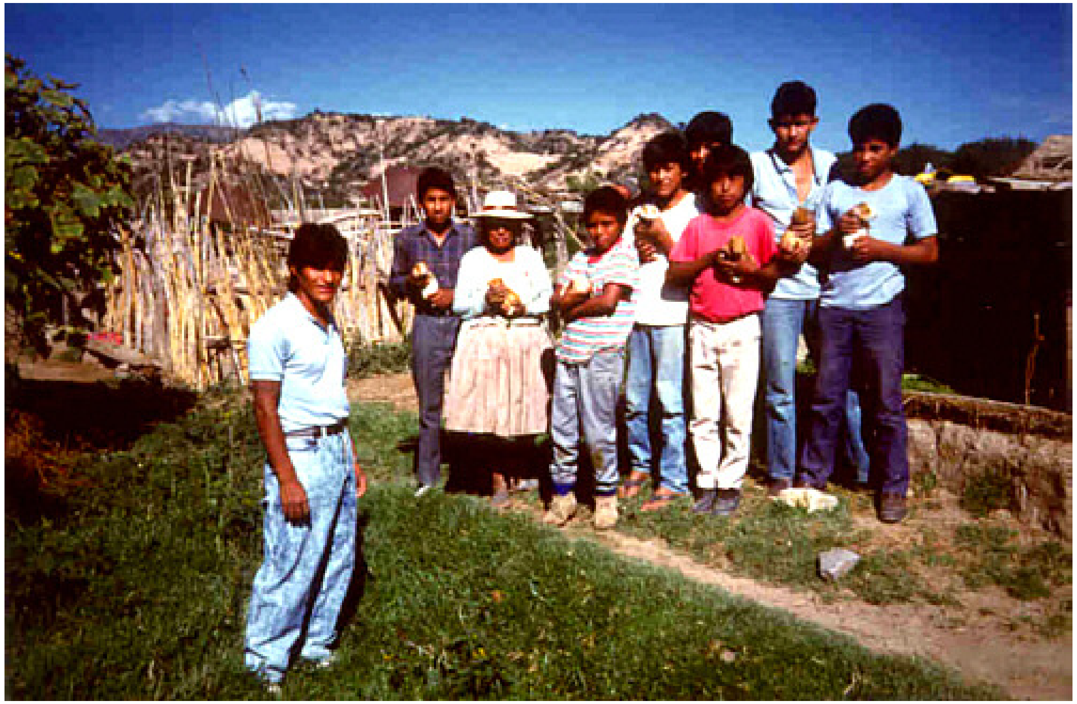


Fig. 7.2.1.1. Rabbits range freely in a small fenced backyard (West Africa). They are cheaply fed with banana leaves.

It must be remembered that rabbits have little tolerance to heat, and are unable to maintain their body temperature when the ambient temperature reaches 30�C. This is a very limiting trait because most Developing Countries have tropical climates. Thus allowing animals to find cooler conditions underground corresponds to the ethology of the species (figure 7.2.1.2.). This point was discussed in Chapter 5.5. (Looking for appropriate new techniques) and shows how new techniques depend upon a correct identification of limiting biological constraints. Technical innovations to reduce heat stress were illustrated in figures 5.5 2 to

5.5.4.

Fig.7.2.1.2. A rabbit colony has dug its burrows in complete freedom under a tamarisk in North Africa. Animals do not move away as long as feed and water are regularly provided.

When rabbits are left free to dig their burrows, they form colonies and reproduce freely but their individual control is difficult, there is limited hygiene and production is minimal (only 2 to 5 kittens per doe per year). Nevertheless the system is simple; mating control and nest building is unnecessary and a colony of 5-6 does produces two rabbits a month (total of about 3 kg live weight) on grazing alone. This must be considered a good contribution to the nutritional welfare of the family. Projects are normally based on training to build and to utilize cages. Providing metal cages is generally a mistake because it presumes an amortization plan. This concept is not easily understood. Similarly, expecting poor people to buy new cages to replace old ones is unrealistic. Another limiting factor to the use of metal cages in the tropics is the high relative humidity. This together with the corrosive action of urine means that the cages rust rapidly. This limitation refers to all metallic structures used to raise small animals and was discussed with reference to poultry (See commentary to figure 7.1.1.12). A convincing example is shown in figure 7.2.1.3. To amend the damaged metal floor the keeper

had to go back to the traditional and sustainable no cost system using bamboo sticks.

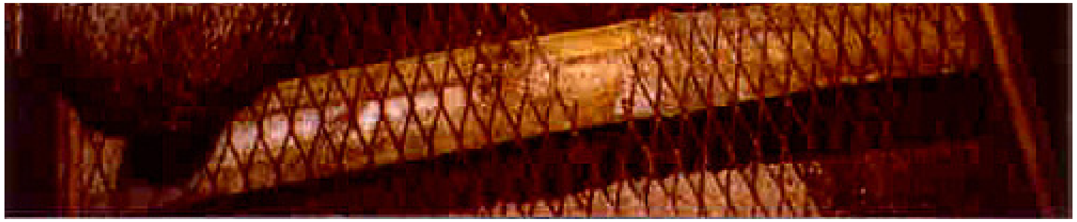


Fig 7.2.1.3. The combined corrosive effect of urine and high relative humidity makes the metal floors of cages very short lived. Split bamboos have been properly utilized in this case as an emergency intervention and the keeper clearly has the technical competence to make a new wood floor when it is needed.

This example refers to the unit illustrated in figure 2.3.3. and teaches how wrong it can be to think that imported technologies are better just because they are costly and efficient in some other place. Cages must be built with local, cheap and readily available materials, such as wood or bamboo. This is the sustainable way that rabbits have been raised for centuries in the nowadays-developed Countries where metal cages are certainly more hygienic and suitable for industrial production. When marketing conditions are favourable, people can buy metal cages to begin commercial production, but this should not be matter to be considered when food security is involved. The very low thermo-tolerance of rabbits (Valentini et al., 1985; Finzi et al., 1986) is a strong limiting factor against the use of cages. Project makers should always consider this point. In North Africa, where rabbit keeping is traditional, animals kept in cages stop reproduction for nearly four months in the hot season. Does are not even mated because, stressed

by heat, they are unable to eat enough to sustain pregnancy and feeding (Finzi, 1986). Rabbits are covered by a highly insulating fur coat, and being unable to sweat they have to lose their endogenous heat mainly by increasing their respiration rate, but this is not a very efficient physiological system. Rabbits, in fact, have developed a behavioural defence against heat. In natural conditions, they shelter in underground burrows where there the temperature is normally lower. If they are confined in cages and exposed to above-ground ambient temperatures of greater than 30 ^{o}C , they suffer and eat less. Above 35�C and with a high relative humidity rabbits will begin to die after a few hours. This is also true for acclimated strains, though they are able to maintain a lower body temperature compared with exotic rabbits (Finzi et al., 1992b). The topic is discussed in Chapter 8 (Local and exotic breeds) and illustrated in figure 8.3. An expert technician should be able to recognize when rabbits are stressed by heat as the animals become prostrated. They extend their body, trying to maximize its surface area. Ears begin to pulsate and become very red, the degree of which depends upon the increased respiratory rate (Finzi et al., 1992c). When rabbits are heat stressed, the only efficient emergency intervention is to immerse the animals in a bucket of water at ambient temperature*. The recovery is immediate and even animals near to death can be saved (Finzi et al., 1992a).

A local population on the edge of the Sahara desert has developed a clever

solution (figure 7.2 1.4.). They dig pits 1.5 m deep or more and then introduce rabbits (normally two does and one buck) to the bottom. From there the rabbits dig their burrows into the cooler soil, well insulated from the heat experienced by the cages above ground. At the mouth of their burrows at the bottom of the pit, temperatures 9.6 �C lower than in shade at the surface have been registered (Finzi et al., 1988).

Fig. 7.2.1.4. **Try to analyse the system before you**

click on the picture to read the legend.

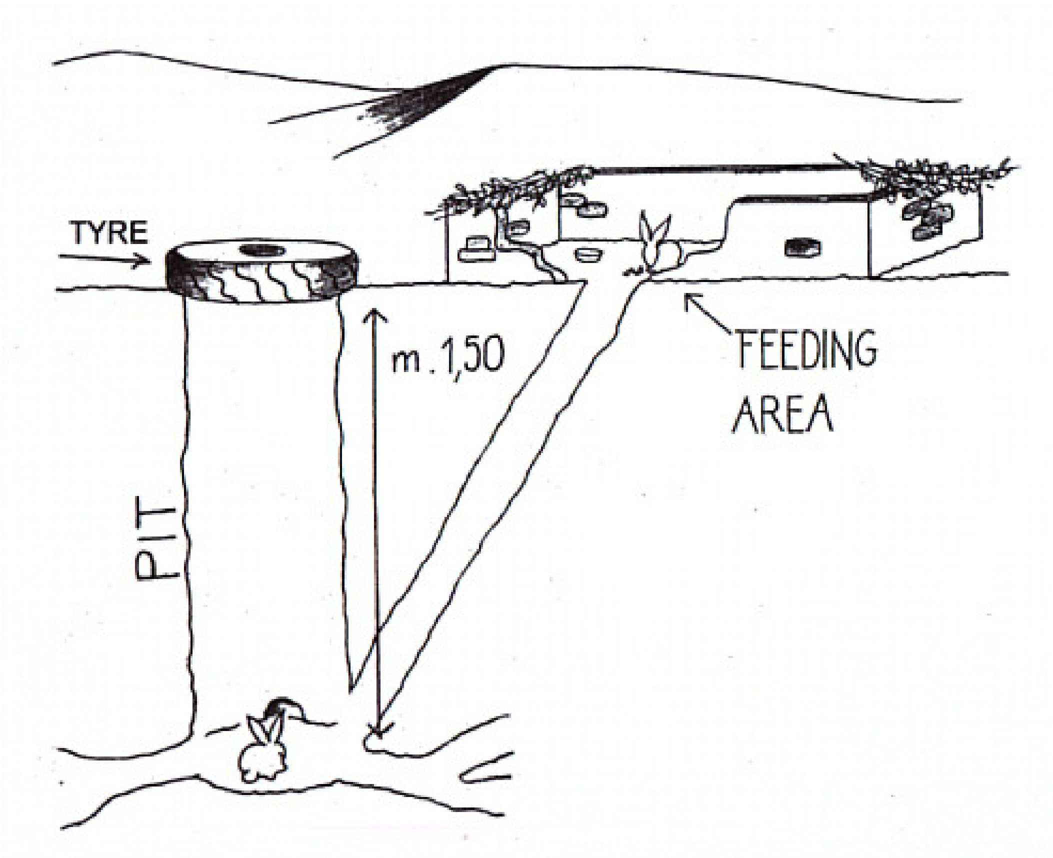


Fig. 7.2.1.5. A wonderful example of simple no cost technology. Rabbits are living at the bottom of a pit and are fed with weeds or alfalfa collected in the oases. The stone is placed at the mouth of an oblique artificially dug burrow, leading to the surface. If rabbits are fed there, they get out and can be easily caught.

