SECOND EDITION

Developing Sustainable Rabbit Projects

S.D. LUKEFAHR

PASS ON THE GIFT
HEIFER® INTERNATIONAL

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DEDICATION

To my parents, William and Patti Wolfe, who actively nurtured my "rabbit fever" as a child, and to Brenda, Jessica and William for all your sacrifices, love and support, especially during those many overseas trips while doing my rabbit work.

PASS ON THE GIFT

HEIFER®

INTERNATIONAL

HEIFER INTERNATIONAL is a nonprofit, humanitarian organization dedicated to ending world hunger and caring for the Earth. Heifer pursues this mission by providing livestock, trees, training and other resources to help struggling families move toward greater self-reliance and build sustainable futures. Heifer's gift of "living loans" offers milk, eggs, meat, wool, draft power and other benefits that become improved nutrition, health, education and income for resource-poor families.

Heifer partners with groups to create a development plan with specific goals based on the values of their community. Partners learn to care for animals and grow crops in ways that can be sustained for future generations. Heifer adds expertise in animal health and management, water quality, gender equity, agroecology and community development.

Over the years, Heifer has developed a set of guiding principles called The Cornerstones for Just and Sustainable Development. The Cornerstones form the acronym "PASSING GIFTS," which is an essential element of our sustainable approach. Heifer requires that livestock recipients Pass on the Gift of one or more of their animals' offspring and training in environmentally sound agriculture. In this manner, an endless cycle of transformation is set in motion as recipients become equal partners in ending poverty and hunger. Since 1944, this common sense approach to sustainable development has enabled Heifer to partner with millions of families in more than 125 countries to improve their quality of life.

HEIFER INTERNATIONAL'S CORNERSTONES FOR JUST AND SUSTAINABLE DEVELOPMENT

PASSING ON THE GIFT

Passing on the Gift is the heart of Heifer International's sustainable community development philosophy. Every family who receives an animal signs a contract to pass on one or more of their animals' offspring to another family in need, along with the training and skills that they have acquired. This unique approach creates a ripple effect that transforms lives and communities.

ACCOUNTABILITY

Heifer provides guidelines for planning projects, screening recipients, monitoring progress and conducting self-evaluations. The groups define their own needs, set goals and plan appropriate strategies to achieve them. They are also responsible for submitting semi-annual monitoring reports to Heifer International.

SHARING AND CARING

Heifer believes that global problems can be solved if all people are committed to sharing what they have and caring about others. One of our most important Cornerstones, sharing and caring is an integral part of our vision for a just world.

SUSTAINABILITY AND SELF-RELIANCE

Because Heifer funds projects for a limited time, project groups must devise strategies for its continuity. In our experience, self-reliance is most easily achieved when a group has varied activities and generates support from several sources.

IMPROVED ANIMAL MANAGEMENT

Feed, water, shelter, reproductive efficiency and health are the essential ingredients in successful livestock management. The animal must be an appropriate breed for the area and should be a vital part of the farm activities without placing an extra burden on the family or resources

NUTRITION AND INCOME

Livestock contribute directly to human nutrition by providing high-quality protein. Indirectly, they provide draft power for cultivation and transportation, as well as manure for soil fertility. Livestock provide income for education, healthcare and housing, and as living savings accounts, provide long-term economic stability.

GENDER AND FAMILY FOCUS

Gender refers to the socially-defined roles of women and men in each culture. Heifer encourages women and men to share in decision-making, animal ownership, labor and benefits. Heifer has a gender initiative, as well as its Women in Livestock Development (WiLD) program.

GENUINE NEED AND JUSTICE

Heifer is a partner to people in need who can improve their quality of life with modest support. Priority is given to marginalized groups. The poorest in the community should be included and receive priority for assistance. Families are eligible regardless of creed or ethnic heritage.

IMPROVING THE ENVIRONMENT

The introduction of Heifer International projects should have a positive impact on one or more of the following: soil erosion, soil fertility, sanitation, forestation, biodiversity, pollution, wildlife and watershed conditions.

FULL PARTICIPATION

Members of the group "own" the project and have control over all key decisions. Heifer is committed to involving all members in decision-making, working with grassroots groups to develop strong leadership and organization.

TRAINING AND EDUCATION

Groups determine their own training needs, and local people are involved as trainers. Training includes formal sessions as well as informal farm visits and demonstrations. In addition to training in livestock husbandry and environmental conservation, groups have requested training in food processing, marketing and human nutrition among others.

SPIRITUALITY

Spirituality is common to all people, regardless of their religion or beliefs. It is expressed in their values, sense of connection to the Earth and shared vision of the future. Often spirituality creates a strong bond among group members, giving them faith, hope and a sense of responsibility to work together for a better future.

ABOUT THE AUTHOR

After completing his graduate education at Oregon State University, where he was affiliated with the Rabbit Research Center, Dr. S.D. Lukefahr worked as a consultant for Heifer International. From 1983 to 1985, Dr. Lukefahr helped develop a grassroots level, meat rabbit program for rural farmers in the northwest province of Cameroon, West Africa. As a professor at Alabama A&M University and Texas A&M University-Kingsville, Dr. Lukefahr has trained many graduate students as rabbit specialists, many of whom are now working in developing countries. He also assisted and collaborated with rabbit scientists in many developing countries. The original edition of this book, *A Trainer's Manual for Meat Rabbit Project Development*, was based on his "Outline of Lectures on Small-Scale Rabbit Farming" document which was used in training programs and by institutions in Africa, Asia, Eastern Europe, Latin America and the Caribbean. For several years, the first edition of this book was the most requested training resource publication from Heifer International headquarters. It was also translated into several languages. Dr. Lukefahr is co-author of the popular book, *Rabbit Production* (Interstate Printers & Publishers, Inc.), and has published more than 150 articles in national and international journals and papers in conference and workshop proceedings. In 1997, in recognition for his humanitarian services, Dr. Lukefahr received the coveted International Animal Agriculture Bouffalt Award by the American Society of Animal Science. From 2004-2008, he served as President of the World Rabbit Science Association, and presently holds the WRSA office of General Secretary for Developing Countries.

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PREFACE

It is a myth that raising rabbits is easy. Successful farmers are either well trained or gain valuable experience with time. Often, such farmers seem to have a natural talent for raising rabbits. Nonetheless, good training and development of special skills and experience are necessary for steady meat production.

Most project training staff who work in agricultural development have not raised rabbits. Despite good intentions, many have insufficient background to conduct a meat rabbit training course. Many otherwise promising rabbit projects have failed. This track record needs to be reversed. Rabbit experts are a seemingly rare commodity. However, some notable projects involved a local rabbit expert who was a farmer, who raised rabbits successfully for many years, and who had the ability and goodwill to teach others. Before training others, a trainer should either be literate or be closely assisted by project staff. Ideally, a trainer has received rabbit training and/or has raised meat rabbits successfully.

The purpose of this book is to guide the trainer in achieving self-confidence and competency in planning and conducting a rabbit training course and, moreover, in designing a viable rabbit project. The ultimate "target group" for whom this book is intended is families who desire a higher quality diet and an alternate source of income, living in both developed and developing countries.

In fact, during the Great Depression, there was a record rabbit population in the U.S. This was because many families combined their "victory garden" with raising rabbits to produce enough food to eat, including inexpensive meat. Rabbits were largely fed garden "wastes" and homegrown forages. Unfortunately, it appears that in some ways history may be repeating itself with the present global economy.

Detailed scientific or technical books on rabbit production are available. The trainers should have several of these books on their bookshelves as a supplemental resource. There is no intent by the author to duplicate this useful information. Instead, a list of selected general texts appears at the end of this book.

This book contains only the essential information needed by the trainer in order to develop lesson plans or lectures on sustainable rabbit farming for limited-resource farmers to later become successful. Detailed technical information and use of scientific terms have been limited. In addition, practical "how-to" manuals should be developed by organizations or institutions working in the farmer's region and should reflect local cultural values, practices and traditions.

Section 1, "Planning a Successful Rabbit Project," was not found in the first edition of this book. This section provides a field-proven working model that offers a new approach to designing and executing a successful rabbit project, based on the author's experiences in Africa, Asia, Eastern Europe, Latin America and the Caribbean. This section deals with the logistics of rabbit project development, from feasibility through evaluation stages. Section 2, "The Learning Guides and Lessons," was developed to assist the trainer in preparing lesson plans that should supplement practical experiences in raising meat rabbits. In addition, each module is introduced by a learning guide that includes learning objectives, terms to know, recommended demonstrations, training group discussions or take home assignments, and sample visual aids.

Good luck in developing a thriving and successful rabbit project!

S.D. Lukefahr

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SECTION 1
PLANNING A SUCCESSFUL RABBIT PROJECT

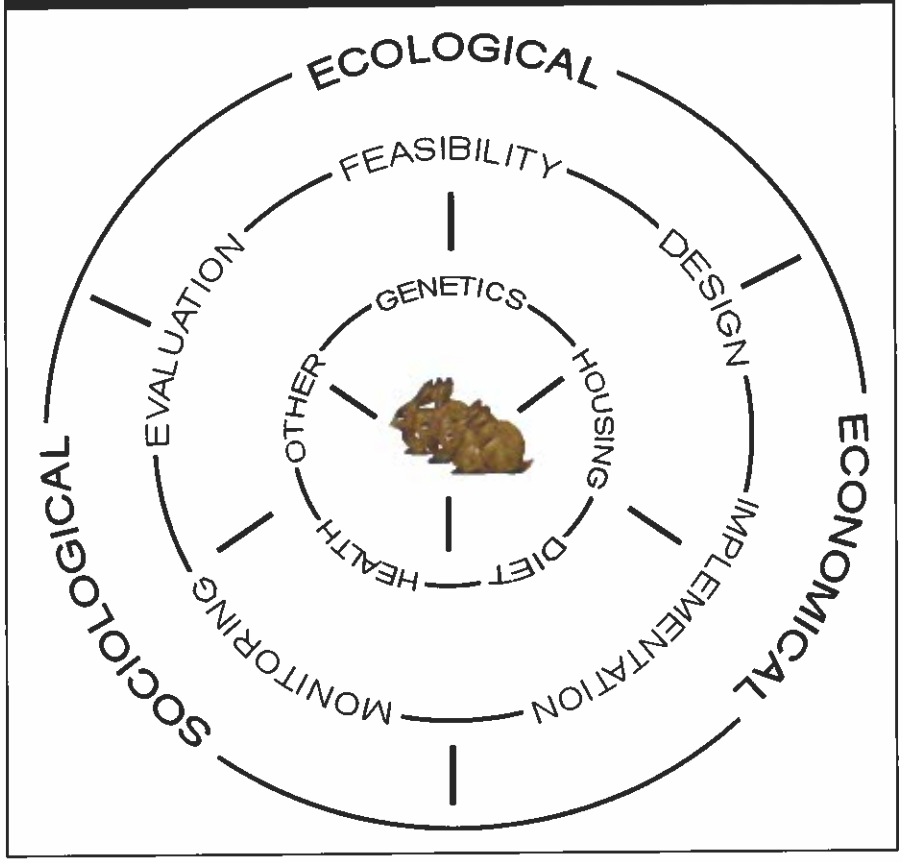
Developing a successful meat rabbit project is a real challenge, but the benefits can potentially far outweigh the investment and sacrifices incurred. In the mission of livelihood development, raising rabbits is simply a means by which our goals can be accomplished. In a world that presently faces many human-caused environmental and economic problems, the rabbit is becoming more recognized as a partial solution to alleviating human suffering. This recognition is largely attributed to the rabbit's ability to reproduce and grow on an inexpensive, forage-based diet from small farm plots (as opposed to costly cereal grains produced from fossil fuel and commercial fertilizer). By the same token, if well fed and managed by the farmer, the rabbit is basically a healthy animal, not requiring routine use of antibiotics, coccidiostats, dewormers or vaccinations. Moreover, rabbit meat is highly nutritious and the supply is continuous for the family. There have been many cases where farmers have greatly increased their income by selling surplus rabbits. Also, rabbit manure makes excellent organic material for composting, vermiculture, fertilizer for fishponds, etc. However, these advantages only become realized if the project is initially well planned and executed.

The purpose of this section is to present the Small-Scale Rabbit Production Model (SSRPM), which is a planning tool used to develop successful rabbit projects. This section should be most useful to those who work closely with communities in developing viable rabbit projects.

In brief, the SSRPM consists of three interrelated sets of factors. The first are internal production factors that directly involve decisions made by the farmer, such as the suitability and/or performance of breeding stock and the availability of local resources used for diets, housing and equipment and to promote health. Intermediate developmental factors address the agency or program staff managing the project and include feasibility, design, implementation, monitoring and evaluation. External environmental factors—ecological, economical and sociological—are measures that reflect project sensitivity in the sense that the farmer should be concerned about these factors. For example, is the market environment favorable for rabbit meat sales? Also, does the community accept the involvement of women who are engaged in the rabbit project?

Obviously, one weak link in the sustainability wheel can cause the model to either suddenly collapse or be driven off track toward project failure. Bearing these interrelated factors in mind, a useful approach is to question whether any one of these three-tiered aspects or factors creates the situation of farmer dependency. Limited-resource farmers should not have to rely, for example, on exotic breeds, commercial feeds, imported welded wire, long-term technical supervisory assistance, husband approval, formal markets,

Figure 1.1. The Small-Scale Rabbit Production Model (SSRPM) Wheel of Sustainability



etc. Careful planning of new projects or timely modification of existing ones is absolutely vital to ensure lack of such dependency situations, which will aid to promote sustainability or ultimate project success.

The "Information Request Form" used by Heifer International is provided in the Appendices of this book as an overview of what a livestock project proposal might look like. When used in the initial stages of proposing a project, this form helps groups define their goals and methods for meeting them. This form also provides Heifer International with a clearer understanding of a group's purpose, capabilities and situation. In addition to serving as a guideline, the "Information Request Form" may also be presented as an actual project proposal and submitted to Heifer International for funding consideration. Once complete, a project proposal should be sent to the Heifer country office closest to the proposed project location. If the appropriate country or regional office is unknown, this information may be requested via e-mail at **info@heifer.org** or by writing to Heifer International, 1 World Avenue, Little Rock, AR 72202, USA. Information is also available at the organization's website, **www.heifer.org**.

PART 1

SMALL-SCALE RABBIT PRODUCTION MODEL – INTERNAL FACTORS

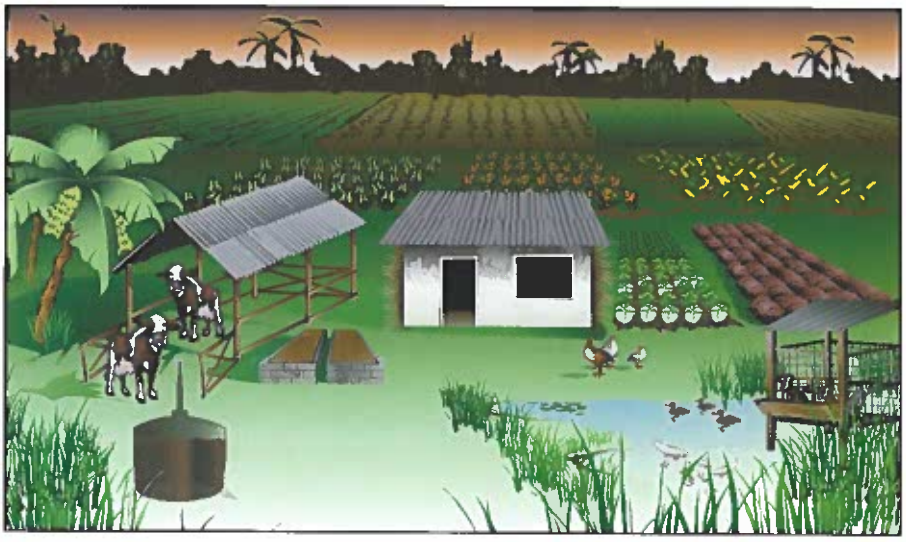
As stated in the introduction, the internal factors of the Small-Scale Rabbit Production Model (SSRPM) consider those aspects of rabbit production that involve decisions made by the farmer. As shown in the SSRPM figure, the internal factors include diet, genetics, health, housing and equipment, and other factors. In the context of sustainability, each factor must not only be accessible but renewable, and at the same time, affordable to the farmer.

The approach used for this chapter is to assess sustainability for a potential rabbit project as if the person was actually preparing a feasibility report. Basically, this approach represents a checklist that determines if each internal factor receives a positive or negative checkmark toward the overall decision of whether to start a rabbit project. In order to assess the internal factors, it is recommended that the person who may be involved in conducting a feasibility report actually visit several successful rabbit farms or projects in the region or country where the rabbit project is being proposed.

DIET

Diet quality has been a major limiting factor of production in many rabbit programs. Reasons include insufficient farmer training, low farmer motivation, lack of a feeding strategy plan, adverse season, etc. Selection of farmers for training and the quality of the training program are covered in Part 2.

For diet and all other internal factors, the rabbit project should reflect an integrative and sustainable farming systems model. This system is driven by the sun (rather than fossil fuel and nuclear energy) as the ultimate



BRYAN ARDENTH

Whole-farm integration

energy source to grow crops that are efficient in the photosynthetic process. Functional integration among all farm components (e.g., livestock, fish ponds, garden and forage plots), whereby the total yield of food from the farm is greater than the sum of its parts, should be the focus. On small farms, grass and legume forages, byproducts from field crops, refuse from garden plants and kitchen wastes are suitable as feedstuffs for rabbits, and represent clear alternatives to fossil fuel-based cereal grain production. Ideally, in the case of limited-resource farmers in the lesser developed countries (LDCs), feedstuffs for rabbits should be procured from the farm using inexpensive and renewable resources. Although it is generally not recommended for farmers to depend on purchased commercial concentrate feeds, exceptions may exist, such as the use of a limited quantity of commercial concentrates that may be justified on the basis that high-market rabbit prices exist.

While forage plots are strongly recommended, some successful projects have been designed that promoted a simple rabbit-garden integrative model. In 1993, the author served as a consultant for Heifer International in Zimbabwe, where it was observed that a project supported by GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) trained farmers to adopt the rabbit-garden model where garden "wastes" were used as primary feeds, forages as secondary feeds and homemade concentrates as supplements that were prepared using local grains (e.g., rapoko, mhunga and sorghum) and grain byproducts grown on the farm.

Legume forages are typically the most important source of protein for rabbits. Dietary energy can be derived from many sources. The feeding of stale bread and tortillas, cull or surplus farm produce, and kitchen scraps is oftentimes suitable as energy feeds for rabbits. The use of molasses blocks is a feasible feeding alternative for subsistence farmers (described in the Feeds and Feeding module). Of relevance, the composition of the diet invariably changes over season as certain ingredients become more or less abundant (especially between wet and dry seasons). Proper training of farmers involving a forage security plan is essential.

In light of the above discussion, the key to a sustainable feeding program is that the number of rabbits on the farm does not exceed the on-farm feed supply. Hence, such a potential for a forage- or garden-based diet must exist for a favorable recommendation to be made concerning diets in the feasibility report.

GENETICS

If local breeds exist that are adaptable to a particular environment, possessing unique genes for novel traits, and if the population size is adequate (i.e., not critical or endangered status), it is generally recommended that limited-resource farmers should utilize such local

stocks. This practice will also promote the conservation of the breed(s). Although exotic breeds have been introduced throughout the LDCs, more research is warranted to ascertain their suitability relative to local breeds, assuming the latter exist. In some past projects, exotic breeds adapted poorly, resulting in project failure. In other projects, exotic breeds performed well, but contributed to the extinction of local breeds ("genetic erosion"). At the country level, this breeding issue needs to be clearly addressed to promote sustainability of genetic resources. In short, research comparing local to exotic breeds should precede the distribution of exotic breeds to farmers.

In Egypt and Uruguay, for example, imported lines developed in Spain of commercial-bred New Zealand Whites perform relatively well. Still in other project cases, farmers have been impressed by the production of F_1 animals (first generation cross of exotic and local breeds); however, in the context of sustainability, how does the farmer breed and maintain the F_1 animal when replacements are needed (i.e., "the F_1 quandry")? Is a dependency situation possibly created between the typical government breeding station and the farmer? If the breeding station later closes, will farmers be less encouraged to stay in business? We should avoid making farmers dependent on stock from a limited number of breeding farms or stations. Ideally, good quality breeding stock can become locally available if farmers practice good breeding management, which they learn through training.

Another pertinent issue is appropriate breeding and/or selection practices that constitute a genetic improvement program. In adverse environments, local breeds may display novel or functional traits, such as long ears, non-dense or sparse fur, and the ability to subsist on forages with limited or no commercial supplements. In this situation, it is imperative that research be conducted to justify selection practices aimed at merely increasing production (e.g., litter size and growth rate). Instead, it would bode well for the feasibility report if good quality breeding stock can be easily obtained from area farmers or a reputable commercial source at a reasonable cost.

HEALTH

Rabbits are a rustic species ideally suited for backyard or small-scale rearing. In many development projects, even under harsh or limiting conditions, rabbits are seldom vaccinated or given antibiotics, dewormers, coccidiostats or other prophylactic drugs or health promotants. Yet, rabbits are often observed to be healthy and productive. These attributes certainly reflect the essence of sustainability.

Of course, there are exceptions. In countries or regions afflicted with VHD (Viral Hemorrhagic Disease) and Myxomatosis, rabbits are particularly vulnerable (covered in the Disease Control module). While vaccination may be necessary, it may not always be feasible at the farmer's level. In the

realm of sustainability, governments should obviously protect their rabbit industry from sources of potential bio-contamination, or else sustainability is at stake. For example, outbreaks of Myxomatosis often follow the rain season when mosquito swarms are prevalent. Other biting insects, such as fleas and lice may also spread the disease, so effective insect control measures at the farm level are critical.

Under so-called primitive conditions, the more commonly observed diseases that can be controlled more easily than viral diseases are ear mites, skin mange, coccidiosis and a variety of bacterial infections. Although most diseases are usually treatable if detected early (using local and effective remedies), the key is prevention. It is imperative that proper and practical training of farmers, as well as of project support staff (e.g., social workers and extension or veterinary agents), be conducted. The author has found that the root of most rabbit problems on small farms is faulty feeding and/or poor sanitation practices, which can be addressed initially during farmer training. Secondly, and of equal importance, is timely on-farm visits (project supervision) by a rabbit project expert, which is essential to ensure that sustainability is not sacrificed by rampant disease outbreaks that should have been effectively prevented or controlled. The existence of such actual or potential resources or support systems is critical for a positive feasibility report.

HOUSING AND EQUIPMENT

Ideally, housing and equipment should be constructed from local and renewable materials. Local materials should be renewable without exploiting the environment. In some development projects, limited and less expensive poultry wire netting is only used for portions of the front-side of hutches, simply for viewing ease. A disadvantage of the use of wood materials (e.g.,

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A hutch in Cameroon made from rapphia palmwood. Also, the forage is fed in suspended bundles and a supplemental feed is provided using a bamboo feeder.

bamboo and rapphia palm) is that rabbits will eventually chew through the wood if the hutches are not properly maintained. If the farmer allows this to happen, rabbits could escape. Also, a weakened hutch structure makes rabbits more vulnerable to predation. In addition, a disadvantage of the use of non-plant materials (e.g., concrete, mud and stone) is that rabbits can dig or burrow their way out from the pen enclosure, again, if not maintained.

In some cases, welded wire is preferred, especially for farmers who are well established, but it should only be used without placing the farmer at high economic risk. In El Salvador, farmers initially used welded wire to have good housing, which encouraged their long-term project commitment (J. McNitt, personal communication). However, a development organization should seriously address what farmers will do to replace their initially provided wire hutches after they wear out. It is generally more cost-effective for farmers to better maintain, repair and replace renewable hutches or pen enclosures than to make farmers dependent on the purchase of expensive welded wire.

Pastured rabbit system. The pen contains young growing rabbits.

A number of alternative housing systems have been reported in the literature. The pit system, consisting of cool underground cells, has been described by Dr. Alessandro Finzi, a rabbit scientist from Italy, and has been adopted for rabbit rearing in hot climates like the Saharan region. A semi, free-range system has also been developed by Dr. Finzi in which rabbits are maintained at ground level in large enclosures where they are allowed to burrow underground. In both systems, feed is brought to the rabbits, typically consisting of fresh-cut forages tied and hung in bundles. Another free-range system was observed in Uganda by the author where farmers released their rabbits in the mornings to graze for forage on their farms, and later were collected and placed in small huts during the evening

(with forage provided) as a safeguard against predators and thieves. In the village, dogs were actually trained to protect the rabbits. Another alternative housing system evaluated in the U.S. is called "pastured rabbits." In this system, rabbit fryers were kindled in conventional cages, and after weaning were fed out in movable grazing pens that were rotated daily over grass pastures. Reasonable production was reported. This system is an option for producers striving to create a more naturally grown, grass-finished product to attract the more health-conscious consumers in which premium market prices are paid.

In all cases, the potential should exist for sustainable housing or pen systems to be adopted by farmers. The system should be simple and inexpensive for farmers, encouraging self-sufficiency rather than dependency. In terms of the feasibility report, if local building materials are not available (e.g., scarcity of wood due to deforestation) and if wire is too costly to import or for farmers to afford, then this factor would receive a negative checkmark.

Other internal factors may exist (e.g., climate, predation or thievery risk, and waste disposal), depending on the local situation.

The following table provides a general guide that can be modified and expanded to determine sustainability issues that involve internal, intermediate and external factors.

Table 1.1. Sustainable and non-sustainable measures addressing the internal factors of the Small-Scale Rabbit Production Model[a]

Factor	Sustainable	Non-sustainable
Genetics	Appropriate stock, Sound selection practices	Non-adapted exotics, Unsound selection practices
Housing	Renewable resources	Costly imported, welded wire
Diet	On-farm resources	Commercial feeds
Health	Prevention/local remedies	Costly medications
Management	On-farm integration	Non-integration

[a] This table is only a general guide; in local situations, exceptions may well exist (e.g., an exotic breed that has been locally evaluated may be suitable and welded wire may be justified, for example, if the project has a revolving fund program).

PART 2

SMALL-SCALE RABBIT PRODUCTION MODEL – INTERMEDIATE FACTORS

Intermediate factors are the guiding project developmental components that include feasibility, design, implementation, monitoring and evaluation. The purpose of this chapter is to highlight the role of the intermediate tier of factors that comprises the SSRPM. This chapter, which is intentionally longer than that of Parts 1 and 3, should be especially useful to planners who are involved in managing development projects, such as employees of a development organization, extension training staff, missionaries, social workers and Peace Corps volunteers. At the end of this chapter, a brief presentation of The Heifer Model used by Heifer International to develop community-based projects will be provided.