Mountains are probably the only areas of tropical countries where, thanks to a lower ambient temperature

due to altitude, there are no problems associated with raising rabbits in cages. Wherever cages are used, they should not be placed in closed buildings. To build a sheltering structure has a cost and frequently it produces only problems. Buildings are generally hot and lack ventilation. Microbial concentration is high, particularly if the ambient temperature is also high; the building must be kept well cleaned in this situation. Open–air keeping is certainly more convenient and the only important condition is an open and well shaded site for the cages. In hot climates, tradition (use of straw or palm leaves for roofs) and nature (climbing plants) offer the right means to reduce temperature inside the buildings (figure 7.2.1.6.).

Fig. 7.2.1.6. A good shelter in West Africa. Climbing plants are very seldom used to obtain relatively fresh environments. The palm-leaf walls permit a good circulation of air. Sharing of this appropriate model should be encouraged.

Nevertheless the improper use of galvanised roofs is spreading. It is difficult for people to understand that metal, hit by the sun's rays, becomes hot and works as a source of radiation over the animals. Still worse is if the roof is low, as frequently happens. An impressive trick to convince people is to make them to touch the metal which is burning hot. This problem seems to be better understood in North Africa where heaps of straw (sometimes very high) have frequently been used on roofs to provide an insulating layer (figure 7.2.1.7.).

Fig. 7.2.1.7. Climbing plants have been used very correctly to shade the walls from solar radiation. Wide windows favour air circulation, as do high trees which also provide shade. The negative effect of using a metal roof has been counteracted by adding a layer of straw (North Africa).

Wooden cages are easily built by breeders (Finzi, 1986; 1987; Finzi et al., 1992c). but should not have projections which can be nibbled by the strong chisel-like front teeth of rabbits. Rounded shapes are good for this purpose since rabbits have a limited capability of opening their mouths. A beautiful cage built using raffia bamboo is shown in figure 7.2.1.8. Long wooden nails were stuck in drilled holes to fix the frame. Another possibility is

tying the frame up with ropes that are made from vegetal fibre. Figure 7.2.1.9. shows how a specific technique must be utilised to keep the main poles perpendicular, but taking care that the ropes remain out of reach of the rabbits teeth*. As indicated in the introduction, the reader is reminded that original technologies developed by the author in the field or by the Experimental Centre in Viterbo are indicated with *.

Fig 7.2.1.8. A beautiful and well-framed no-nails raffia-bamboo cage built in Central Africa. It is a good example to show how local traditional technology can be very efficient and competitive.

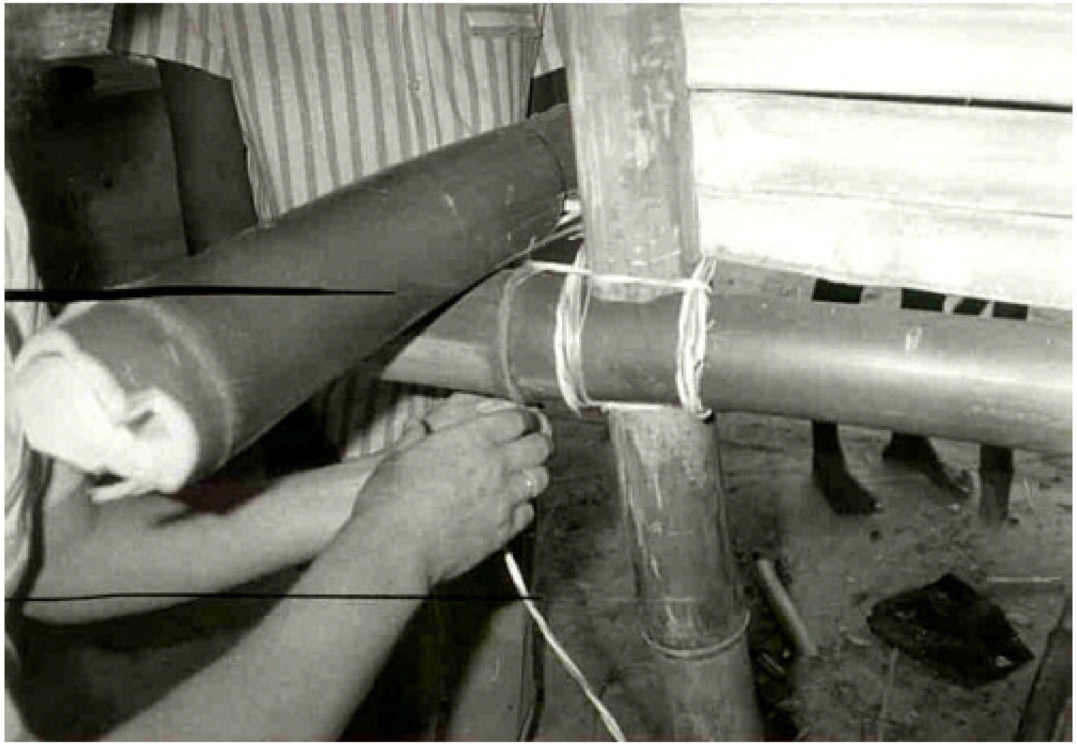


Fig 7.2.1.9. A bamboo frame is being prepared.* The main poles are tied up with a rope made from palm leaf fibres. Smaller pieces of bamboo are inserted with the rounded surface towards the inside of the cage to avoid nibbling by the rabbits.

A mixed technology has also been developed that adapts common hutches into cages which can be used to transport poultry to the market*. They are very cheap and can be found easily everywhere. It is sufficient to protect the wood frame from the inside with a thin wire-net to avoid rabbits nibbling it (figure 7.2.1.10.). Another mixed technology* to build up a cage is shown in fig.5.5.3.

Fig. 7.2.1.10. A cage to transport chickens, made of palm-leaf stalks, is adapted to become a rabbit hutch*. The easily nibbled frame is protected by attaching thin wire-netting to the inside. Strong metal mesh is used for the floor. It must hold the weight of a rabbit and permit droppings to fall through.

The cage floor should not allow faeces to accumulate. The technique is properly described by Lebas et al. (1997). Where it is difficult to disinfect the cages, hygiene becomes of paramount importance. A floor that can be easily removed and immediately substituted with a clean one* is shown in figure 7.2.1.11. The removed floor can be washed later and exposed to solar radiation for natural disinfection. Wood should be treated with

used car oil to make it less susceptible to impregnation with urine and termite attack.

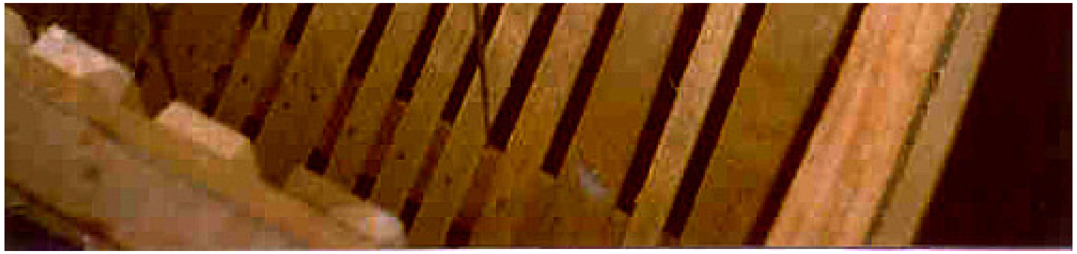


Fig. 7.2.1.11. Try to analyse the system before you click on the picture to read the legend.

There is nowadays a tendency to build smaller cages than the ones described in the old books and still built in the rural areas of developed Countries. This is due to the influence of technicians who make reference to modern cages in the industrial units where the cost of structures is a limiting factor. Small cages can reduce the costs also in developing Countries if building materials are not free or cheap. But the ancient model of wide and tall cages has some advantages such as permitting a lower animal density for a given number of rabbits and the possibility of utilising rake feeders (figure 7.2.1.18.). A very good old-fashioned rabbit breeding unit in the Guinea gulf area is shown in figure 7.2.1.12.

Fig. 7.2.1.12. Try to analyse the system before you click on the picture to read the legend.

A very beautiful hutch unit to raise rabbits has been abandoned. It is easy to recognise from afar, looking at the roof, the open doors of the cages and the grass growing again where the workers used to walk. In the wet equatorial climate grass is abundant all the year round, therefore it is puzzling why a production unit that should be sustainable and profitable was abandoned.

This is an example of the effect of para-technical factors. The topic is discussed in Chapter 2.2. (Technical and para-technical factors).

The unit was perfectly functional. It was built during the colonial period but, when this came to an end, the owner left the country. Though the workers were well trained and able to maintain production, the property passed to the Government. Two para-technical factors then played a decisive and negative role. The new rulers were lacking in competence and believed that the old fashioned unit was obsolete and could be substituted with a more modern one. A very big unit, raising 2,500 does, was then built, adopting modern very expensive metal cages. Also feeding with no cost abundant grass and leaves was abandoned and pelleted mash was imported to feed the rabbits. The new production system was immediately found to be unsustainable. When the Government stopped feed importation, the need to go back to the use of grass caused a lot of problems, since metal cages did not permit such a feeding system. A large amount of roughage had to be brought in every day with lorries. Feedstuffs were necessarily taken into the cages where

they were immediately spoiled by faeces, urine and treading. The consultant suggested going back to the abandoned system which had proved sustainable. Smaller units, spread in different places as before, also gave the chance of better exploiting the biomasses locally available, while transport problems were avoided.

An appropriate technology has been developed to raise free ranging rabbits inside a yard forming a closed warren* (Finzi and Amici, 1988; Finzi et al., 1994). A scheme is shown in figure 7.2.1.13. To avoid rabbit burrows being flooded by heavy rains, it is sufficient to prepare a haystack or any heap of straw or hay covered by a plastic sheet or other material*. Rabbits choose always to dig their burrows under the straw heap and stop digging elsewhere. Appropriate nests can be prepared. They are chosen by does if the entrance is through a piece of tube, though they often give birth to their young in the hay.

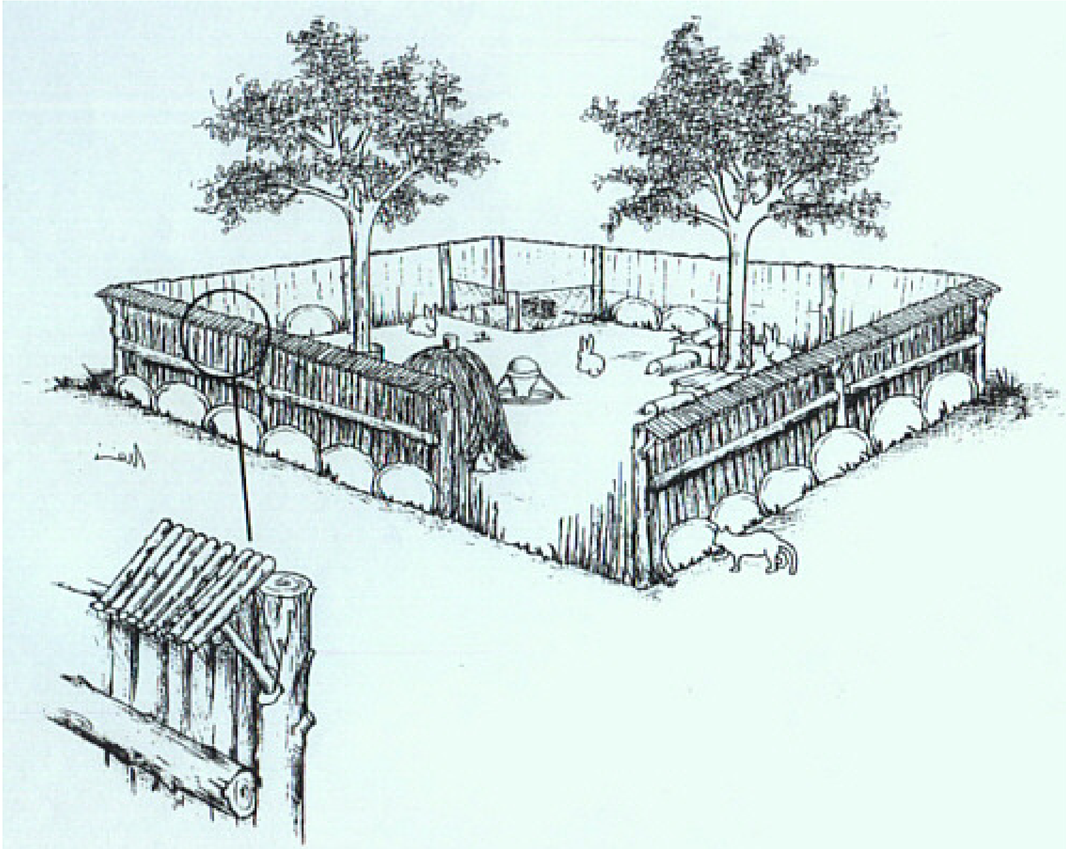


Fig. 7.2.1.13. Scheme of an improved fenced warren*. The haystack to shelter the colony, accessible nests and the self-catching trap can be seen.

A self-catching system* can easily be prepared using a closed area where food and water are available. A swinging door can be activated to permit rabbits to enter but not to get out again. The animals can then be caught for checking as required by the breeder (Finzi and Amici, 1988; 1991). The system works well in exploiting marginal areas or to produce organic meat in developed

Countries, provided it is well protected from predators. It has not yet been tested in developing Countries where it should also work. Of course it is a colony system but individual control is possible if the buck is kept aside and does, trapped in the self-catching area, are taken to its cage for mating whenever necessary. Pregnancy and sanitary controls are also possible. Trapping the animals every two weeks is an efficient management system that allows the owner to keep them under control. Normally three does are kept in a 100 m^2 area. This is divided into two parts that are used in rotation for periods of six months. Also an underground cell system* has been developed by the Centre and tested in very different conditions. It proved to be the best system to be adopted in tropical areas. The topic is discussed in Chapter 5.5. (Looking for appropriate new techniques) and a scheme is described in figure 5.5.2. Each unit is formed by a small cell (about 40 x 40 cm or wider) covered with earth and connected by a short tube to an external cage. A lid to permit access forms the top of the cell. The lid should be made of wood or insulating materials to avoid the cell becoming hot by irradiation from above. Rabbits shelter in the cell during the hottest hours of the day and enjoy better microclimatic conditions. The animals that utilise the underground cell have a lower body temperature than the ones raised in cages. (Finzi, 1987, Finzi and Amici, 1991; Finzi et al., 1992b). The system is modular and the producing units can grow slowly according to needs. The underground model can be built directly by the owner at low cost with local materials that are normally clay, cement or bricks for the cell, and wood or wood and wire-netting for the external cage. Cheap clay pots, very common in local markets, were later adopted by North

African technicians. Because of the relatively small size of pots, they developed the idea of adding a smaller pot to be used as a nest. Of course all the system is interconnected because the nest links with the central pot and this in turn with the external cage. Figure 7.2.1.14. shows a small demonstration unit.

Fig. 7.2.1.14. In this demonstration unit, underground cells have been produced with clay pots. The second row forms the nests. Green cover has recently been planted and the grass on the cages is to feed the animals. The shadowing effect of the reed mat can be seen and this helps to cool the unit. The tank on the left is serving the automatic watering system.

The lids were put upside-down, partially filled with earth and used as flowerpots. In this way a more beautiful environment was created and the wet earth in the lids had the effect of refreshing the cells. Indigenous grasses collected in arid zones were planted to maintain soil humidity when it was irrigated, and to keep the sides of the pots moist. The wood-framed wire-net cages were placed at ground level over a gutter (figure 5.5.2.) to collect faeces. Periodic cleaning was possible by moving the cages. If a plastic sheet is laid over the gutter, urine nitrogen can be recovered for manuring purposes*. The need for specific equipment should not necessarily make technicians think of industrial models. Wood could be used to prepare nests, but locally crafted clay pots should be preferred. They are not nibbled by rabbits and can be easily washed and disinfected in the fire if necessary. Two good prototypes are illustrated in figures 7.2.1.15. and 7.2.1.16.

Fig. 7.2.1.15. Two well-protected nests for rabbits developed by a producer in Saharan Africa. A siphon drinker made with a glass bottle and a metal feeder for concentrates can be seen on the left.

Fig. 7.2.1.16. To favour air circulation, holes have been made in a pot adapted as a rabbit nest. The palm leaf structure has been protected on the

inside with a wire net*. The technology has been illustrated in figure 7.2.1.10. But the wood base has not been taken away as advised. A mistake that makes faeces accumulate and cleaning difficult.

In the underground cell system the nest is easily formed by putting a brick or a stone to close a part of the cell* (figure 7.2.1.17.).

Fig. 7.2.1.17. Brick-shaped stones have been used by the Experimental Centre of Viterbo to prepare an underground cell and a very comfortable nest. A simple and cheap prototype* for developing Countries.

Feeding rabbits with no-cost roughage achieves the aim of food security. The traditional high hutches may be provided with rake feeders (figure 7,2.1.18.) while, when smaller cages are used, some system must be found to avoid putting grass on the floor where it is quickly trodden and dirtied with faeces and urine.

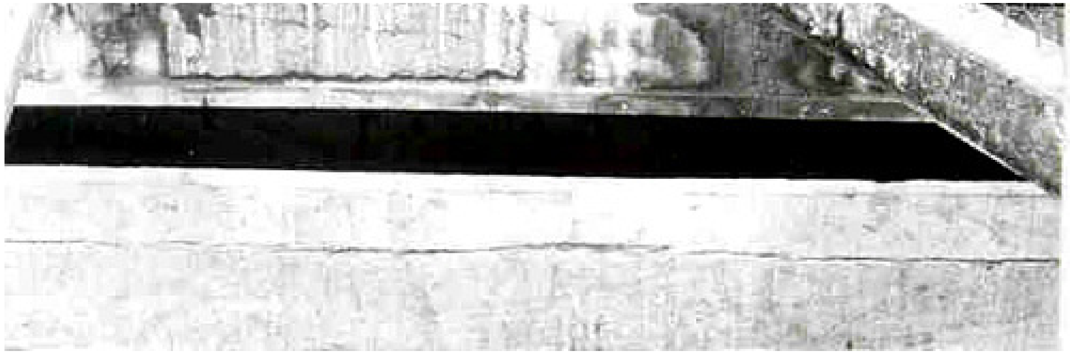


Fig.7.2.1.18. One of the few hutches still utilised in the unit shown in figure 7.2.1.12. Roughage is fed in the rake. The bottom of a tin box is used as a water trough.

Two systems to prevent forage being spoiled on the floor are illustrated in figures 7.2.1.19. and 7.2.1.20. When the cage is low, administering the forage from the top is certainly the best way to feed the rabbits. It is quick, any amount can be provided and it is not necessary to open the cage.