PROJECT FEASIBILITY

The purpose of conducting a feasibility study is to determine whether the rabbit project should be started. Is it a locally appropriate solution to the so-called human problem (typically being hunger and/or poverty)? It is paramount that the community has the opportunity to actively participate, primarily through meetings, to reach a consensus in making the initial request to a program organization to explore the feasibility of a rabbit project. Hence, from the very onset, the idea is their own. A sense of project ownership is critical to ultimate project success.

Historically, many rabbit projects have failed in terms of the non-realization of its program goal and objectives. To the novice, it all sounds too good to be true: people in need will all benefit from the abundant meat supply and their incomes will rapidly increase. What sounds too good to be true often is.

Often times, the failed project was the direct consequence of being a non-appropriate intervention or was simply a bad idea in the first place. For example, perhaps there was no competent rabbit expert, such that critical knowledge was never learned by farmers, or the culture forbade visits by male extension agents to homes where women raised rabbits, or simply that farmers were never genuinely interested in the rabbit project idea because it was someone else's idea that was imposed upon the community.

Six common reasons for past rabbit project failure include: a feasibility study was never conducted; there was little or no community involvement; there was a lack of rabbit market activities; there were no rabbit experts available; farmers were poorly trained and/or supervised; and there was no project spread or multiplication involving new rabbit farmers.

Fundamentally, a potential rabbit project must be strongly justified in all areas (i.e., internal, intermediate and external factors) to be recommended for its initiation, support and development. In determining the feasibility of a rabbit

project, the program staff needs to first assess the internal SSRPM factors from the standpoint of appropriate resources and/or technology. For major projects, it is recommended that a rabbit expert be hired as a consultant.

A feasibility checklist should be developed to address internal and external SSRPM factors from the standpoint of technical soundness (Tables 2.1 and 2.2). At a community meeting, the checklist should be introduced and discussed.

Table 2.1. Sample rabbit project feasibility checklist relating to internal factors

Factor	Topic
Diet	1) Do renewable on-farm resources potentially exist? 2) What forage species, grass and legume, are locally available? 3) What garden plant byproducts are available? 4) Need for commercial feeds/supplements?
Genetics	1) Availability of hardy, local breeding stock? 2) If exotic breeds exist, have they been evaluated or researched to determine their suitability for use by farmers under local conditions?
Health	1) What are the common rabbit diseases in the area? 2) Are local remedies available that can either prevent or treat diseases?
Housing	1) Do low-cost, renewable resources exist for constructing cages and feeding and watering equipment? 2) Is wire for cages affordable to farmers? If not, can wire be provided through a revolving fund program?

Table 2.2. Sample rabbit project feasibility checklist relating to external factors

Factor	Topic
Ecological	1) Can a rabbit enterprise promote the conservation of farmer's on-farm resources? 2) Can a rabbit enterprise be integrated into present farming practices? 3) Promotion of nutrient flow/cycles?
Economical	1) Does the farmer have sufficient capital to invest and operate a rabbit enterprise? 2) Do markets for rabbits exist or can these be developed? 3) Can a pay-back on a loan be developed whereby offspring from the initially received breeding stock are returned to the program for distribution to another family? 4) What is the calculated net return to labor?
Social	1) Does the family have the interest and time to operate a rabbit enterprise? 2) Would families plan on consuming rabbit meat on a regular basis? 3) Would a family member be willing to attend regular rabbit farmer meetings? 4) Is the farmer willing to help his neighbors when they begin their own rabbit enterprise? 5) Does the community support the rabbit project?

In addition, the feasibility checklist can be modified and expanded to include all relevant SSRPM internal and external factors that reflect the local situation. In certain cases, it is desired to interview a random sample of representative farmers and other relevant groups. The community group could provide a list of farmers' names from which the sample could be drawn. Later, the farmers' responses are analyzed, results are interpreted and conclusions are made to recommend whether or not to initiate the project.

Other sources of information are also needed to develop a more comprehensive feasibility report. Besides farmers, interviews may also involve, for example, potential business buyers of rabbit meat when markets are later developed, extension specialists who may coordinate the technical assistance of agents to supervise rabbit farmers and local social workers who may be interested in specific outcomes of the rabbit project (e.g., the empowerment of women and economic, health and nutritional impact on the family).

Again, for major funded projects, the feasibility team could even consist of experts in fields of economics and marketing, extension training, health, nutrition and sociology. Each team member would obtain relevant information from a variety of sources. For example, the marketing specialist would be fortunate to obtain copies of master's theses from universities that engaged students who conducted a market feasibility study of rabbit meat demand and/or sales. The thesis reports may have been one outcome of a research grant that was awarded to a rabbit scientist who could be involved in the program's feasibility report.

Finally, once the feasibility report is prepared, it should once again be shared with the community. The community should be pleased if the report's recommendation is favorable since they were directly involved in the feasibility study. If such is the case, then the proposed project needs to be designed and a source of funds identified to formally support the project.

PROJECT DESIGN

If the feasibility report recommends project initiation, then the next step is for the program staff or consultant (while working closely with the community) to carefully design the rabbit project. In many ways, a project design is similar to a project proposal. Basically, a project design is a blueprint or work plan of how the project will be implemented, monitored and evaluated considering all the critical internal and external factors of the SSRPM. A project design will also include information from the feasibility report so as to provide critical background and justification of the genuine needs of the target group, as well as a clear show of the program goal and objectives. An activity timetable should also be prepared that highlights the calendar of major project events. Figure 2.1 is for a hypothetical 18-month

project. Most rabbit projects supported by Heifer International cover a two- to three-year funding period, followed by two years of monitoring.

Figure 2.1. Simplified activity timetable for a rabbit project

ACTIVITIES	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
Feasibility Assessment	X	X																
Project Design			X	X														
Select Farmer Trainees					X													
Conduct Training						X	X	X	X	X	X	X	X	X	X	X	X	X
Develop Farmer Leaders												X	X	X	X	X	X	X
Establish Farmer Leader Network																X	X	X
Project Evaluation																		X

While there is no set format for developing a project design document, the purpose is to provide enough detail so that it can be clearly followed later. Moreover, it is just as important to allow for flexibility in the design or blueprint plan. This sweeping statement deserves further explanation. A project design closely parallels the detailed materials and methods section of a journal manuscript or the proposed procedures of a research grant. A good scientist provides the critical detail necessary such that other scientists can repeat the same experiment. In development, the individual who designs the project is usually not the same person who will later implement the project. The extent of detail should relate to the how, when, who and where of the project. For example, in farmer training, how many farmers will be trained, when will training occur, who will do the training and where will training take place?

If the reader is not familiar with project designs or proposals, a sample from Heifer International has been included in Appendix B of this book. To reiterate, flexibility refers to the ability to make changes to the design once the project is implemented, without adverse consequences being felt. To illustrate, perhaps it was intended by design that 100 farmers would receive rabbit training in the first year of the project in four groups or cycles, but later it was realized that this figure was too ambitious, so the figure was reduced to 50 farmers so that they could all receive high-quality training and regular on-farm supervisory visits.

To set the stage for describing intermediate factors, an example of a clear program goal and specific objectives statements for a typical rabbit project is presented, as follows:

Goal:
Benefit 300 farmers over three years by improving diet quality and increasing farm income by establishing sustainable, small-scale rabbit enterprises.

Objectives that support the goal:
1) Provide rabbit training to 100 farmers each year, 25 each quarter;
2) Distribute trios of breeding stock to trained farmers, who will initially establish production enterprises of five to 10 does each, supported by renewable local resources. Later, farmers will pass on breeding stock (to honor their in-kind loan) to newly trained farmers to ensure project multiplication;
3) Closely monitor production activities (weekly or biweekly) as farmers expand operations to 10 to 20 does to ensure that families consume a minimum of one to two rabbit fryers per week;
4) Coordinate market activities involving sales of surplus fryers such that annual income on all farms is increased, on average, by 50%; and
5) Develop a rabbit farmer leader in each village (by the end of the year) who will ultimately take over the program.

A broad or general goal statement is acceptable. However, objectives that support the goal must be specific and measurable or quantitative so that the project's impact can later be easily and objectively determined. For instance, good objectives may follow the SMART rule. SMART objectives are Specific, Measurable, Achievable, and they describe Results and are Time-related.

As a working prototype for this chapter, five major components of a rabbit project typically include:
1) Farmer training
2) Stock distribution
3) Rabbit production
4) Consumption/marketing
5) Leadership development
It is paramount to project success that farmers are well trained, which of course assumes a competent trainer. But how should we select farmers for training?

Actually, the program staff should not make this decision, but rather it is best if the community makes this decision. Remember, this is a community project. The best training involves small rather than large groups of farmers. Training should take place on a demonstration farm in the region

(as opposed to a distant training center), and should not be conducted intensely over several days, but rather in tandem over several weeks' time as explained below.

Experience shows it has been more effective to teach one lesson, such as forage plot establishment, and then allow farmers a week or two to adopt the innovation. Then, at the next training session, farmers receive a new lesson (e.g., hutch construction), and so forth, until all the lessons are taught and activities adopted, by which time the farmers are ready to receive breeding stock. In general, farmers can better understand and later recall the new knowledge if it is provided using a tandem approach, as opposed to being overwhelmed by too much technical information over a short period of time. Moreover, this approach offers incentives to help identify highly motivated farmers who oblige by completing each lesson of the rabbit training course and, after receiving breeding stock, will go on to become successful rabbit farmers. The final lesson during training should be one of sharing a rabbit meat meal with the farmers (followed by awarding training course certificates), so that they will have this positive experience to remember. To re-emphasize, such details should be clearly specified in the project design document.

Stock distribution should result only after farmers have been well trained and have prepared a proper place and established forage plots or gardens for raising rabbits. There are two important issues here. First, to establish a small enterprise of only a few rabbits for the farmer, such as five does and one buck (a buck is not necessary if a neighbor has a good buck; this also fosters community goodwill). The provision of only a few rabbits per farmer allows the program to purchase fewer total rabbits and/or distribute fewer rabbits to more farmers. The stock being provided to the farmer should be at least three months old and ready to breed in two or three months, so that the animals can first acclimatize to their new surroundings.

The second issue is a financial one. If affordable, farmers should purchase the rabbits so that their value is appreciated. From experience, farmers assign no sense of value to something that is given away freely. If they cannot afford the stock, then an in-kind loan arrangement could be considered. The repayment plan could be as simple as the subsequent return of the same number in offspring as provided by the original parent stock.

Successful production requires the timely supervisory visits of a rabbit expert, which may be a specialist or an experienced extension agent or local rabbit farmer leader. But, how timely is timely? A rule of thumb figure is to visit the farmer at least every other week. The motive is to visit the farmer often enough so that minor or potential problems can be remedied before they become major problems that could lead to enterprise failure. Positive

experiences should far outweigh negative ones, such that the farmer is continually encouraged to persevere while gaining confidence. In other words, his efforts are being rewarded. When a negative experience occurs, such as young rabbits (kits) escaping through a hutch, the loss should be portrayed as a valuable lesson in which the farmer learns how to better maintain hutches. Further, if too many big problems are allowed among farmers, then an escalating effect will occur, whereby the rate of project abandonment by farmers gets out of control and then becomes irreversible. A popular adage in development is that a failed project is worse than no project at all (Bunch, 1982).

If production is successful, then the family should soon benefit from the regular consumption of meat and increased income through the sales of surplus fryers. It is this event where the original program goal and objectives are most critically assessed. The project design should also specify that basic records of farmers' consumption and marketing activities will be kept. Oftentimes, the rabbit program has the two-fold focus on nutrition and income. If the primary goal is to improve diet quality, then, for an average-sized family, it might be recommended that the project design specifies, for example, that for every three rabbits produced: two are consumed and one is sold (excluding replacement needs). The opposite is recommended if the primary program goal is economic.

As a guide, a live fryer weighing an average of 2.0 kilogram (kg) with a 60% carcass yield (including head and edible organs) should produce about 1.0 kg of edible meat (85% yield) of which there should be approximately 200 grams (g) of protein (Table 2.3). Hence, two to five fryers should provide a total of 400 to 1,000 g of animal protein per week.

If target groups for which rabbit projects are designed are meeting one-half of their daily protein requirements, the following calculations can be made. Based on the daily protein requirement of 0.75 g/kg of body weight for adults (for women: non-pregnant or lactating; FAO/WHO/UNU 1985), and a mean body weight of 60 kg, five rabbit fryers consumed in one week would meet one-half of the daily protein needs for the equivalent of 6.3 adults. Of course, planners should adjust the above generic figures to develop realistic goals to determine rabbit fryer consumption levels needed to bridge specific protein gaps for individual families.

In terms of economic impact, for example, in Indonesia, a live rabbit weighing between 2 and 3 kg sells for $1.22 U.S. per kg (Y. Raharjo, personal communication). If a small family that rears 10 breeding does consumes only two fryers a week, as many as 86 fryers with an average live weight of 2.0 kg could be sold for $210 U.S. annually. This figure represents 15.9% of the average annual income of farmers in Indonesia, which ranges between $90 and $130 U.S. per month (Y. Raharjo, personal

communication). If a larger family that rears 20 breeding does consumes five fryers a week, a total of 120 fryers with an average live weight of 2 kg could be sold for $293 U.S. annually. In contrast, if operations of either 10 or 20 does are maintained solely as sources of income (except for the same number in doe replacements), $464 and $927 U.S. could possibly be generated annually, respectively (Table 2.3).