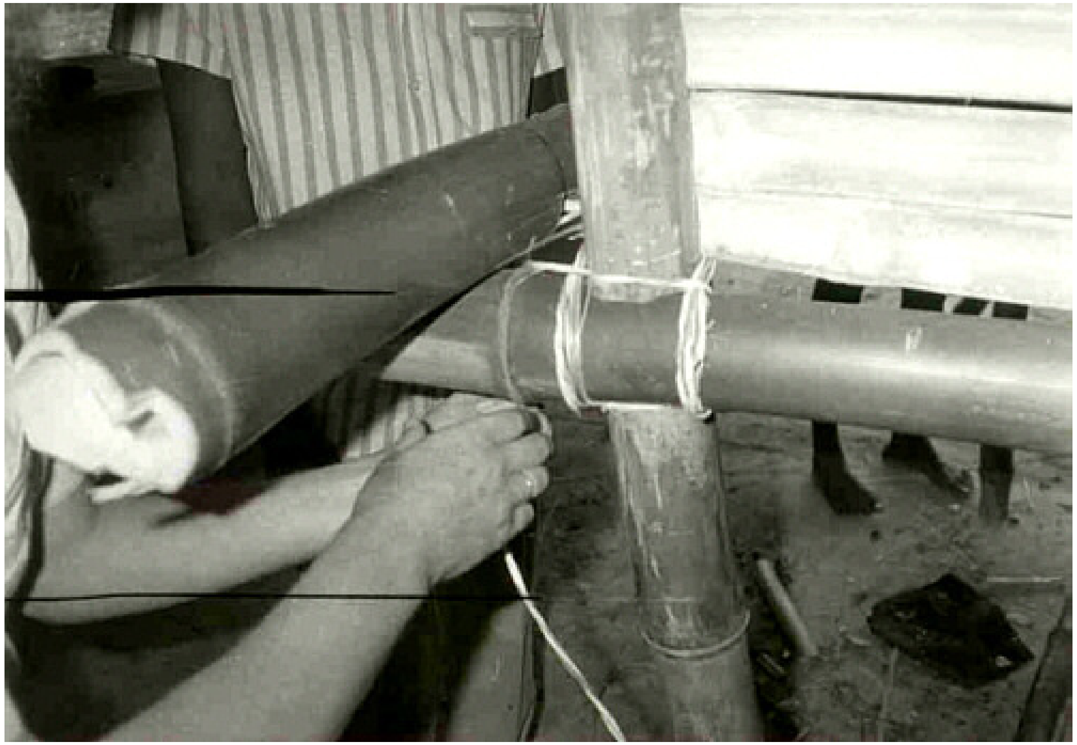


Fig. 7.2.1.19. Try to analyse the system before you click on the picture to read the legend.

Fig. 7.2.1.20. In this very beautiful cage an outstanding rabbit can be raised. The animal is fed from the top. This is an uncommon technique that should always be recommended. Tin boxes have been used as a mould to shape the cement block. This is another technique to be recommended because oxidation of the metal is avoided (Central Africa).

Whenever a bowl or any container is seen inside a cage, it means that some concentrates are being fed to the animals. It is useful then to study when and how much is administered. Maybe higher production is required to supply the market, or simply fewer animals are better fed and give a good meat output.

Sustaining late pregnancy and first lactation could be an appropriate goal. Also concentrates can be administered to maintain production in the dry season when no green forage is available. Sometimes concentrates are fed without any specific purpose. Much can be learnt by the technician who exploits every opportunity to ask questions, and this often results in some valuable suggestions. Siphon drinkers utilising waste glass bottles (as illustrated in figure 7.2.1.15.), are common and the technology to build them, together with other systems, is known and described (Lebas et al., 1996). An interesting model locally invented is shown in figure 5.5.5. Applied research by the Experimental Centre in Viterbo has produced good drinkers and feeders utilising recycled plastic bottles inserted in a hand crafted clay base*. The scheme is described in figure 7.2.1.21. and a prototype to make drinkers for guinea pigs is shown in figure 7.2.2.9.

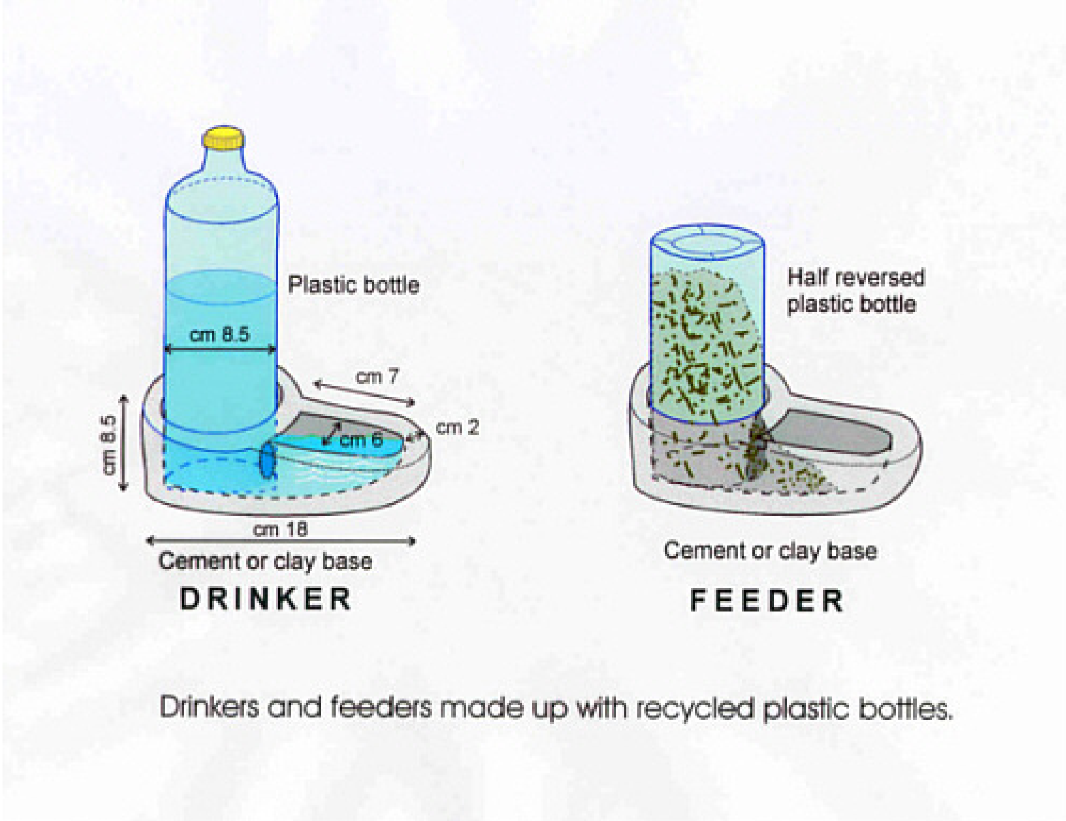


Fig. 7.2.1.21. Scheme of a siphon drinker and a feeder made up from waste plastic bottles inserted in a hand crafted cement or clay base*.

Waste plastic bottles can now be found everywhere and the newly designed drinkers have the advantage of easy replacement with no loss of water.because the bottle does not need to be turned upside-down Simply a hole is made in the base by using a red-hot nail. The feeder is produced by discarding the top of the bottle and then cutting a hemispheric hole in the border. In Developing Countries all the available vegetable matter should be properly utilised, aiming at limited but no cost

production. In these conditions a doe can produce from 6 to 10 weaned young per year. It is not much, but a goal of 2 kg live weight per week, for the needs of the family, can easily be achieved by keeping 6 to 8 does. Mashes are not suitable for rabbits and granulated feeds are rarely available. Anyhow the use of balanced feeds is only economic if a convenient market can be found, and this is only likely in peri-urban areas. In this situation, good breeders can attain a production up to 20 young/doe/year. Two rabbits per week can thus be produced by a stock of only 5 does. If the nutrition of rabbits is based on roughage, first mating must be delayed until 6 or more months of age, and a new mating is not generally recommended until at least 6 weeks after parturition. Unfortunately, technicians often suggest re-mating only two weeks after delivery, or even immediately after delivery. The result is an extremely high mortality and loss of litters. No doe is able to sustain repeated pregnancies and simultaneous feeding without a break after parturition, especially if balanced feeds aren't available. Molasses blocks or crumbles can be produced at rural level (Finzi and Amici, 1996; 1997) and rabbits use them well but many factors such as high molasses content and palatability of roughage must be considered. Anyhow losses are less than when pellets are fed, particularly if the latter are administered in poorly designed feeders . When blocks are used, the remnants should be recovered and included in new blocks, before they become so small > that they get lost under the cage (figure 5.4.4.) as appens with pellets. Production and correct utilisation of blocks and crumbles is discussed in Chapter 11.2. (Feeding and simple technologies).

Mice are considered the worst predators of new-born litters since they are able to pass through the spaces left among the floor slats to make drops fall down in wood or bamboo cages. Then mice eat the small new-born in the nest. Bafflers against mice are described in Chapter 5.3. (Old technologies still utilised) and illustrated in figure 5.3.2. A clever, simple, appropriate system to protect the litters, according to a locally developed management, is described in Chapter 5.5. (Looking for appropriate new techniques).

Cresol is very active disinfectant against coccidia*. Oocysts are killed by a concentration 0.1% of the chemical (Margarit *et al*, 1996). Cresol is very cheap and it is relatively easily found, but it is necessary to pay attention because phenols are frequently sold as cresol. They have a good bactericide action but they are nearly inactive against coccidia. Also bleach is active, cheap and easily found, but chlorine must reach at least a 0.5% concentration to kill the coccidia.

It must be remembered that rabbits are very well integrated by ducks (Muscovy ducks). The birds choose to stay constantly under the cages as a selected habitat (figures 6.6. and 7.1.2.1.3.). The reason is that, also when they cannot feed with pellets fallen from feeders because of a grass-based diet, they scavenge among

faeces and always find insects and their eggs or larvae, that are a protein rich nourishment (Gualterio et al., 1988). This point is discussed in Chapter 7.1.2.1. (Muscovy ducks).

Rabbits integrate also with backyard horticulture. They offer good manure and receive and exploit properly all the vegetal wastes. More information on this topic can be found in Chapter 6. (Differentiation and integration) and Chapter 9. (Small species and horticulture).

If technicians or consultants are ready to learn from experience, unexpected cultural traits can be discovered (figure 7.2.1.22.). The acquired knowledge must be taken into account when project for development are prepared since added values can be useful to make sustainable the keeping of the species involved.

Fig. 7.2.1.22. Looking to this two-level battery

cages in Central Africa, the small tin box, the presence of which is difficult to be explained, kept attention. It was then discovered that it collects the urine and all the gutter system receiving the urine from the surface covered with corrugated metal sheets was built with this specific purpose. It was explained that, in the area, rabbit urine is believed to cure or prevent poultry respiratory diseases, according to local ethnomedicine. The market cost of a litre of rabbit urine was the same as a guinea pig.

Information on simple systems and equipment to raise rabbits can be found in many manuals (GTZ, 1985), (Finzi and Amici, 1991), Lukefahr (1992), Sandford (1996), and the Self-Teaching Manual on Backyard Rabbit rearing of the Caribbean network of co-operation in small animal development (1986). Useful information is reported also in the book, already quoted, from Lebas et al. (1996).

Though many people are unsuccessful, due to relatively difficult managing, generally projects succeed to create some new breeder. Their presence is a permanent stimulation for other people to begin, so that they can be considered as indicators of success also if they remain a small percent of the persons initially involved. This is true also because people who are capable to produce are

nearly always educated persons, able to teach and to diffuse a proper technology.

7.2.2. Guinea pigs

Guinea pigs are an autochthonous species that archaeological research shows was raised since very ancient times in the Andes mountains. It is locally known with the name of "cuy". The animals are commonly kept in the kitchen, where they run freely around among the pots, eating any kind of vegetal wastes (figure 7.2.2.1.). Probably this keeping system was originated because guinea pigs suffer cold environments and die in the rigid climate of the high Andes unless they can range freely near the fireplace. Nevertheless this explanation is not sufficient and other reasons (for instance its simplicity or a cultural heritage) must explain why the same system is the most common also in the hot African climates.

Fig. 7.2.2.1. Guinea pigs by the fireplace is a most common scenery, both in South America or Africa, when field raising systems are analysed. Only the palm leaves, typical of tropical climates, being fed to the animals suggest that the illustration is not from the Andean area.

Sometimes the animals can be found also in the bedroom, where it exists. Keeping in cages is possible, but it looks very uncommon in rural areas (figure 7.2.2.2.). Raising guinea pigs in the kitchen is a system so widely diffused that it must be considered as easily accepted when the goal is to diffuse the species to support programs for

food security. The species is spontaneously diffusing, maintaining its specific keeping system that is sustainable and profitable. To support this process leads certainly to develop successful projects. Kitchens, anyhow, are always kept very clean and hygienic problems should be considered more theoretic than real.

Fig. 7.2.2.2. A West African woman taking care of her guinea pigs. Breeding in cages must be considered uncommon in rural areas. This was the only observed case.

Guinea pigs are rustic and are seldom sick if density is not becoming excessive. Adult weight is less then one kilo and young should be slaughtered to a live weight of no more then 450 g, since their growth becomes later very slow. A heavy breed has been selected in Peru and many projects are diffusing this strain or advising to make crosses. As a consequence the original native strain is becoming endangered and should be protected.

The reasons to protect native guinea pig are many. First of all it is nonsense to loose the smallest mammal utilised by man. The meat of the native strain is

considered more tasty and preferred in the rural areas. It is known that the Peruvian breed grows faster, as it is obvious, but feed consumption is also higher and generally concentrates are administered. This is not possible in rural areas. Anyhow the efficiency of the two breeds has never been compared in poor field conditions where it should be difficult to demonstrate that the Peruvian breed is more efficient that the native one when all parameters are considered, including feed conversion, cost of feed integration with concentrates, health, replacement rate and others.

Native guinea pigs pertain to the cultural world of Andean people. The meat is offered to important visitors and eaten in social or religious feasts, since it is considered absolutely the best. The animals are also used for sacrifices and in ethnomedicine. The many functions of guinea pigs in the socio-cultural system have been treated in Chapter 2.1. (Dynamics of animal production systems).

Though the fact is nearly unknown, guinea pigs are spreading spontaneously in Centre and West Africa (figures 7.2.2.2. and 7.2.2.3.). This shows its exceptional fitness to be bred by no-income low-feed populations. To find the animals in the villages it is necessary to know the local name because generally people do not know the

English or French word and technicians do not know the local word. The problem is discussed as an interesting example in Chapter 16. (Language).

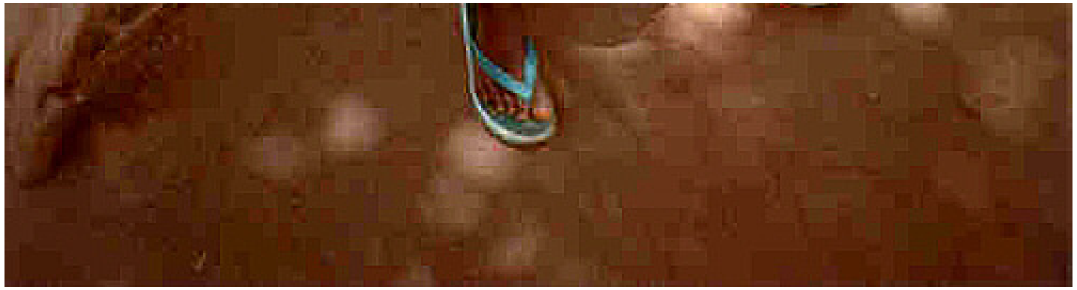


Fig. 7.2.2.3. Try to analyse the system before you click on the picture to read the legend.

In Africa the species has lost its original reference to the magic world, though some new peculiarity is being created again. Other species are utilised for sacrifices or for social reasons while guinea pigs are mainly directly consumed. This is a good point in favour of guinea pigs to be considered when programmes for food security are projected (figure 4.4.).

Guinea pigs are more eaten than sold, thus well contributing to nutritional welfare of poor populations. They request nor cages nor specific cares. The animals go simply around in the kitchen and eat any vegetal waste and some leaf or grass which is easily collected in small amount to nourish them. It is wise to consider always this species when programmes are developed to help rural populations.

Guinea pigs produce a mean of 2-2.5 born per litter and

can have four or five parturitions per year. Losses are not many in warm climates and predation is a minor problem when the animals are kept in the kitchen. Thus it is reasonable to wait for 8 produced per doe per year.

Raising begins generally with a pair at a cost that normally is about one dollar. It must be considered that this is a very small amount to help people to begin. Later on a colony is formed. One male to 8-10 females is an appropriate ratio though males are frequently in excess. From such a small stock a meal from 1.5 to 2.5 kilos of live weight could be expected each month.

Avoiding raising the animals inside the house is often suggested for hygienic reasons. It is doubtful that to keep guinea pigs is less hygienic then to keep any other animal. On the contrary guinea pigs are believed to scare mice away. This believing is very diffused and it was possible to confirm it when small mice were found killed by guinea pigs raised in a controlled environment. It can be also considered that, if they compete for food, guinea pigs are bigger than mice are. These reasons should be considered before judging negatively the custom of raising guinea pigs inside the dwellings in poor villages of Andes or Africa.

Anyhow to keep the animals in small boxes inside a

specific building is a system that has a tendency to diffusion in the original area. These small boxes are called "pozas". They are about 0.5 to 1.0 m^2 wide and the walls are about 1 m high when a specific environment is utilised. Inside the kitchens generally dimensions are quite smaller. Pozas are built with adobe but also bricks or other materials can be used. They represent a simple, cheap, local technology (figure 7.2.2.4.). A poza very well managed was found in the kitchen of a West African dwelling, newly re-invented by the housekeeper. This is an example of spontaneously convergent technology and it means that it is appropriate and easy to be accepted and realised also outside the original area.

Fig. 7.2.2.4. Try to analyse the system before you click on the picture to read the legend.

When pozas are utilised in small buildings or empty rooms, cold weather, common on mountains, can be a problem. Guinea pigs flock together to keep themselves warm and new-born are easily quenched.

The best solution to keep guinea pigs out of the house is probably to prepare small appropriate shelters according

to a technology spontaneously developed in the Andes (fig. 7.2.2.5.). The scarce volume of these shelters makes it possible that the warmth produced by bodies is not dispersed and the temperature can remain sufficient to permit the animals to survive during the cold nights.

Fig. 7.2.2.5. An Andean woman has built true small houses with their own backyards to shelter guinea pigs. A simple, no cost miniature of human dwellings. Adobe or simple mud to make the walls and straw to make the roof are local, traditional technologies. Inside the small, low shelters the heath produced by the animals is not dispersed during the cool night of this 2,500 m high rural area and guinea pigs can survive.

When the building is wide, avoiding losses during the cool nights is difficult. All the animal of the colony crowd together and litters are easily quenched. The efficacy of reversed pots to which small passages have been opened on the border to give entrance and shelter to young guinea pigs has been tested* (figure 7.2.2.6.). Only the smallest subjects can enter and gather there in. They are protected by quenching, while the physiological warmth produced is not dispersed in the environment. The

shelter works well if a rigid base is applied at the bottom of the pot to permit only to young animals to enter.

Fig. 7.2.2.6. A shelter* to protect young guinea pigs is being tested. They cannot be quenched and heath produced by the animals is not dispersed. The common mistake of throwing the feedstuffs on the floor, where it is wasted, can be observed.

Guinea pigs can be fed with freely collected grasses or leaves, beside kitchen wastes. In this case production is practically inexpensive and contribution to family welfare may become very important. This happens in very poor areas. Unluckily grasses and wastes are usually thrown on the ground where they are trodden and spoiled by faeces and urine. This happens also in bigger units and even in research centres. The spoiled feedstuffs are about 16%. This amount can be reduced to 1-2% if roughage is offered in special wire-net baskets (figure 5.5.1.). Holes of about one inch in the wire-net are the most suitable* (Finzi et al., 1994).

But very poor people are not even able to buy wire-net. Two pieces of wood or a split branch can be then used.

The device was called "barra"*. The stems of the grass are pressed between the halves of the barra and then hanged over the poza (figure 7.2.2.7.). In this case also up to 14% of the grass normally spoiled can be saved.

Fig. 7.2.2.7. Alfalfa is hanged over the poza with the simple "barra" device. When the nearest part of the grass is consumed, the barra is lowered and, at the end, is opened to permit feeding the residual grass*.