Table 2.3. Projections of nutritional and economic impact from a small- to medium-scale rabbit operation consisting of 10 or 20 breeding does and one buck from an extensive, farm-based production system

Item	Weekly fryer consumption level by family			
	10 breeding does		20 breeding does	
	0 fryers	2 fryers	0 fryers	5 fryers
Total protein intake, g	0	400	0	1,000
No. of adults meeting ½ of their daily protein requirement	0	2.5	0	6.3
No. of fryers marketed per year	190	86	380	120
Total live weight of fryers marketed per year, kg	380	176	960	240
Total revenue, USD	464	210	927	293
Income of mean annual farmer's salary, %	35.2	15.9	70.2	22.2

Source: Modified from Lukefahr, S.D., 2007. Strategies for the development of small- and medium-scale rabbit farming in Southeast Asia. *Livestock Research for Rural Development*. Volume 19, Article #138. Retrieved February 5, 2009, from **http://www.lrrd.org/lrrd19/9/luke19138.htm**.

The development of local rabbit farmer experts or leaders is perhaps the most important program activity. Another saying in development is that this very activity is "how we can best work ourselves out of work." In the project design document, a description should appear of how the best rabbit farmers will be identified and groomed by the program staff. To illustrate, a potential farmer leader (much like an apprentice) can be taught one-on-one how to informally train new rabbit farmers on their own farm, and later how to provide them with sound advice, breeding stock, forage materials, marketing information, etc. However, besides being a best farmer, other qualifications include enthusiasm and resourcefulness, natural abilities to teach and to be a leader, and willingness to volunteer for the common good of the community. It usually takes a bare minimum of six months to one year to develop a farmer before he or she can emerge as a local farmer leader. Since this role is voluntary, the reward involves personal pride, prestige and respect by the community.

PROJECT IMPLEMENTATION

To implement or start the project, it is obvious that one follows the design document. It is also said in development that a project well designed is

a project half accomplished; hence, emphasizing the importance of a carefully designed project. The aim is to start small and develop the project gradually, while allowing for necessary adjustments (due to change) to the project design plan.

The first project activity usually relates to farmer training. It is essential that the first cycle of farmers is carefully screened as candidates for training. As stated previously, candidates should be selected by the community, typically through a voting process, as those individuals who are the most highly motivated and likely to eventually become successful rabbit farmers. Instead, if the program selects the trainees, this could well cause jealousy within the community. Moreover, candidates selected for training should feel an obligation to the community because of the vote of confidence. In addition, a strong match should exist between enthusiastic trainees and a competent trainer. During training, it is important that farmers are responsive by demonstrating their new knowledge, such as through active discussions, construction of hutches and establishment of forage plots on their own farms. These incentives effectively serve to further screen out less-responsive farmers, so that more training efforts can be devoted to the more responsive ones.

A farmer training session in Guatemala. The trainer demonstrates how to properly handle a rabbit.

Again, according to the design document, the final training lesson should be on the nutritional value, preparation and consumption of rabbit meat using local recipes. This experience usually leaves a lasting and favorable impression on farmers to work hard toward the goal of providing for their families highly nutritious rabbit meat on a regular basis.

Breeding stock should only be distributed to farmers who have completed training and who have set up a proper place for raising rabbits. Farmers should receive breeding stock on a timely basis, ideally within a month after

completing all requirements of training and site preparation. A community celebration of this activity should also be planned, which further engenders an obligation for farmers receiving breeding stock to do well. In some projects, farmers sign agreement forms in the presence of the community to testify that they will honor their breeding stock loan by later returning the same number of offspring, which in turn will be distributed to the next cycle or generation of trained farmers, also selected by the community.

Early rabbit production success or failure is a good test of the effectiveness of training. Of course, those farmers who best understood what they learned during training should be rewarded with the first arrival of several healthy litters. Another aim of regular visits, however, is to test the farmer's understanding of critical knowledge by asking several questions followed by discussion of the importance of such knowledge. Nonetheless, experience is always the best teacher! Farmers should consider mistakes as positive learning experiences, and not allow themselves to become too frustrated.

Once production occurs, the regular consumption of rabbit meat by the family and the marketing of surplus rabbit fryers (for breeding stock and/or for meat) should occur. Of course, these critical activities relate to the original goal of improving diet quality and increasing farm income for the family, as the supporting objectives (e.g., training, stock distribution and production) become realized. Encourage the farmer by statements such as your children's health will improve and you will increase your income! Records of these activities should be developed by the program and provided to farmers, which will later be sampled for subsequent analyses during project evaluation.

Although program staff can identify potential farmer leaders at any time, it may take at least six months to one year before such farmers ("diamonds in the rough") can first gain adequate experience before this activity can become a program focus. In following the design plan, a potential farmer leader will be trained like an apprentice would, by being taken to the field on a regular basis to learn first-hand how farmers are properly trained and supervised, so that such skills can be gradually learned and developed. The fledgling farmer leader could also attend regular program planning and local farmer meetings. Of course, the aim is that the leader apprentice will later assume the role of the rabbit project leader (local village expert).

PROJECT MONITORING

The attitude concerning monitoring is to keep the project on track toward the realization of the program goal. Know that it is never too late to modify the objectives even after the project has been implemented. Change is always to be expected. A well-designed project leaves ample room for flexibility, later resulting in smooth adaptation to necessary changes. Examples of common causes for change will be provided in this section.

In addition, to monitor a project, quantitative data is especially needed which can be gathered from primary sources (e.g., figures from training and stock distribution activities and farmers' records). In contrast, qualitative data can be gathered from secondary sources (e.g., interviews and surveys).

In this section, reference will again be made to the five project components that each match to a specific program objective. For each component, a problematic scenario will be presented, followed by a demonstration of a working solution.

As previously mentioned, a common scenario in regard to training is that the original objective was too ambitious. The program may have realized this problem after attempting to provide regular on-farm visits to too many farmers. The change to down-scale the number of trainees in the next cycle will reduce the total number of farm visits (not to mention reducing fuel costs), and also improve the quality of training that will now involve fewer farmers. Keep in mind that training is continuous; while there is initial formal training, there is also subsequent informal training, the latter of which takes place on the farmer's farm – at the school of hard knocks!

It is also a good strategy to test farmers – both during and after training – to ensure that they are learning. The use of common pre- and post-test instruments is recommended to assess learning. If results are discouraging, the lesson can be repeated. Also, during regular farmer meetings, timely discussions are critical, such as how to care for newborn litters prior to the actual births of the farmers' first litters. Farmer meetings are also a good time to discuss common problems and opportunities, such as a disease outbreak, a new market source or an improved forage species.

For the stock distribution component, it might later be observed that because of an adverse environment (e.g., a hot climate), farmers are not fully realizing the output of 100 to 200 fryers per annum (or an average of 8.3 to 16.7 fryers per month) produced from five to 10 breeding does, even though they are doing everything correct from a management standpoint. If farmers have the resources, such as low-cost feed and hutches, and time, the needed change would be to increase the size of the operation (e.g., from a breeding enterprise of 10 to 20 does).

Another scenario is that because markets may have recently been expanded, farmers desire to increase their operation size from a breeding enterprise of 10 to 20 does. In both scenarios, although the original project design may have indicated an enterprise of five to 10 does, these modifications are made to increase breeding doe numbers to ensure that the program goal and objectives are not only realized, but possibly even exceeded. However, caution is advised: to be economically sound, farmers should only *gradually* increase their operations to ensure that optimum benefits or profit margins

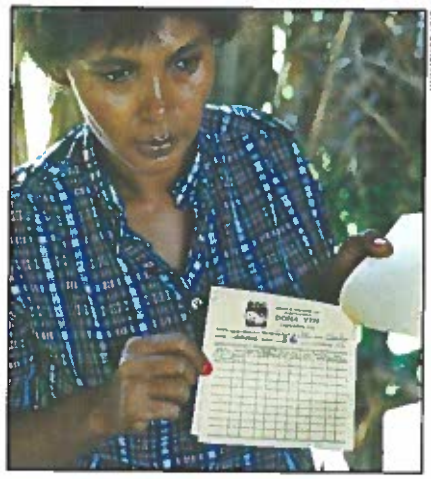
are being maintained by keeping production costs at a minimum and without outstripping on-farm resources, such as feed and labor.

In addition, is the stock distribution activity (ergo Heifer's trademark practice and Cornerstone, Passing on the Gift) being smoothly coordinated? Is the community present to witness and celebrate this event? Does this in-kind loan scheme work well? Of course, these critical activities need to be closely monitored, assessed and modified if needed.

How should rabbit production be monitored on farms? First, it is recommended that a simple checklist form be used to assess the present status of the rabbit enterprise on each farm visited. As a guide, Table 2.4 provides a sample of questions that could be asked of the farmer.

Table 2.4. Performance checklist used to determine rabbit project status on farms

Yes	No	Question
		Rabbits appear healthy?
		Buck(s) and does are producing?
		Kits/fryers are well developed?
		Adequate shelter?
		Protection from predators and thieves?
		Hutches/equipment are clean and well maintained?
		Good variety of suitable feeds is being used?
		Forage or garden plots are well managed?
		Water is available?
		Manure is being recycled on farm?
		Family involvement is evident?
		Rabbit meat is being consumed regularly?
		Surplus fryers are being sold?
		Records up-to-date?



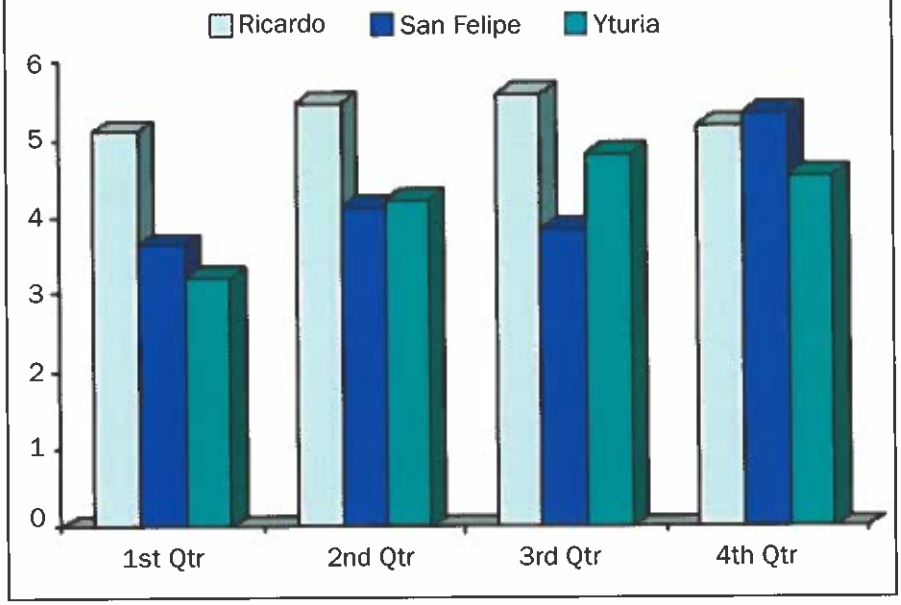
S.D. LUKEFAHR

A woman displaying her up-to-date rabbit records from a project in the Dominican Republic. Good records are vital to determine benefits to the family and project impact to the program.

The rabbit expert who is performing the supervisory visits should always ask to examine records to ensure that they are accurate and up-to-date. After the farm visits are completed for the period, it is useful to review the checklist responses to determine if a general problem possibly exists. For example, if on several farms, rabbits have health problems or if newborn litters are not surviving, an informal refresher training meeting should be held on a local farm to discuss the problem and identify practical solutions. Obviously, timing is critical. Further, such a session should be followed by a community meeting where the problem and solutions are presented so as to apprise the community of the situation. Remember, this is a community project.

Monitoring the project's components or objectives should also include direct measures of production and other activities that can be analyzed by the program staff. To illustrate, Figure 2.2 is a bar graph used to compare average litter size weaned at two months of age by season or quarter. Of three village project sites visited, only Ricardo village is on track. This is because under less-than-ideal conditions in lesser developed countries, the aim is for five marketable fryers per litter from does producing four litters per year. Changes need to be made to bring the other village sites up to speed. In other words, determine the problem and fix it promptly!

Figure 2.2. Mean litter size at market age (90 days) by season (quarter) and by village project site. The target is at least five fryers per litter.



The production objective is pivotal to the goal of consumption of rabbit meat by the family and the marketing of surplus fryers to increase income. During farmer visits, records of consumption and marketing also need to be carefully examined. Graphs can show, for example, weekly or monthly trends in the family's frequency of rabbit meat consumption, as well as fryer sales, to determine if project targets are being met. For major projects, it is advised that a professional nutritionist or health worker be closely involved to conduct scientific-based, controlled trials to assess possible nutritional and/or health impact. It is useful to interview the farmer to determine if improvements in the children's health, attendance and grades at school, etc. have been recognized. During the same interview, other questions could include what recipes are being used and if they invite their neighbors to meals featuring rabbit meat. Simple financial records should also be regularly examined. Again, it is critical that production costs be kept at a minimum. Of course, those farmers who keep good records should be complimented for their efforts.

Following the original project design, a simple marketing system will also need to be developed, which also requires close monitoring. In developing countries, the best system generally involves the collection of farmers' fryers from a central pick-up point, usually at a farm. From the pick-up point, the delivery and sale of live and uniform fryers to the business vendor take place. Farmers are paid in cash after subtracting transportation costs. As markets are developed and expanded, caution is needed to avoid the possibility of flooding the market. A good program makes efforts to ensure that demand exceeds the current supply, and that rabbit meat is sold at a competitive price compared to popular meats. Of course, records reflecting centralized marketing activities are necessary to determine the economic impact of the rabbit program, especially later when the program is evaluated.