When guinea pigs are fed with cultivated grass, mainly

alfalfa is utilised. In this case raising the animal can become too expensive in comparison with selling prices and sparing 15% of the forage or raising 15% more animals adopting the use of wire-net bags is a factor of improvement that should be always considered. Barras are cheaper but the work is more; the choice depends on the cost of personpower.

Guinea pigs need drinking water, though this is not always done when fresh forages are administered. Technicians advise the use of clay bowls, but it must be considered that bowls are frequently overthrown wetting the litter. Anyhow guinea pigs are used to make dirty drinking water with faeces and urine, so that hygienic conditions are quickly impaired. To avoid these problems, bowls have been cemented to a brick and a brick stair was made to rise the level of the bowl over the litter* (fig. 7.2.2.8.). In this way bowls are no more overthrown and the technique looks very advisable. Hygienic conditions are also improved and a mean reduction of dirties of 77% can be obtained (Finzi et al., 1997).

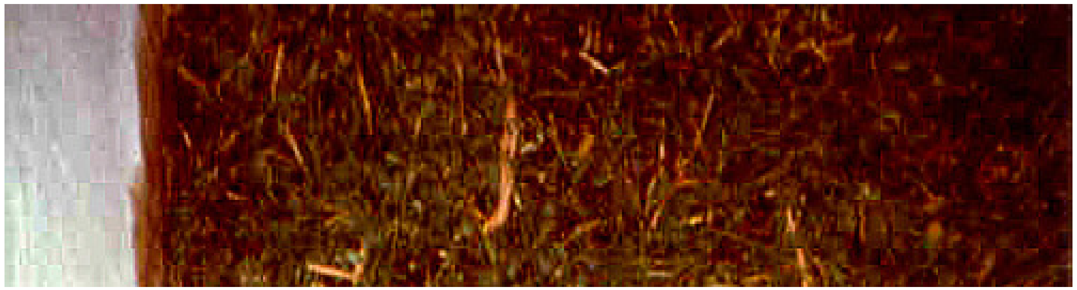


Fig. 7.2.2.8. A bowl is fixed with cement to a brick and a small stair is formed. In this way bowl is

not overthrown and, at a higher level over the litter, water remains relatively cleaner.

A further improvement was obtained with a new prototype of simple no cost drinker. It can be produced also by the breeder himself moulding clay or cement to obtain a base on which a wasted plastic bottle is inserted. A hole is made with a warmed nail in the bottom of the bottle to permit the water to pour out and a very practical siphon can be obtained* (figure 7.2.2.9.). The drinking surface should be about 4x4 cm. The dirties collected are the half than in the bowl and can be reduced to a minimum of only 2 g/week in a colony of 1 male, 5 does and their litter if the drinker is disposed at a higher level.

Fig. 7.2.2.9. A new prototype of siphon drinker has been added in a poza where the hanging barra system is utilised to reduce wasted alfalfa. Hygienic conditions of administering water and grass are very improved. The bed litter is maintained proper and dry.

The same thing can be said with reference to feeders built up with a similar technology. The scheme is the one

described for rabbits and shown in figure 7.2.1.21. Dimensions may be proportionally reduced, but may also remain the same if the equipment must serve all the animals of a colony.

Though the use of concentrates is frequently advised and it can improve both reproduction and growing, feeding cost increases and the technique may be adopted only if marketing conditions are favourable. This is sometimes possible if a town market can be reached. In the rural areas far away it is much better to produce at no cost and feed the animals only with freely collected roughage.

Guinea pigs are easy to be bred and suitable to improve the nutritional conditions of families. Considering that spontaneous diffusion of the species is a consistent proof of sustainability of the keeping, its positive traits should be always kept in mind by project makers interested to food security also outside the Andean area. But projects must be developed according to tradition and a new social relationship cannot be introduced without risk of being unsuccessful.

While analysing the systems to raise small animals in an Andean country it was observed that the small building shown in figure 7.2.2.10 had been abandoned. It was built according to

a project to diffuse and improve guinea pig keeping, supposing that a social managing of the unit was possible. To profit of the project many women accepted to participate and to attend the lessons, but as soon as the project was finished, each of them took a part of the animals and went back to take care only of her own subjects.

Some of the women was already raising guinea pigs and others knew the traditional management in the pozas or free ranging in the kitchen. They were not interested to learn about genetics or physiology, but only to keep the animals according to the traditional sustainable systems. And there was no reason to leave the home to lose time to feed a social lot of animals where property and work to do should bring to discussions.

At the moment of ending the project, it was probably considered successful since the building was there, guinea pigs were there also, and women had been trained as established. Nevertheless the amount of money necessary to build the abandoned structure could have permitted to buy and distribute

much more animals and to help more families.

If training was supposed to be necessary, to do this directly in the homes could at least give the chance to technicians to learn something about the reality they wanted to improve. But the frustrating point was to observe, later on, that many projects in different times had obtained the same negative result as if project makers were not able to learn from their own mistakes. Probably they simply preferred to continue to propose the same type of intervention since they had observed it be easily accepted by donors.

Fig. 7.2.2.10. An abandoned building. The shelter was built according to a project to diffuse a social way of guinea pigs keeping in the Andean area

To prepare projects easy to be financed is not the same as to prepare sustainable projects. Unfortunately donors are used to look to reality through the eyes of project makers and project makers find it easier to work according to what they think reality is. Once again is shown the importance of analysing systems and testing new ideas before starting projects. In this case social

para-technical factors have been constantly underestimated. In Chapter 2.3. (Development modifies sustained production systems) the disastrous effect of starting an industrial production of guinea pigs without a previous analysis of technical parameters has been described.

If training is thought necessary, probably it is better to teach and practise in the agricultural schools (figure 7.2.2.11.). Here is the right place and the right time to learn something about physiology, nutrition, reproduction and other topics.

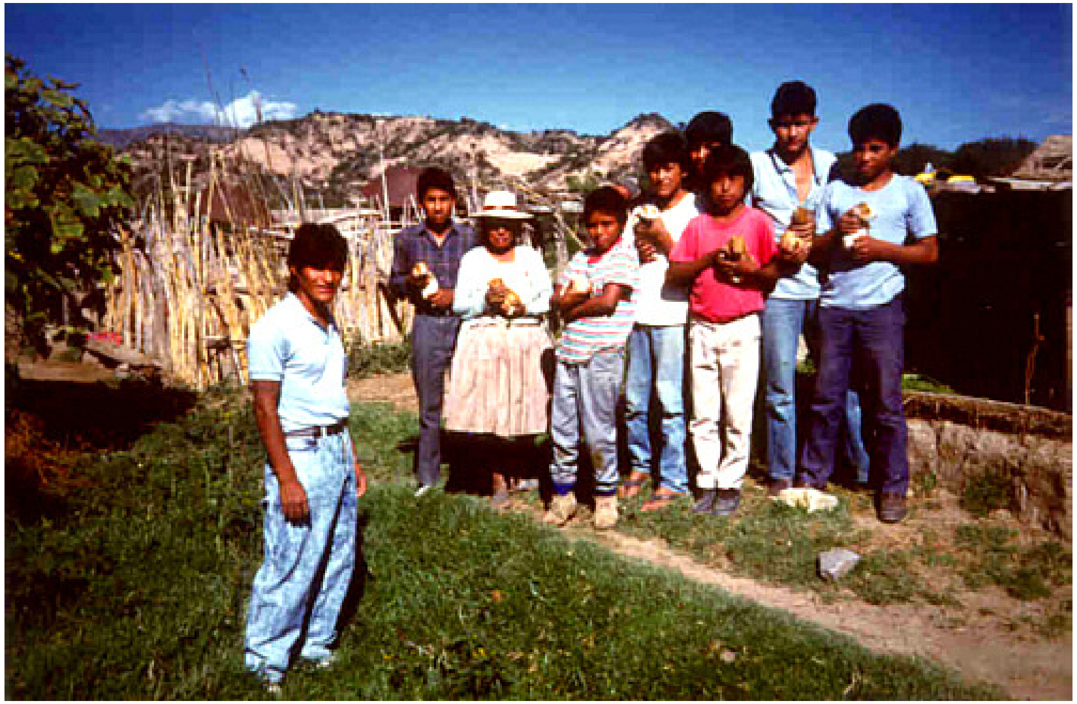


Fig. 7.2.2.11. Technology of rising guinea pigs could be an important chapter when backyard systems are studied in agricultural schools. Here a professor with his students in the Andean area.

7.2.3. Other mammals

Other mammals can be or become species of interest in specific areas they have originated from and can be profitably raised also elsewhere. One example is grasscutter (genus Thryonomys) in Africa.

The species is not properly domesticated but it can reproduce in captivity. Thus it can be hunted, captured alive and reared in cages or in some unused room where some concrete pen of about 4 m^2 can be built. Animals are kept at a density of about 2-3 subjects per m^2.

The animal is present in western Africa, from Senegal to Nigeria (Adoun, 1992), as in eastern Africa and southward until South Africa. Its presence has been observed in the semiarid Sahel as in the great equatorial forest belt, near the cost as in the highlands at 3.000 m of altitude (American National Research Council, 1991). In this wide area it can be considered as an element of a possible species differentiation.

Grasscutters are fed on local grasses, mainly elephant grass and guinea grass (figure 6.5.). According to Ganmavo (1992), over a cultivated area of about one ha, an income increase of about 15% has been estimated as possible raising grasscutters. The species eats only the stems, so that leaves are wasted (figure 7.2.3.1.). It was observed that rabbits eat only the leaves and leave the stems, so that grasscutters and rabbits can constitute a perfect integrated system for the complete utilization of local grasses*. The best scheme is to feed rabbits first. Then it is easy to collect the stems and administer them to grasscutters; the inverse is less easy because leaves are more and probably they have been dirtied and trod by the animals before collecting.

Fig 7.2.3.1. The grasscutter is eating a grass stem after stripping the leaves that lay spoiled on the floor. The species is not completely domesticated and handling it is dangerous, considering their powerful incisive teeth. This is the reason the cage wire-net must be very strong.

The meat is very appreciated and expensive so that to raise these animals could be convenient. But raising

grasscutters is not easy. They are rather aggressive and their powerful incisive teeth are dangerous and able to nibble and destroy the equipment (figure 7.2.3.2.)

Fig. 7.2.3.2. These hard ceramic bowls to feed and water grasscutters have been heavily damaged by nibbling. This shows how strong must be the equipment. In this semi-industrial unit the animals are raised on the ground in wire-net pens.

Before beginning to produce grasscutters, market condition must be well examined because a great deal of

the marketed animals is coming from hunting (figure 7.2.3.3.). Of course, hunted animals can be sold at a lower price then if they are coming from a production unit, and this can be a serious impairment to marketing. Not profitability was still the main limiting factor at the second half of the eighties (Baptist and Mensah, 1986) and the situation does not look changed significantly since then.

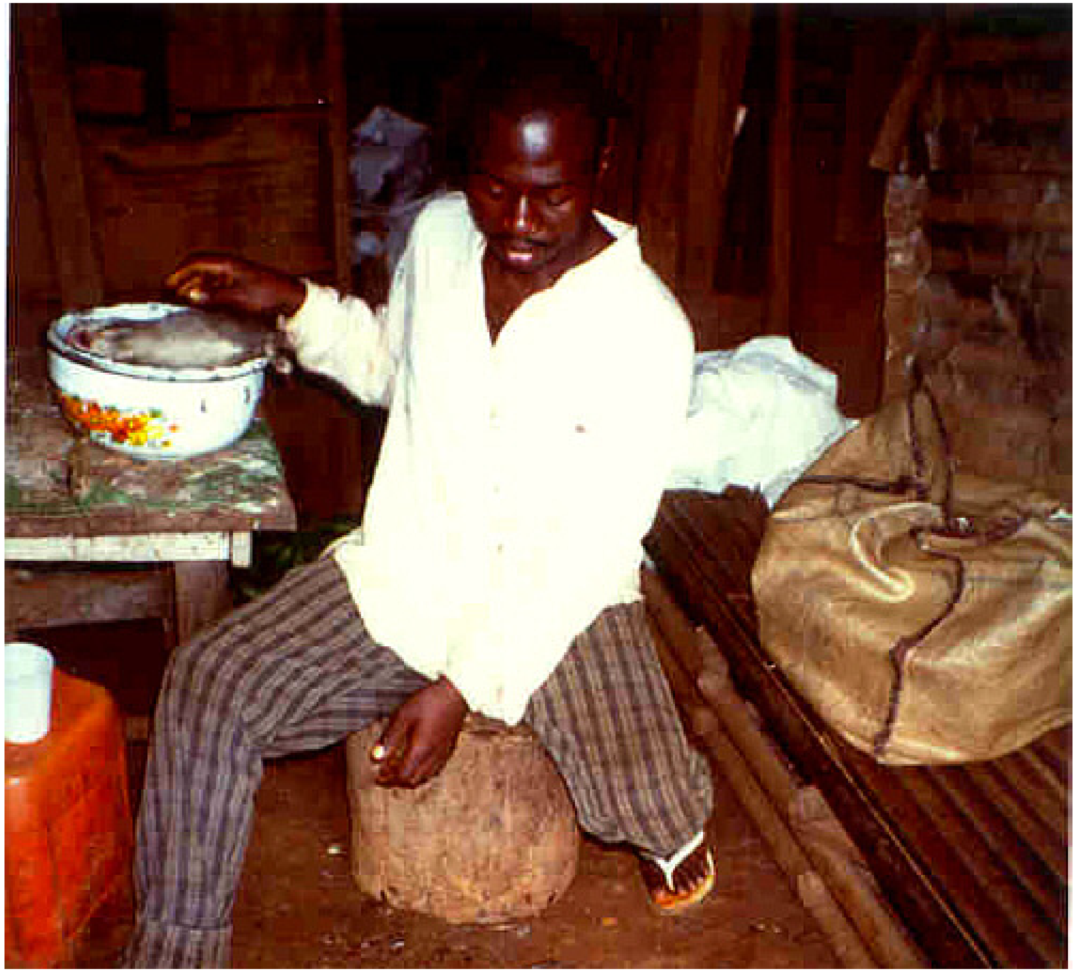


Fig. 7.2.3.3. Hunted grasscutters are sold in the market (Centre Africa). Young grasscutters, when trapped, can be fattened in rural areas. But raising the species does not look economical until hunting and trapping give an easy and abundant yield.

Apparently perspectives are better with reference to giant rat (genus Cricetomys). In fact it is much easier to find these animals raised in the villages (figure 7.2.3.4.). Even though some research has been performed (Malekani, 1996), keeping is done mainly according to local, spontaneous technologies. It begins generally with a pair of young rats trapped in the forest.

Fig. 7.2.3.4. Giants rats are shown to the visitor. They are kept in the gasoline tank that can be seen in the bottom (Centre Africa).

Giant rats are naturally tame and are managed catching them by the tail (figure 7.2.3.5.) They are fed with fruits, tubers, leaves and by-products of agriculture and can produce 3-4 puppies, 3-4 times a year. Higher yields can be observed but it is unrealistic to consider such outputs as repeatable means.

Fig. 7.2.3.5. Giant rats are very tame and easily handled. Normally they are trapped in the bush and then fattened in the house. Breeding them in captivity is possible.

The meat is very appreciated and easily sold, if not directly consumed; thus to begin with small units of 2-6 pairs can be advised as possible, sustainable and convenient. Keeping the animals in an empty tank of gasoline is the local technology. The system looks efficient, cheap, well accepted and spontaneously diffusing. The tank must be covered with a lid because rats are able to jump out. Rats are frequently escaping when taking out the lid to feed them. A villager got the idea of limiting the top of the tank with a concave lid opened in the centre (Figure 7.2.3.6.).The lid was made adapting a recycled old metal basin.

Fig. 7.2.3.6. The owner has improved the rat housing system limiting the border of the tank with a concave lid. The central hole permits to observe and to catch the animals, in the same time avoiding them to escape jumping out. This happens frequently when a flat lid must be taken off to feed the animals.

This is a good example of appropriate, simple technology, locally developed. The analysis of the system gave the chance of discovering it. Technicians have proposed also the utilisation of cement boxes or cages, but these systems are more expensive. They look as an

unnecessary complication, at least in the actual phase of raising giant rats at family level.

As grasscutters and giant rats in Africa, coypu (genus Myocastor) could be raised at backyard level in South America. Though the species is considered able to get 2 litters per year and 4-5 animals per litter, data calculated from real yield show an output of about 4 per doe per year. The yield is about 4.5 kg live weight per animal at 6-8 months of age (Biasatti *et al*., 1998-99). In a corral of about 5 m^2 in the backyard, a family of 1 male and 6 females can be arranged. The expected yield is about 9 kg live weight per month. This could be a very good contribution to cover the protein nutritional needs of the family.

If coypu is raised for purposes of food security the system looks sustainable, supposing available nutritional resources are at disposal. The AA. mentioned above have developed an integrated system including production of earthworms and manure. The matter attains the topic treated in Chapter 6 (Differentiation and integration). The flows diagram in the integrated module is shown in figure 7.2.3.7.

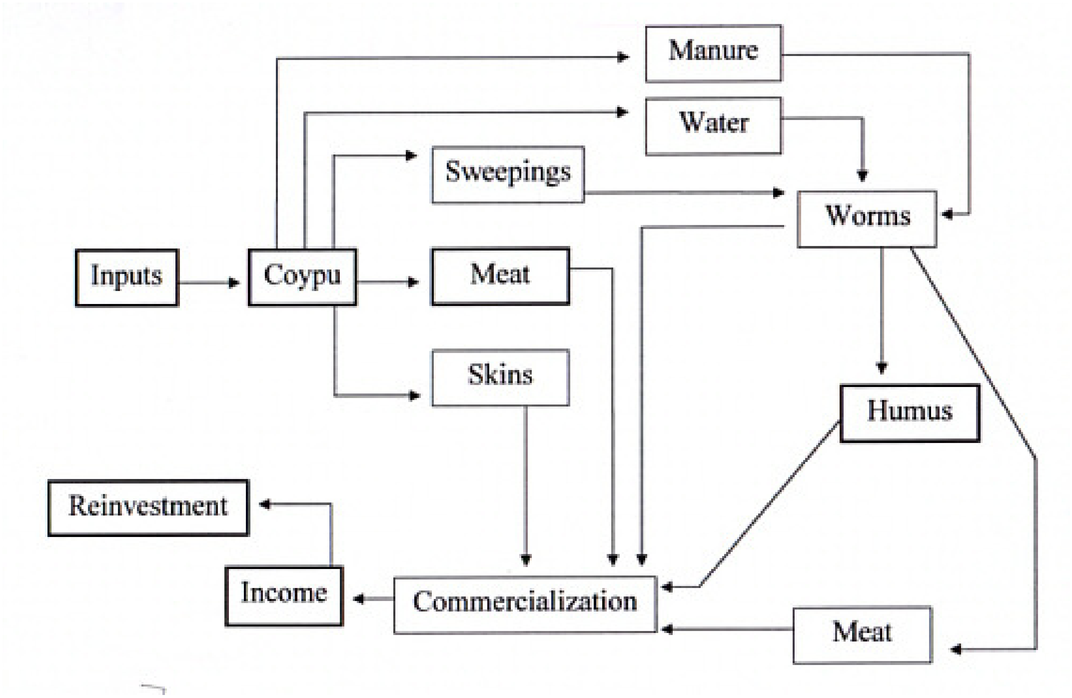


Fig. 7.2.3.7. Flows diagram in the integrated system coypu-earthworms-manure (Biasatti *et. al.*, 1998-99).

Fig. 7.2.3.7. Flow diagram in the integrated system of coypu-earthworm-manure (Biasatti et. al., 1998-99). Though the meat is well liked and could be considered as the sole production goal, coypus have also been described as a dual-purpose (meat and fur) species. The original interest was for fur. It is interesting to consider how para-technical factors, some of them described in Chapter 2.2. (Technical and para-technical factors), negatively and decisively affected breeding. These factors were the growing pressures from environmental groups against the use of animals for fur and market fluctuations

arising from a change in clothing fashion . More information on small mammals was produced by the American National Research Council (1991).

7.3 Other species

Other species can be raised to contribute to the nutritional needs of the family and to produce some occasional extra income. In this context, African giant snails and Central and South American iguanas are an new interesting species. Bees are mentioned as a traditional keeping.