S.D. LUXEFAHR

A grassroots-level rabbit marketing scheme in Cameroon. Farmers' fryers were collected by the village project leader and sold at a farmer's cooperative market.

Later, as local project leaders are identified from the ranks of successful rabbit farmers, this activity also needs to be monitored. To reiterate, as an apprentice, each farmer leader trainee should be taken out to the field where he or she can observe first-hand how the rabbit expert practically assists farmers so that such skills can be learned and developed. In due time, the expert allows the leader to play an increasingly major role in the activities of informal farmer training and on-farm supervision (i.e., technical advice).

In time, the farmer leader will serve the community as a source of information to obtain breeding stock, forage materials, marketing opportunities, etc. A farmer leader may also market farmers' rabbits, via public transportation, to awaiting business managers. Records should be maintained of such farmer leader activities. The farmer leader's knowledge could also be assessed through the use of pre- and post-test instruments.

Perhaps the most important human element is that the leader has a strong zeal toward project success, evident by a high level of enthusiasm and pride, which is contagious to other farmers. For all his or her efforts, the reward is the success of the rabbit project as it multiplies and impacts additional farm families in the community.

PROJECT EVALUATION

All rabbit projects should receive a formal evaluation once the formal life or period of active funding of the project has ended. This event is referred to as project phase-out. In fact, sometimes a major project is even evaluated

years after the project ended to determine if there was a lasting positive impact.

It is unfortunate that many failed rabbit projects had neither a feasibility nor an evaluation report prepared. No wonder the project failed! An evaluation or final report is always required by the donor agency. In addition, for multi-year, major funded projects, many organizations require periodic progress reports (e.g., quarterly or semi-annually) and annual evaluations. For example, a major rabbit project in Poland was co-supported by Heifer International and other institutions several years ago. A mid-project evaluation was performed based on an on-site visit by the author who served as a consultant. There were several concerns at the time about the project, mainly that the objective of training and assisting thousands of farmers was too ambitious. Table 2.5 contains a list of the recommendations from the evaluation report.

Table 2.5. Sample recommendations from a mid-project evaluation conducted in Poland

Rate of Program Expansion	a) A slower rate of project expansion is recommended until a critical mass of rabbit farmer competency is developed. b) Amplification of training of field extension staff and present rabbit farmer participants is critical.
Feeding Strategies	a) Farmers should establish forage plots using quality grass and legume species. b) Avoid emphasis on the feeding of a diet consisting mainly of costly pellets, unless the market later justifies this practice. c) Plans for feed mill construction should be delayed until the market is secured.
Stock Quality and Breeding Practices	a) The main meat breeds observed on farms – Blue Vienna, Californian, Champagne d' Argent, and New Zealand Red and White – possess desirable meat conformation qualities for the marketplace. b) There is no real need for the importation of stock to "improve the genetic quality." c) The cooperating rabbit research station should be considered primarily as a source of high quality buck stock, now that a sufficient number of doe stock is present on farms. d) The program can facilitate the annual exchange of bucks across village sites so that inbreeding and/or loss of gene variability can be prevented.
Health Management	a) Vaccination for stock protection against Viral Hemorrhagic Disease should continue to be subsidized by the program at this early stage of the life of the project.

Market Development	a) A market feasibility study needs to be conducted as soon as possible. b) Farmers should be informed as soon as possible about anticipated collective marketing plans. c) The area processing plant has the capacity to handle rabbits from 5,000 to 10,000 small-scale farmers.
Plans for Eventual Program Phase-Out	a) A plan to identify and develop local rabbit farmer leaders is strongly recommended to help ensure project multiplication and/or long-term program success.
Re-Evaluation	a) The project should be evaluated again in one year to determine progress.

Source: Lukefahr, S.D., 1993. Internal Report to Heifer Project International and Winrock International.

If a rabbit scientist was awarded a grant that involved outreach to rabbit farmers, then the final progress report may serve the purpose of a project evaluation. It may also be useful to transform the evaluation report into a manuscript for publication in a widely circulated or refereed journal.

Why do we evaluate projects? So that we can document, share and even publish valuable information from lessons learned during the life of the project. If the project was a big success, then what factor(s) accounted for the success so that these may be adopted to make future projects even better? Instead, if the program was a failure, then what factor(s) was identified in the report that should be avoided in planning future projects, so that the same mistake is not repeated (to prevent waste of money, time and resources)? Certainly, there are cases where the cause of project failure could not be avoided (e.g., a natural disaster).

Several common reasons for project failure include:
1) A feasibility study was never conducted
2) Low level of community participation
3) Limited markets
4) Lack of a rabbit expert
5) Poor training and/or on-farm guidance of farmers
6) No effective project multiplication (i.e., no increase in numbers of rabbit farmers beyond those who were trained)

Rabbit projects usually receive a goal-based evaluation. That is, the evaluation focuses on the program's goal. However, since the realization of the goal depends on its supporting and measurable objectives, then the evaluation should direct a focus on each of these objectives. In this chapter, the five project components include:
1) Farmer training
2) Stock distribution
3) Rabbit production

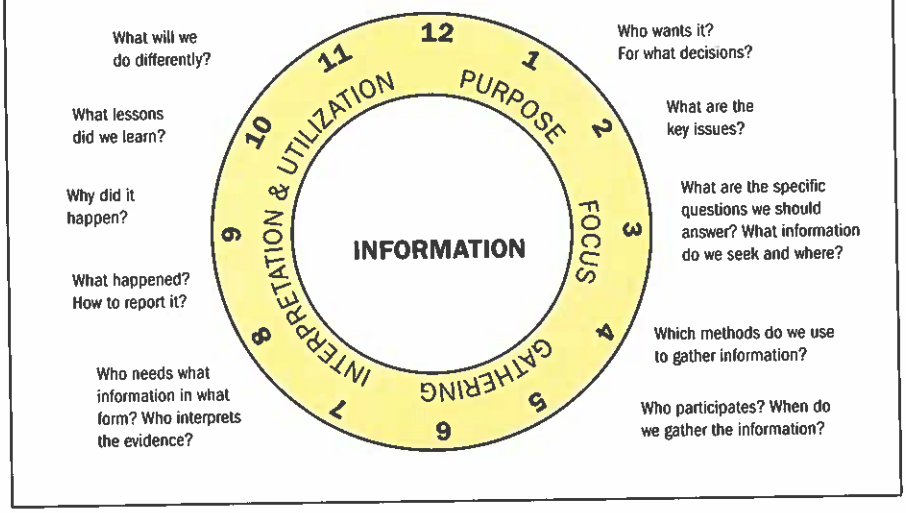
4) Marketing/consumption
5) Leadership development

If this was a large and well-funded project, then a major evaluation needs to be done. This involves the formation of an evaluation team, whereby each objective is designated to an expert (e.g., a training specialist, a rabbit expert, an economist and a nutritionist). Needless to say, it is vital that a comprehensive and unbiased evaluation report be prepared.

In contrast, if this was a small rabbit project, either the program manager or even the community may do the evaluation. It goes without saying that the community should actively participate in the evaluation process because it is their project. At a community meeting, the purpose for the evaluation should be clearly explained, as well as the critical need for their involvement.

A valuable instrument to the evaluator(s) is the original project design, as well as the periodic progress reports. For the large projects, each team member will require additional records. For example, the economist will ask for copies of financial records of central rabbit marketing activities and records from a representative sample of farmers. Also, each evaluator might wish to interview farmers and even meet with the community to ask specific questions about their own perception of the project's impact. This information should also be included in the evaluation report. A useful schematic showing the stages of project evaluation is provided in Figure 2.3.

Figure 2.3. The Project Evaluation Clock



For each of the five objectives or project components, the task is simply to determine and to quantify the level of activity. To illustrate, for the training objective, the key questions for the evaluator(s) are: How many farmers were trained, and was training effective? This part of the evaluation report will also provide a narrative account of the training approach and reasons or

evidence of how it was or was not effective (i.e., lessons learned). The same evaluation strategy is used for the other objectives or project components. The report is usually full of situations that occurred during the formal life of the project, such as constraints and limitations, disasters and opportunities, and spin-offs (unplanned benefits of the project). An example of spin-offs was a project in Egypt where parents became functionally literate as a result of their children teaching them how to keep rabbit records and read the instructional manuals.

A good evaluation report concludes with a retrospective short list of recommendations for future projects in terms of what factors were considered an asset (i.e., helped to make the project a success) and what factors were a liability. The lessons learned from the evaluation should soon be shared with the community during a meeting. To reiterate, the evaluation is most useful in planning future projects to be even more successful (Bunch, 1982).

In conclusion, the intermediate factors of the Small-Scale Rabbit Production Model (SSRPM) are vital from a project development standpoint. Obviously, a great deal of planning, coordination, expertise, capital, good timing, patience, and other inputs and resources are required to develop a successful rabbit project. The SSRPM can be used as a holistic and sustainable guide to plan successful rabbit projects from start to finish. With a focus on small farm families living in poverty and the opportunities provided through training and supervision and through the procurement of a few breeding animals (being supported by renewable on-farm resources), many benefits can be imparted through the rabbit project. Moreover, a truly successful project will continue to flourish by impacting even more poor families through Passing on the Gift of breeding stock and training, as well as through the continued efforts of local rabbit farmer leaders and continued acceptance and support by the community.

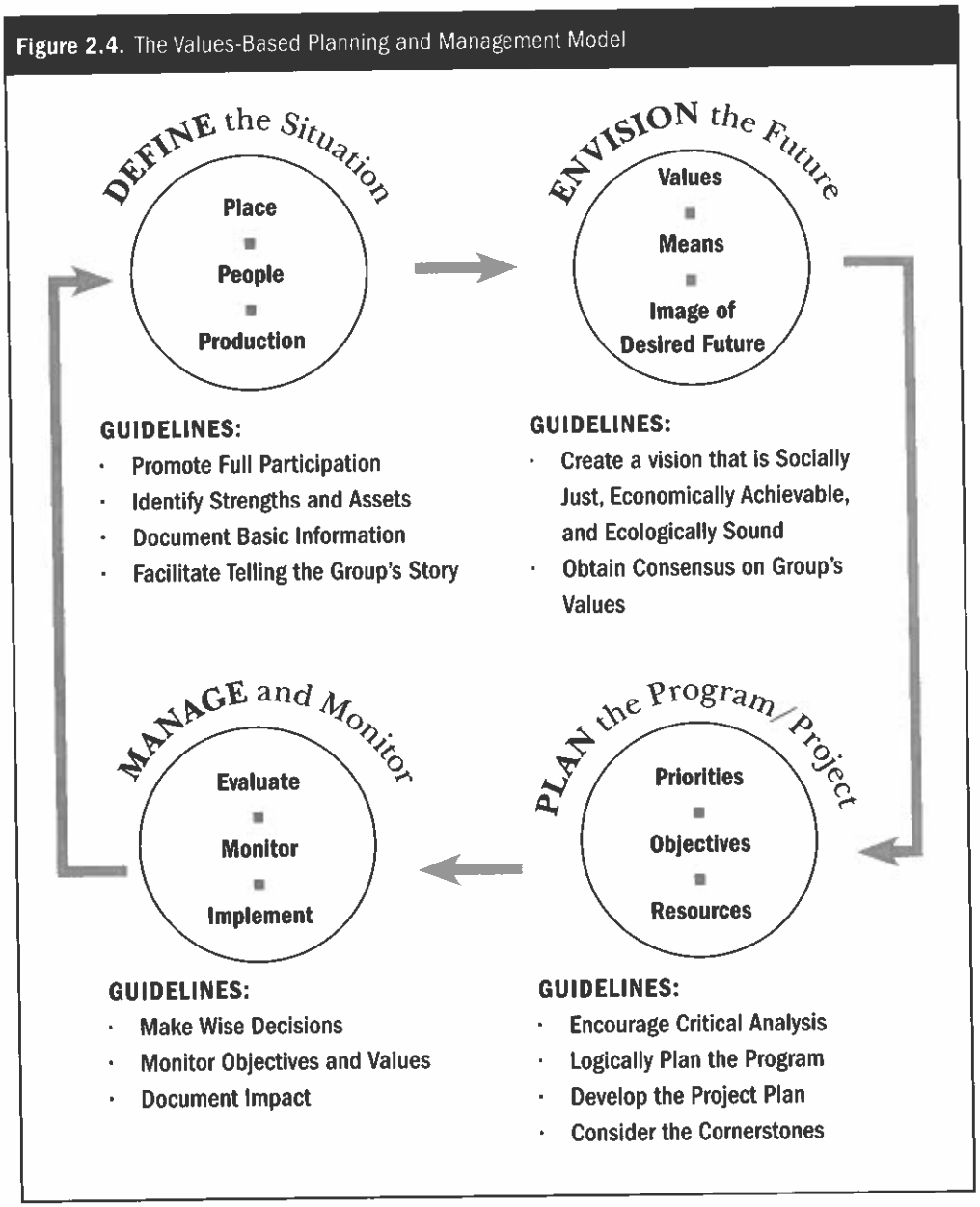
THE HEIFER MODEL

Through years of experience in assisting communities in more than 125 countries in 65 years, Heifer International has developed its own model in project planning. The SSRPM model was developed because knowledge and experience unique to raising rabbits require some expertise to develop successful projects. In contrast, a Heifer project may, for example, involve a community goat project. The participants are already familiar with traditional methods of raising goats. After a devastating hurricane or a disease outbreak, goats were in short supply in the region. Because the people were poor, they could not afford to buy many goats. Hence, such a need for assistance could be well justified by Heifer. Moreover, such a project could be envisioned and completely managed by the community. One exception could be a training component whereby possibly all farmers in the community would receive training in disease prevention and treatment.