7.3.1 Giant snails

Snail species produce appreciated and sometimes very expensive meat. Giant snails are consumed in West African countries and contribute to the nutritional welfare of food-deficient people. They are mainly collected in the field, but many small backyard raising units have been put in place, thanks to the assistance of organisations or programs for rural development. Giant snails pertain to the Achatina and Archachatina genus (five species in total). They weigh 150 to 300 g, but Achatina can reach 400 and even 500 grams. The potential to cover protein deficiencies is thus evident. Snails are easily commercialised and may become an appreciated source of extra income. But it is important to remember that they are also utilised in traditional medicine and this increases their value, due to socio-cultural implications. A colourless liquid is utilised, produced by the dorsal part of the animal when the top of the shell is broken in a particular way. The liquid is

widely believed to protect against tetanus and epilepsy; in some places it is also utilised to cure wounds, burns, asthma, bleedings and eye diseases. This importance in ethno-medicine must be properly exploited to reinforce the efficiency of snail-raising projects. To underestimate it is a mistake and technicians can be alienated, or even treated as enemies, with respect to people's traditions.

Heliciculture can be practised in small concrete houses (50 to 100) sections or inside holes dug in the earth and plastered with clay containing 20 to 50 sections (Sodjinin, 1998). Concrete units with less than 20 sections, but apparently very well managed and productive, have been observed (fig. 7.3.1.1.).

Fig. 7.3.1.1. A well managed cement housing for giant snails, taking up little space in a small backyard in the surroundings of a West African town.

In the villages, snail keeping is often carried out inside old metal or plastic buckets or pots and waste materials are efficiently recycled (fig. 7.3.1.2.). The simplest system observed is formed by a heap of stones where snails find shelter (fig. 7.3.1.3.). Management, in this case, is difficult, but it is sufficient to wet the area and to offer something to eat in the late afternoon. This encourages the snails to come out at night and makes them easier to collect.

Fig. 7.3.1.2. Recycled materials ensured favourable economics for this rural snail keeping.

Fig. 7.3.1.3. A heap of stones in a backyard form a simple, economical, but scarcely efficient snail keeping (camouflaged snails are indicated by the arrow).

Snails are fed with papaya leaves and integration with bran is possible. Husbandry involves feeding the animals, regularly wetting the structure, protecting the animals

from predators (mainly domestic fowl) and ensuring that the tiny newborns do not escape. Protection from predators and prevention of escape need properly designed housing systems. Apparently it should be possible to mould clay containers according to the scheme* drawn in figure 7.3.1.4. When they are set partly underground, it should be easy to keep them wet. These clay pots can be produced locally nearly everywhere and it is possible to make a protruding internal rim that prevents the escape of newborn snails. The lid prevents escape of bigger snails.

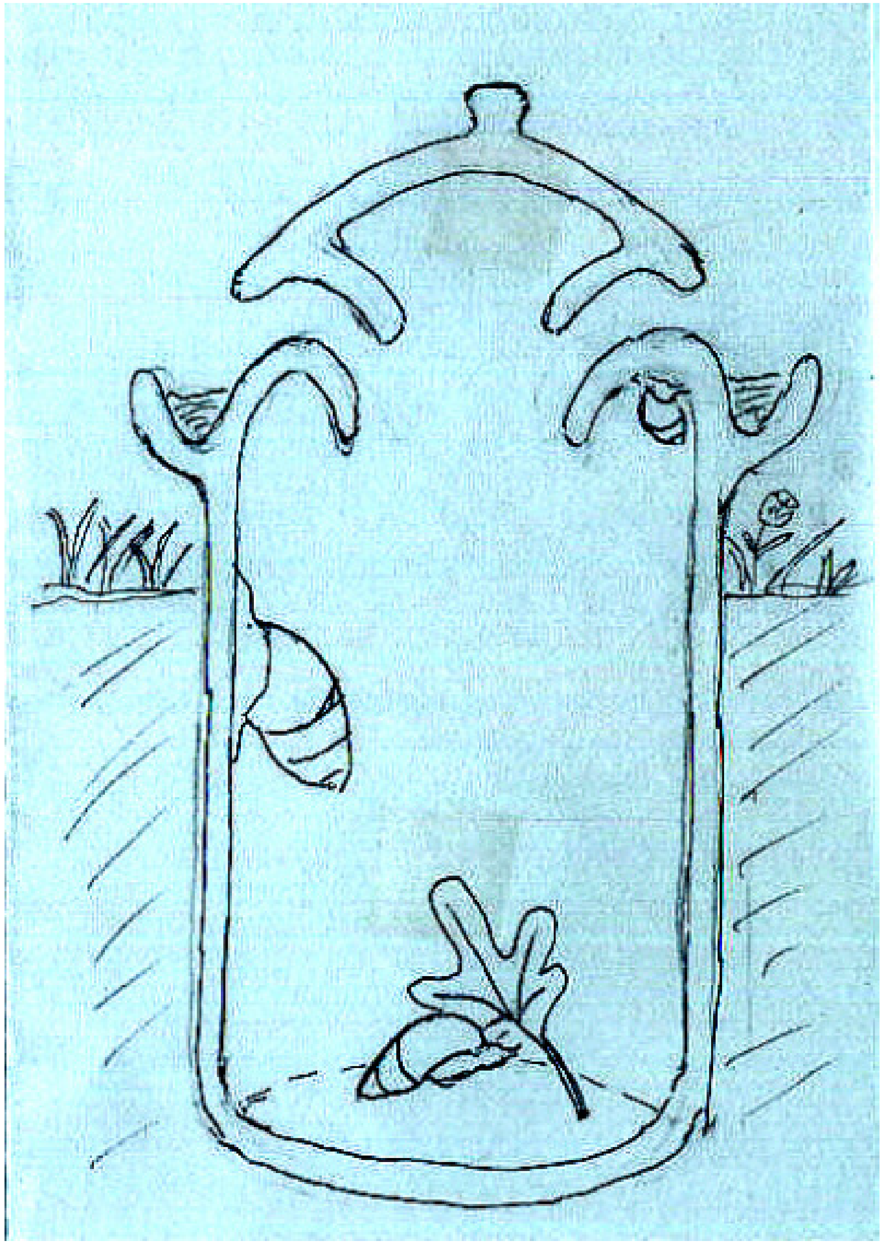


Fig. 7.3.1.4. Scheme of a locally and easily hand-crafted clay prototype to raise giant snails*.

If preventing ants entering the pot is a problem, a small external circular gutter filled with burnt machine oil is normally sufficient for this purpose. The proposed new technology comes from field analysis of practical snail keeping problems, but has not yet been tested and probably need some adaptation for improved functionality. Staphilinids are more dangerous snail predators. Carnivorous beetles, such as carabids, calosomids and others eat dead snails as do ants (Various Authors, 1998). In Africa, the presence of ants on dead molluscs has generated a general belief that they are able to kill snails. Although we know that they eat them only if dead, it is wise to prevent ants and other insects entering the production units. Giant snails have different local names according to region, species and colour. It is necessary to know the names before beginning to work in the field, but a local survey can produce wrong information. This problem is discussed in the Chapter 16. (Language). Snails can contribute to animal diversity in the backyard. The housing structure can be relatively small and situated in a corner of the yard or in the lower part of a multi-floor structure. In an integrated system, snail shells can be used as a source of calcium for laying hens. Animals discarded because they are dead, eaten by ants or for other reasons are a good source of protein for all fowl species. Leaves wasted as a result of feeding can be composted . Useful information can be found in the publication mentioned above (Various Authors, 1998), although it is devoted to industrial production. Simple information, well supported by figures, can be found in two booklets produced by FAO (FAO, 1986, 1988). They are specific to the African species and promotional aspects are considered

particularly for commercial purposes. In the case considered here, the market should be previously analysed because local prices depend on snails freely collected in the bush. Other snails (genus Pomacea) are farmed in some Asiatic Countries in ponds and concrete tanks as human food and as a source of income. Escaped snails have become a pest in rice fields and instead of a chemical control, trapping has been proposed to utilise them as animal feed. Whole or crushed snails have been tested as a possible feed integration for chickens, ducks, tilapias and pigs (Serra, 1997).

7.3.2. Iguanas

Another species, which offers good perspectives, is the green iguana. These reptiles have a range that extends form Mexico to Brazil. They are often called "chickens of the trees" and have been eaten both as a delicacy and a staple food for at least seven thousand years. According to Werner (1998), farmers can raise iguanas in fence rows formed by strips of trees stratified according to height. The largest iguanas occupy the tallest fastest growing species in the centre, while trees planted towards the ends of the rows allow perches for smaller iguanas. Since iguanas are cold blooded, they need sun to maintain their metabolism. Narrow strips of trees provide the reptiles with an optimal amount of sunlight. Hatchlings are contained and protected from snakes in enclosures of tall metal sheet walls. Wire netting strung over the enclosures protects them from opossums and hawks. Trees and thick branches placed in the enclosures provide shade and perches. On the ground, tiny bamboo compartments in which lizards can hide are raised on stilts and set in trays of water to keep out ants. Nearly 100% of iguanas kept in captivity survive, while in nature about 95% fall prey to predators in their first two years. They are raised on cheap high-protein supplements, fresh-cut leaves, flowers and fruits. In these conditions iguanas reach sexual maturity one year earlier, and one year-olds weigh twice as much than in the wild.

7.3.3. Bees

One or a few honeybees' hives are sometimes observed not far from dwellings. Correctly set a little distance from dwellings to reduce the risk of people being stung, they can be still considered as a part of the backyard, or near-the-house system. Several species can be utilised, though Apis mellifera is the most common and important. Man has been able to gather honey since ancient times, but beekeeping is also so old that the guarantee of sustainability is absolute. Appropriate, simple and cheap technologies are described in the old books. A lot of different products can now be obtained and profitably marketed when socio-economic conditions are favourable (Krell, 1996). Bees are not competing with other species and they do not need daily care. As a consequence they should always be considered as an element of possible diversification. The only problem is that management requires specific competence. Equipment required is generally not cheap, but it can easily be produced by the beekeeper with free local materials. Beekeeping should be more frequently considered as part of an integrated animal keeping system for poor rural people.