A schematic for *The Heifer Model* is shown in Figure 2.4. This model basically consists of four steps in terms of community-based participation. First, the community defines the situation or problem and proposes a possible project. Secondly, a process of community envisioning aids in considering all available options to make a final decision of what project is truly needed. Later, the community develops a project plan. And lastly, the implemented project needs to be properly managed and monitored (similar to aspects addressed above in the SSRPM model).

For further understanding of Heifer's methodology for project planning and development, the planner is strongly encouraged to read *The Heifer Model*, which is included in the General References list.

Figure 2.4. The Values-Based Planning and Management Model



PART 3

SMALL-SCALE RABBIT PRODUCTION MODEL – EXTERNAL FACTORS

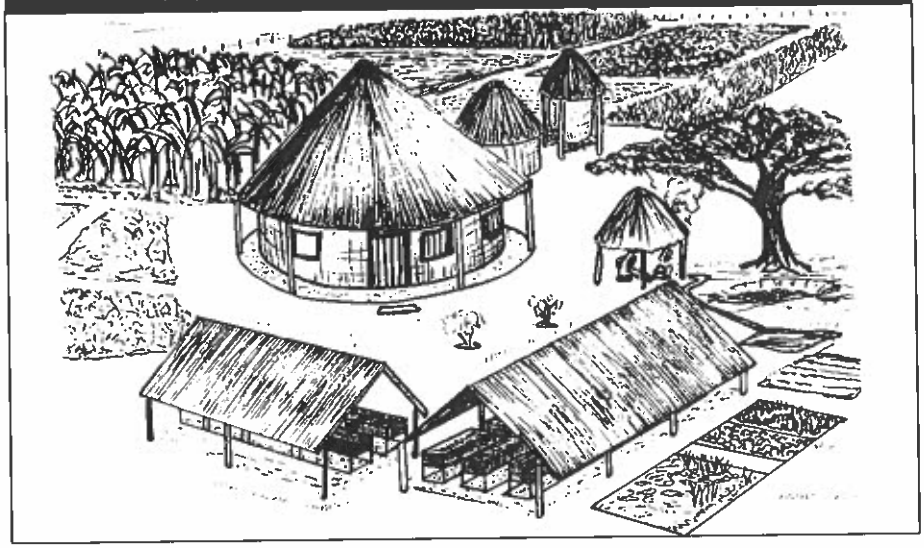
The Small-Scale Rabbit Production Model (SSRPM) also considers external factors—ecological, economical and social—that can ultimately affect the outcome of the project. To reiterate, the SSRPM is a planning tool that:
1) Serves to aid the farmer to be a good steward of the environment
2) Provides a strong economic incentive to produce
3) Contributes to the goodwill of the family and community.
Hence, the program must be sensitive to these three factors.

The same approach used for Part 1 will again be used in this chapter, which is to present the information on external factors as if the person was actually preparing a feasibility report. The person who is preparing the report (in close collaboration with the community) should bear in mind that if even one of these external factors receives a strong negative mark, the initiation of a rabbit project may not be justified.

ECOLOGICAL SENSITIVITY

In terms of ecological aspects, the SSRPM emphasizes use of local building materials for constructing hutches and equipment that are obtained from renewable resources (Figure 3.1). However, it is important that the use of these materials does not contribute to deforestation, global warming or soil erosion. The rabbit's diet is based on feedstuffs that likewise are cultivated and harvested from plots or gardens. Further, farm integration practices should involve the recycling of nutrients that protect the environment, such as planting legume forage species (e.g., *Leucaena* and *Tricanthera*) to fix nitrogen into the soil, and using rabbit manure for composting to enrich soil fertility, increase water-holding capacity and support beneficial soil micro-organisms.

Figure 3.1. A sustainable farm makes good use of renewable materials for construction purposes



Additional models of integration for sustainable rabbit farming include rearing rabbits in hutches over tilapia fish ponds and rearing guinea pigs or Muscovy ducks below rabbit hutches. To offset dependence on chemical fertilizers, rabbit manure has been used as a medium for horticultural, greenhouse or nursery plants, or for vermiculture (earthworm production). Worms can either be sold for cash (fish bait) or fed to poultry or swine as a low-cost protein supplement.

S.D. EUKEMAN

Integration of rabbits with fish in Vietnam. This pen of fryers is over a pond containing Mekong catfish.

An important feature of the SSRPM is that sustainable measures can be readily adopted by the limited-resource farmer and lend themselves well to diversification (combination of other crop and livestock activities) to further ensure food and economic security, while maintaining a healthy farming ecosystem. In contrast, in commercial operations it is often simply not feasible to maintain sustainable or diversified systems due to economic or labor constraints.

For the purpose of the feasibility report, the potential for developing such a sustainable ecosystem for small farms that include integration of rabbits should carefully be examined. Sources of information could be gathered based on, for example, published reports, area visits to diversified and integrative farms, and visits with extension specialists and animal scientists who are active and successful in developing integrative models at research stations.

ECONOMICAL SENSITIVITY

Ideally, and especially from a humanitarian aid standpoint, the rabbit project or enterprise should be designed such that farmers are engaged at minimal investment and operation costs, including labor. Minimal investment and

operation costs are both realized if renewable resources (e.g., local building materials, feedstuffs and breeding stock) are available and properly utilized. If this favorable economic environment exists, such that limited-resource farmers are not exposed to major economic risk, then sustainability is certainly made possible. Moreover, benefits from meat consumption and sales of surplus stock should readily offset all expenses, and make significant contributions to diet quality and income earnings.

For any alternative agricultural enterprise, including rabbit production, an economic incentive to produce must be justified. Farmers will certainly abandon their rabbit enterprise if strong markets do not exist. Markets have to be created or expanded if a regional rabbit program is to succeed. Potential markets that can be created include, for example, traditional open markets, farmers' cooperative markets, food stores, cafes, street vendors, hotels, schools and hospitals (covered in the Marketing Rabbits module).

A desirable economic situation that exists in some countries is when the market price of a rabbit fryer is less than that of a broiler chicken (to make rabbit meat highly competitive), but where the profit margin is higher for rabbit. Where stable markets do exist, it is imperative that farmers are not tempted to sell more rabbits than what their families should be consuming so as not to flood the market or to sacrifice the desired nutritional impact of the project. Farmers can learn the vital lesson to "eat two and sell one" to emphasize the primary nutritional goal for most rabbit projects in the LDCs.

Promotion of rabbit ("conejos") meat dishes on a sign outside a restaurant in Peru.

In terms of feasibility, there is a track record of many reports that did not recommend that a rabbit project be started because no formal markets for rabbits could be found. Instead, if the potential is high that markets can be created or expanded, then the feasibility report can still recommend that the project be initiated (assuming, of course, that no other serious constraint is identified). This determination can be made, for example, by interviewing owners of businesses (e.g., farmers' co-op markets, schools with cafeterias, road vendors, stores where meat is sold, hotels and restaurants) that express a strong interest in buying rabbit meat once it is made available. Standard market feasibility surveys can be modified and used to make this determination.

Planners should bear in mind that informal markets for rabbit meat are usually more important than formal markets. Of course, the family's demand for rabbit meat is the first priority. Next, the local demand of neighbors (not to mention local farmers' markets in the village that exist in many societies) should not be overlooked. The lack of formal markets should not be the sole basis for making a decision to not start a rabbit project. Formal markets can be created in time.

SOCIAL SENSITIVITY

Of course, a sustainable and alternative (small-scale) rabbit project will more than likely be accepted by the rural community if they are involved in the initial planning stages, and then continually participate in decision-making aspects (e.g., who amongst themselves will receive rabbit training and breeding stock). This "participatory approach" to development is highly recommended by world hunger organizations because it engenders a strong sense of project ownership, among other direct benefits.

A positive social environment of acceptance has other dimensions, as well. To illustrate, are women allowed to engage in agricultural projects, an issue referred to as "gender sensitivity"? Also, can women be visited on their farms by male extension workers? Do husbands allow their wives to spend money earned from rabbit sales? Are children encouraged, even rewarded, to participate in the rabbit enterprise so as to thwart the likelihood of them abandoning farming as a possible career choice and instead migrating to urban centers? In recent years, an emergence of rabbit development projects directed at women and children has occurred. In several women-managed rabbit projects, both social status and income levels increased as direct benefits. Too, in many projects, women and children have been the sole managers of the rabbit enterprise.

S.D. LUKEFAHR

A rabbit project in Cameroon that focused on family health and nutrition through the training of rural women.

In Cameroon, Heifer International uses rabbits as a top priority project to elevate the social status of impoverished women and to improve the diet quality for their families. "Gender sensitive" projects brought women together and engaged them in leadership and/or organizational, management and marketing activities.

Rabbit projects have also been designed for children by introducing rabbit projects at schools. The rabbit's diet is typically based on garden and kitchen wastes, rabbit lessons are incorporated into the agricultural curriculum, rabbit meat is served in cafeterias and children later introduce rabbits in their home villages. Rabbit projects have also been aimed at orphaned children or AIDS victims because of the low start-up costs and early benefits.

In the context of development, sustainability could even be defined by world hunger organizations as those projects that were subsequently managed by the community, independent of technical assistance or funding, that continually impacted the lives of a multitude of rural and peri-urban based, limited-resource families.

Ideally, the person or team that prepares a feasibility report should address all such relevant social aspects. Of course, the direct involvement of the community is essential in determining the potential social aspects of the project. Based on the feasibility report, if a proposal is to be submitted for formal support and/or sponsorship by a funding agency, such as Heifer International, it is paramount that strong evidence be provided on the ecological, economic and social impact of the proposed project.

A rabbit project always attracts children. Gawrońska, a girl from Poland, used to go straight to her uncle's house from school to help him feed and care for his rabbits before going home.

As a planning guide, a general checklist form is commonly used to screen projects for funding, in part, on the basis of the external factors described here in (Table 3.1).

Table 3.1. Sustainability checklist for external factors for planning rabbit projects[a]

Factor		Yes	No
Ecological	Recycle farm nutrients (integration)?		
	Gardens or forage plot establishment?		
	Renewable resources for building materials?		
Economical	Low investment and operating costs?		
	Loan possible for breeding stock?		
	Availability/opportunity for markets?		
Social	Time available to raise rabbits?		
	Participation of women and children?		
	Respond to technical advice?		
	Regular consumption of meat acceptable?		
	Promote the goodwill of community?		

[a]This table is only a general guide; in local situations, other external aspects or issues may need to be addressed.

SECTION 2
THE LEARNING GUIDES AND LESSONS

"The Lessons," which include basic information on major topics that relate to rabbit production, were prepared to assist the trainer prepare lesson plans for rabbit training courses. Modules should serve as a supplement to the trainer's own knowledge and experience. Performance objectives for trainees can be developed using problem-solving techniques. Each module also provides new concepts, solutions to common problems and management techniques that can improve rabbit production.

The trainer should have one or several of the books available (e.g., FAO, 1986, Lebas et al., 1997, and McNitt et al., 2000) from the General References list. In addition, a list of internet resources such as online rabbit manuals is provided in the Internet Sites section on page 165. These books and other materials can serve as a valuable resource to the trainer to provide detailed technical information, preparation of lesson plans, solutions for field problems, etc. They may also be used to obtain information from figures, graphs, tables and the text. Existing published information is not duplicated in the lessons of this book. Requests for literature should be made directly to the author or publisher.

STORY FROM CAMEROON

Heifer – The Seed that Guarantees Sustainability

Bettah Bathsheba, 58, lives in Mughu village in Cameroon. She was infected by leprosy at an early age. The gravity of the disease eventually caused her to be moved to Mbingo Baptist Hospital for special treatment which prevented her from going to school. While receiving treatment, she married a farmer named Mbangwi and settled in Mughu. She is a mother of nine (seven boys and two girls) and member of the Mughu Women Mixed Farming group.

Bettah Bathsheba receives two rabbits from Heifer International.

The group first applied for assistance with Heifer International in 1997. "After a year, our group was screened and we received trainings on pasture development, followed by tree domestication, zero grazing and other social training. Finally 16 farmers were selected out of 18 members and placement of livestock was done. I was a beneficiary of two rabbits," Bathsheba said.

After her engagement with Heifer, she noticed significant changes within her family. "I stopped stressing myself to produce gari (a starchy food made from the cassava root) regularly. With rabbits, I had enough manure to use on the farm. I planted vegetable seeds that Heifer gave me. I saved the money I would have used for fertilizer and purchased other household needs. I previously cultivated vegetables once a year because I could not afford fertilizer. With manure from my rabbit project, I currently cultivate in and out of season. I realize 21,000 CFAs (Cameroon Francs or $50 U.S.) monthly from vegetable sales. Presently I have six rabbits, 11 goats, one pig and countless guinea pigs," stated Bathsheba.

Nutritional diversification from the rabbit project brought about improved family health, her son Lucas affirmed. "The nutrition of our household has improved as we eat vegetables more often with diverse foodstuffs such as yams from the farm. Besides, we now have access to animal protein because mum can harvest a rabbit for a meal without my father scolding her since the rabbits are available. The result is obvious; we are healthier. In cases of ill health, we sell rabbits and other livestock to pay the bills."

Bathsheba can now conveniently pay for all her children's school needs, and none of them go to school barefoot. One of her sons, sponsored from her rabbit project proceeds, also supports the family. "My son Lucas was in grade four when I started receiving assistance from Heifer Cameroon. Money from the sale of rabbits helped me maintain him in school. With income from the project, he went to Banso Baptist Health School, graduated and now works as a nurse at Mbingo Baptist Hospital. He earns money and helps support the family," she said proudly.

Thanks to Heifer Cameroon's assistance, Bathsheba generates income to support her family. "Now I hardly borrow money since I have various means of generating income, either from my animals or sale of vegetables. My family wears better clothes and we no longer look miserable."

"My life and that of my family witnessed a change and I wanted others to witness this change, too. I fulfilled my passing on the gift commitment by giving rabbits to Esther Bih, and I used to visit her twice a week to see how she was doing with the rabbits. I have also passed on knowledge on rabbit rearing to my children and daughter-in-law and they are now skillful in rearing rabbits."

With regard to the environment, Bathsheba said, "I no longer do slash and burn; rather I use compost manure and practice fallowing. This produces better yields without destroying the soil. I also planted agroforestry trees and fruit trees such as guava, kola nut, pear and plum."

"I am so happy that Heifer Cameroon came into my life and empowered me to help myself and others," Bathsheba said. "I have helped my husband to provide for our big family."

MODULE 1

BENEFITS OF RABBIT FARMING ..... The Learning Guide

Learning Objectives

By the end of this session, trainees will:

- Be able to identify the benefits of rabbit farming
- Be able to develop a personal goal for their rabbit project
- Be familiar with the nutritional value of rabbit meat
- Be able to articulate ways a rabbit project could contribute toward social stability or community development in their own village
- Be familiar with the benchmarks of production
- Be able to estimate potential income from rabbit farming

Terms to Know

- Buck
- Compost
- Doe
- Enterprise
- Fryer
- In-kind
- Litter
- Pelts

Recommended Demonstrations

- Determine meat production levels for a 10-doe herd size.
- Show products made from rabbit skins.
- Visit a demonstration farm and show how to make proper compost.

Training Group Discussion and/or Take Home Assignment

- Discuss how to calculate potential profit for a 10-doe operation; consider costs and then sources of revenue (be sure to include the value of fryers consumed by the family and the value of replacement stock).
- Discuss what role each family member could play to support a small-scale rabbit enterprise.

Sample Visual Aid

NUTRIENT COMPOSITION OF RABBIT MEAT

Species	Protein %	Moisture %	Fat %	Energy cal/kg
Beef	16.3	55.0	28.0	3,168
Chicken	20.0	67.6	11.0	1,782
Lamb	15.7	55.8	27.7	3,124
Pork	11.9	42.0	45.0	4,510
Rabbit	20.8	67.9	10.2	1,749
Turkey	20.1	58.3	20.2	2,618

SOURCE: USDA, 1963.

Sample Visual Aid

Table 1.1. Safe protein intakes for selected age groups and physiological status

Group		Age (yr)	Safe Protein Level (g/kg/day)
Infants		0.3-0.5	1.47
		0.75-1.0	1.15
Children		3-4	1.09
		9-10	0.99
Adolescents	Girls	13-14	0.94
	Boys	13-14	0.97
Adults		19+	0.75
Pregnant women		2nd trimester	6+
		3rd trimester	11+
Lactating women		0-6 mo	~16+
		6-12 mo	~11+

Source: 1985 FAO/WHO/UNU.

MODULE 1

BENEFITS OF RABBIT FARMING

The Lesson

The purpose of this module is for participants to learn the benefits of the rabbit **enterprise**. While there are several potential benefits from rabbit farming, a participant might focus on one, two or several specific benefits (for example, meat production or income generation). Benefits and/or products from rabbits include, for example: meat, skins or leather, fur or wool, manure, income generation, occupation, gender empowerment and social stability. It is important that the trainee knows his/her goal before starting a rabbit project.

ESTABLISHING A GOAL

The goal should be clear. For example, a common goal for participants in many rabbit projects is "to improve the quality of my family's diet." A goal should be supported by specific objectives (preferably measurable or quantitative), the first of which could include participation in a rabbit training course. Other goal-based objectives could be: 1) to initiate a five-**doe** enterprise (later expanding to 10 to 20 does) using a four **litter** per year breeding schedule; 2) to maintain basic production and financial records; 3) to consume 2 kg of rabbit meat per week (based on family size); and 4) to work with local project officers and participate in rabbit club meetings.

MEAT PRODUCTION

Rabbit meat is very nutritious. It is a rich source of protein (about 20%), minerals and vitamins. Also, relative to other common meats, rabbit meat is low in fat, sodium and cholesterol. Unlike ruminants, rabbits can directly utilize forage proteins and convert this to animal protein. Animals with one stomach, such as chickens and swine, generally rely on cereal grains for meeting their dietary protein and energy needs. Thus, rabbit meat is an inexpensive source of protein. And, because of the small size of the rabbit, the meat can be consumed in one meal, thus avoiding the need for refrigeration. It is little surprise that rabbits are referred to as "biological refrigerators."

The novice farmer should start with only one **buck** and a few does since certain skills, experience and close daily attention are required for a successful operation. An average figure for production in a subsistence-level rabbit enterprise that uses on-farm resources is 20 marketable **fryers**, which is based on four litters yielding five fryers each, on average, per doe in a year. This illustrates the high reproductive capability of rabbits. In intensive-level operations involving commercial feeds, wire cages and improved breeds, this figure can be increased but with added cost (covered in the Production Systems and Economics module).

BENCHMARKS OF PRODUCTION

- A breeding doe should produce at least 20 marketable offspring from four litters per year based on an extensive production system.
- Ten does should provide 200 fryers annually. Depending on the family size and its age and body weight composition, the meat from two to five fryers could be consumed weekly, and the rest sold for income.
- A live fryer weighing an average of 2 kg with a 60% carcass yield (including head and edible organs) should produce about 1 kg of edible meat (85% meat yield), containing approximately 200 grams of protein.
- Therefore, two to five fryers should provide a total of 400 to 1,000 grams of animal protein per week for the family.
- The daily protein requirement is 0.75 g/kg of body weight for adults. Based on an average body weight of 60 kg, the meat from five rabbits would meet one-half of the daily protein requirements for the equivalent of 6.3 adults for one week.

The above figures were used in Table 2.3 to show nutritional and economic impact for a small-scale rabbit enterprise.

A project staff person or, for large projects, a nutrition consultant should determine the total weekly protein requirements for each family that is participating in the rabbit project (see Table on page 48).

INCOME GENERATION

In addition to improving the quality of the family's diet, any farmer who raises rabbits will have the goal of increasing his or her income. To project income from a rabbit enterprise, one must consider start-up or investment, depreciable and operating costs, in addition to monetary returns. Ideally, a rabbit enterprise should be started with little cost. A shelter, hutches and equipment can usually be made from building materials found on the farm or in the village. The hutches could be placed along the veranda or in an unoccupied room of the family compound. Bamboo, palmwood or bush sticks for constructing hutches and equipment, as well as thatch grass or large leaves for roofing, can usually be acquired at little cost. Welded wire is not necessary for the construction of hutches (covered in the Housing and Equipment module).

Breeding stock should never be given freely to farmers (barring an emergency situation). Either the farmer should pay for the stock, receive the stock through a loan or provide an **in-kind** service to the project. For example, three young rabbits might be provided to a farmer at less than market price in exchange (later) for the same number of their offspring, which in turn could be provided to a new farmer. Such a practice fosters community goodwill. It also accomplishes the objective of initiating a rabbit enterprise at minimal cost, which reduces financial risk. Only experienced rabbit farmers should expand into an intensive operation

where higher investment and operating costs are required.

In a subsistence-, extensive-scale enterprise, the operating costs can be low if feeds (for example, forages, garden wastes and kitchen scraps) are grown or made available on the farm. In an intensive-scale enterprise, the greatest operating cost is feed (refer to Production Systems and Economics module).

Projected income can be calculated based on the figure of 20 marketable fryers per doe in a year. A value should also be assigned to fryers that are consumed or used as replacement breeding stock. The local current market price could be applied to the figure for total live weight of marketed fryers produced to project total revenue. Potential income can then be related to projected costs to calculate profits, the rate of return, opportunity costs and return to labor.

SKIN AND WOOL PRODUCTION

Depending on cultural preference, a potential source of income may be the processing of skins and harvesting of wool. One fryer will yield a skin with an area of approximately 1,000 cm^2. The skin should be used as an important byproduct. First, and because skin is mostly made of protein, it may be de-haired (by singeing the fur over an open fire), cooked and eaten with the carcass. The skin could also be tanned and de-haired to make leather (called vellum) or simply tanned to make **pelts** as fur products such as garments, handbags and toys. In several countries, such as China and France, major rabbit skin industries have emerged. In 1975, three leading exporters in France exported 6,340 metric tons of dried rabbit pelts worth 87.5 million francs.

A woman from an Indian village who participated in a rabbit project in Guatemala. The women learned how to take rabbit fur, and, using traditional dyes, developed quality items which they sold in the market, which increased their income. One item that they made was that of the original logo of Heifer International (below).

Skins must be of good quality to make quality products. It is important to know that skins from a fryer are of poorer quality than skins of mature rabbits. Fur from immature fryers is often made into inexpensive felt. It takes much labor and time to process rabbit skins into pelts, which might be a comparative advantage in developing countries. Lucky rabbit's foot or tail charms are another option, but this option depends on the local culture or export opportunities. Instructions for skinning, drying and tanning rabbit pelts are available through an internet search. Local tanning methods should also be considered.

MANURE AND OTHER BYPRODUCTS

Like most animal manures, rabbit manure is an important source of organic matter and provides some nutrients as well. However, contrary to popular belief, animal manures alone are not a rich fertilizer source. According to one report, dry rabbit manure contains 18.8% **crude protein**, 9% moisture, 13.5% **crude fiber** and 19.2 mega joules **gross energy** per kg. Rabbit and other animal manures can be used to produce methane gas as a household source of alternative energy or as valuable **compost** as a medium for worm production, called vermiculture.

The nitrogen (N), phosphorus (P) and potassium (K) composition for rabbit manure is approximately 3.3 to 3.7% N, 1.3 to 5.2% P and 2.9 to 3.5% K. However, these values depend largely on the quality of the rabbit's diet. In other words, NPK values will be lower if rabbits are maintained on a low level of nutrition. Nonetheless, these approximate NPK levels can be used when calculating fertilizer value for composting or feeding value for livestock and aquaculture production. Raising rabbits in sheds over tilapia fish ponds has been demonstrated to increase fish yields. This occurs from the rabbit manure that fertilizes the pond by increasing algae production, which is the primary food for tilapia.

If properly prepared, animal manures can become a significant source of soil nutrients for use by plants. For example, rabbit manure can be composted with animal feed wastes and later added to the soil as fertilizer. Composting involves the gradual process of decomposition of organic matter from manure and release of nutrients, which become available for plant use. As a rule, a mature rabbit will produce about 100 grams of fresh manure daily.

Other byproducts from rabbits may include the entrails or viscera that could be added to the compost pile, cleaned and cooked for consumption, or used as casings to make sausage. The blood may be collected for consumption, composting or as an animal feed source. In some projects, the internal organs (brain, certain glands) and blood have been collected and sold to make antiserums and vaccines. Rabbit bones can be dried and ground to make bone meal and fed to livestock as a supplementary source of minerals. Nothing produced from the rabbit should go to waste.

OCCUPATION AND SOCIAL STABILITY

Raising rabbits can become an active source of livelihood or occupation shared by the entire family or community. Family labor should be divided into the various activities of rabbit production. For example, children can assist in the collection of forages, women in daily cleaning of the hutches, and men in the breeding and record keeping chores. The small size of the rabbit and the controlled nature of its hutch environment is one distinct advantage of raising rabbits. However, one adult member should provide

overall supervision and management, such as in the inspection of plant species before feeding to ensure no toxic plants are included.

Using the shared family labor approach, the cost of labor is negligible for a small subsistence- or extensive-level rabbit enterprise. Approximately 10 to 18 hours per doe in a year's time are expended. It has been estimated that it takes a total of about 30 to 40 minutes of labor to produce 1 kg of rabbit meat.

Social stability can be enhanced by an active village-level rabbit project, especially since there are few taboos concerning the production or consumption of rabbit meat. A sense of community spirit can be produced through formation of a local rabbit club or market cooperative. The centralized collection of fryers for marketing, the sharing of breeding stock and providing rabbit training to neighbors are common activities for rabbit projects in many countries. The role of women has also been enhanced in community rabbit projects in some countries. The involvement of youth in rabbit projects could reduce their need to search for work in urban areas.

STORY FROM GUATEMALA

Families Increase Coffee Production with Rabbit Manure

In October 2005, the Lake Atitlán region in Guatemala was seriously affected by Hurricane Stan. Mudslides killed more than 500 people and seriously affected the region's coffee production, which is the main income generating activity in the region.

Despite the difficult situation faced by the families and the rather dark horizon left after the storm, the communities conducted an assessment that allowed them to identify the short, medium and long-term effects of the storm. Heifer determined that there were inherent, favorable conditions that could—with some support—help improve families' livelihoods and reactivate coffee production, therefore giving rise to the project Reactivation of Coffee Production of Small Producers in the Lake Atitlán Watershed.

Project participants receive training in using rabbit manure as fertilizer for crops.

This project supports 822 families who are members of the Sololá Coffee Organic Producers Association (APOCS). The farmers are indigenous Tzutuhiles, Cakchiqueles and K´iches who live in the communities of the Lake Atitlán basin.

After Hurricane Stan, Heifer provided rabbits and training in their care to women in the devastated area. The women knew the rabbits would allow them to obtain food for their families and generate additional income from the sale of the surplus. At first, it was a challenge to get families to eat rabbits because it was not part of their traditional diet. Today, there is a strong demand by the local population for the rabbit meat, as well as from visitors who frequent the town to purchase their own supply.

The importance of this project did not stop with meat production. The rabbit manure was also harvested and used to improve the soil quality and enhance coffee production in the area. The animal's manure is a principal ingredient to produce organic fertilizer that improves crop production.

The rabbits have given the families of the Lake Atitlán watershed a source of food, a source of income and a source of fertilizer to strengthen their coffee production. They have been able to transform conventionally grown coffee farms into organic ones that are internationally recognized for producing a grain of gourmet quality. Additionally, the work and tenacity of these families have led to a reduction in the time that they now invest in internal migration to the South Coast to look for work and improved levels of education for their children, and have become an alternative employment source for hundreds of peasants.

MODULE 2

WHOLE FARM INTEGRATION ..... The Learning Guide

Learning Objectives

By the end of this session, trainees will:

- Be familiar with sustainable (holistic) farm elements
- Be familiar with different types of farm integration models
- Be able to determine what integration method is most appropriate for them

Terms to Know

- Animal-agroforestry integration
- Animal-animal integration
- Animal-aquaculture integration
- Animal-crop integration
- Holistic approach
- Off-farm inputs (resources)

Recommended Demonstrations

- Visit demonstration farm(s) that illustrates a holistic approach involving beneficial integration practices.

Training Group Discussion and/or Take Home Assignment

- Take a sheet of paper and draw your farm showing the parts that make up your farm. What parts are integrated? Explain how. Does anything produced on your farm go to waste? If so, could it be better utilized as recycled wastes to enhance nutrient flow?
- How can the identified parts of your farm help support the raising of rabbits? Could rabbits be integrated to complement your own farming system? Explain how.

Sample Visual Aid

EXAMPLES OF ON-FARM INTEGRATION	
Animal-Animal	Rabbit feed wastes to support guinea pigs, and rabbit and guinea pig manure as a feed source for ruminants
Animal-Crop	Crop and garden wastes fed to animals and manure compost recycled for crop production
Animal-Agroforestry	Leguminous leaves fed to animals and manure compost recycled for seedling tree production
Animal-Aquaculture	Pond water or dried fish supporting animals
	Manure/sludge compost for fish production
Animal-Vermiculture	Rabbit manure as a medium for worm production
	Worms sold as fishing bait or fed to poultry and swine

MODULE 2

WHOLE FARM INTEGRATION

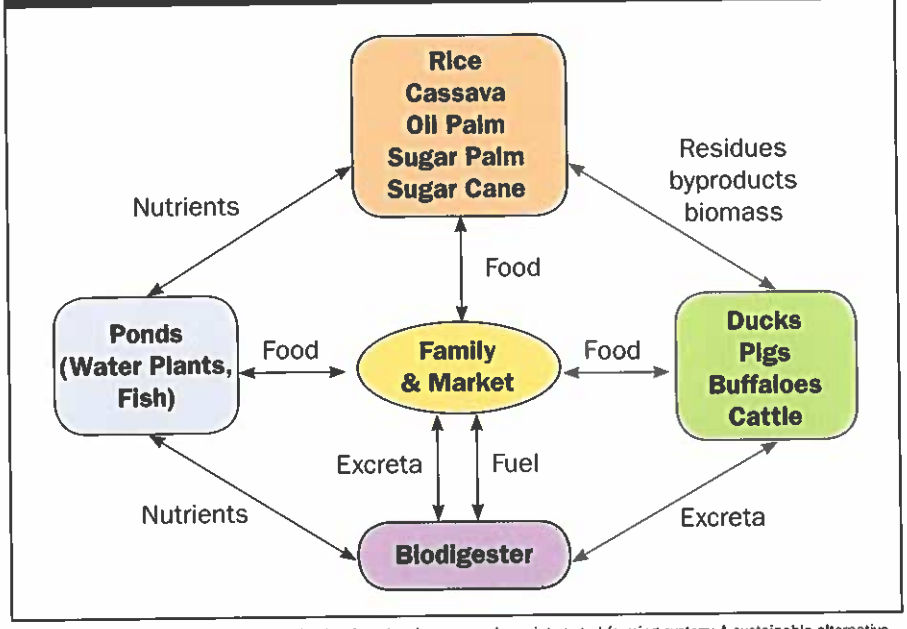
The Lesson

A HOLISTIC APPROACH

A typical smallholder farmer has limited resources, which include land, housing and equipment to house rabbits, capital and labor, but also knowledge and valuable skills that relate to rabbit production. In developing rabbit projects, the emphasis is generally on limited-resource farmers who have small farms (less than one hectare). This focus requires an appropriate approach to development involving how to make the small farm more productive and sustainable using local resources while protecting the environment. In other words, the goal is to help farmers become self-sufficient and more prosperous economically, not to make farmers dependent on costly **off-farm inputs** such as exotic breeds, commercial feeds and equipment and supplies.

The farmer must manage the farm efficiently to optimize benefits (e.g., food and income) for the family. The farm should be considered as a whole unit that consists of smaller parts as shown in Figure 2.1 as a general guide. A simple example: A farm might be comprised of two parts, a garden and a small goat herd. To optimize farm benefits, these two units should complement one another. Garden wastes could be fed to the goats when available (as well as forage from plots), and manure and feed refuse from the goats could be recycled to garden soils through composting. This practice, called integration, can reduce the need for costly off-farm inputs such as chemical fertilizer and animal feed supplements.

Figure 2.1. The Integrated Farming System



Source: Preston, T.R., 2000. Livestock production from local resources in an integrated farming system: A sustainable alternative for the benefit of small-scale farmers and the environment. Proc. Workshop on Sustainable Livestock Production on Local Feed Resources, Ho Chi Minh City, Vietnam. Accessed Dec. 10, 2009. Available at: **http://www.utafoundation.org/utacambod/sarec/preston.htm.**

Intensive agricultural integration models are particularly evident in Asia where traditional integration leads to improved, more efficient food production. Also, the environmental resources of the farm (e.g., native plants and the soil) can be conserved through various integration practices, which foster sustainability.

This module emphasizes the concept of whole farm integration, and shows how rabbits can optimize farm benefits for the family to enhance food security. Examples of integration models involving rabbits are discussed below.

FEATURES OF A SUSTAINABLE SMALL FARM MODEL

- Animal production based on on-farm resources
- Recycling of nutrients from feed wastes, manures, slaughter byproducts, etc., involving composting
- Low-cost feeding from forage plots, crop byproducts, native wild plants, garden wastes and kitchen scraps
- Housing and equipment made from local materials
- Low economic risk of investment or operation
- Rapid reproduction of livestock when expansion is desired
- Livestock as "walking banks"
- Utilization of family labor for livestock management

ANIMAL-ANIMAL INTEGRATION

Integration between different animal species can be beneficial. For example, ducks, muscovies or guinea pigs may be raised on the floor under rabbit cages, whereby rabbit feed wastes that fall from the cages are consumed. Dry manure from rabbits could be mixed with other feed ingredients and fed to livestock, particularly to ruminants. Also, rabbit blood and visceral wastes can either be fed fresh or dried and recycled as a low-cost protein supplement for livestock.

Earthworms raised below cages in rabbit manure can be harvested to feed fish, fed fresh or dried as a protein supplement for livestock or sold as a source of income. In the U.S., some rabbit producers earn more income from earthworm sales as fishing bait than from meat rabbit sales.

Honeybee production can also be beneficial. The use of animal compost can replenish soil nutrient reserves, while bees pollinate certain agriculturally valuable plants. The overall outcome is more efficient food production at minimal costs.

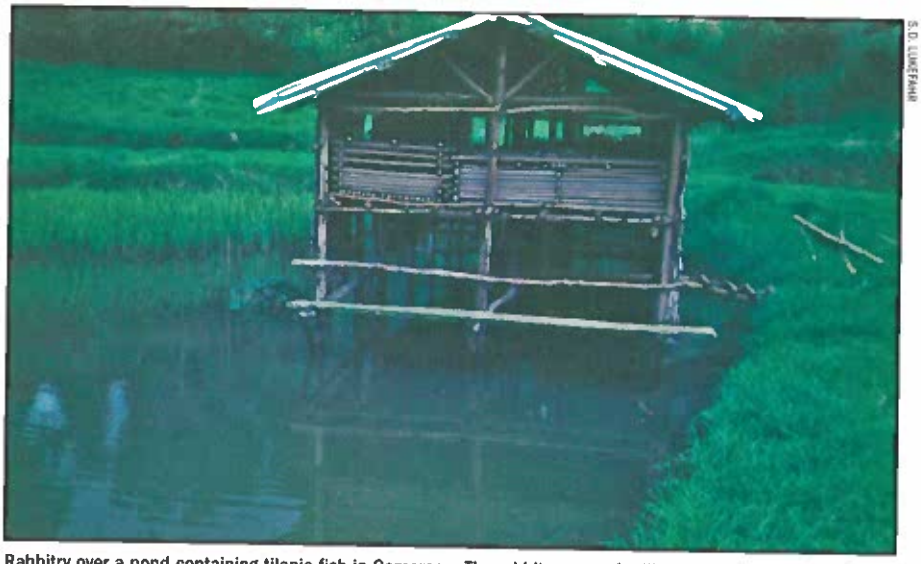
ANIMAL-AGROFORESTRY INTEGRATION

Trees serve many useful purposes. They provide shade and windbreaks, and are used in alley cropping, as living fences and for firewood. Leaves from forage trees can also be harvested and stored for dry season feeding.

Leguminous shrubs and trees can add critical nitrogen to the soil, and they can provide shade for rabbits and other animals, as well as nutritious forage. In alley cropping, rows of legume shrubs or trees can enrich adjacent rows used for crop or garden production. Compost made from rabbit manure could be used for establishing tree seedlings. Methane gas produced from animal and plant wastes can be used on the farmstead for cooking or light, thus conserving trees that may otherwise be used for firewood.

ANIMAL-AQUACULTURE INTEGRATION

A pond on the farm makes possible the production of aquatic plants, fish, frogs, freshwater prawns, water fowl and the opportunity for integration with agriculture. Integration of fish production and livestock production is a traditional practice in many cultures. In Bangladesh, commercial frog farming has become a major industry. Using aquatic plants as livestock forage (e.g., duckweed, water hyacinth, water peanut and water spinach) and fish-duck integration are common practices in Asia. The pond can often be a source for irrigating water to support forages, especially for dry season feeding, or fruit trees and garden vegetables.



S.D. LINDEMANN

Rabbitry over a pond containing tilapia fish in Cameroon. The rabbit manure fertilized the pond that produced more algae for the fish to consume. This extension center demonstration nearly doubled the fish harvest.

Rabbit manure can be utilized directly as fish food. Nutrients from the manure can support production of phytoplankton, zooplankton and other aquatic organisms which fish use as food. In turn, some varieties of fish raised, in part, on rabbit manure can be dried and used as a protein supplement for animal feeding. Rabbits have been known to consume dried fish.

Approximately 10 to 15 mature, non-reproducing rabbits (or the equivalent thereof) could be stocked per 100 m^2 of pond area. About 10 kg of rabbit manure per 100 m^2 pond area should be applied per week. The rabbit's manure and urine could both be collected and added to the compost pile in

the pond, or the rabbits could be housed directly over the pond. Chlorella, a green algae, can be grown in a shallow pond and supported on manure and urine from rabbits and other animals, and then be fed as a protein-rich (60% protein) foodstuff to livestock or people.

ANIMAL-CROP INTEGRATION

Agriculture byproducts from crops or gardens, such as vines, leaves, stems, cuttings, peelings and husks, can be recycled as feed for rabbits. These byproducts can be obtained from cereals, legumes, tuberous plants, tree crops, etc. However, crop residues or garden wastes are not always available, so forages grown in plots become a more important feed source. Processed agricultural byproducts, such as rice and wheat brans, cottonseed and palm kernel meals, and brewer's dried grains, can be acquired and stored as concentrate ingredients (covered in more detail in the Feeds and Feeding module).

T.R. PRESTON AND P. SAMKOL

Feeding of water spinach (*Ipomoea aquatica*) to a rabbit in Cambodia (however, forages should be fed in bundles or in mangers, not on the cage floor).

When there is a surplus, cereals and tubers (typically grown for human consumption) can supplement the rabbit's diet as an energy source. In certain cases, cultivation of plant foods (e.g., peanuts and sweet potatoes) for direct rabbit consumption can be economically justified if strong markets exist. Also manure and feed wastes can be composted to improve the soil in order to grow better crops or forages. A good planning exercise for farmers is to schedule their feeding program on a year-round basis, based on the seasonal availability of specific plants.

Overall, the complementary integration of animal and plant components can improve efficiency of total farm productivity as a sustainable, environmentally friendly farm system. The role of rabbits as an integral component is one that should be considered wherever appropriate.

WARNING

Not all plants from the garden can be safely fed to rabbits. For example, potato leaves are poisonous and cabbage leaves (when fed in excess) can cause digestive problems. Other plants that are unsafe include tomatoes, eggplants and onions.

STORY FROM UKRAINE

Rabbits Speed Rehabilitation of Center's Residents

In the spring of 2008, Heifer Ukraine implemented a project for people recovering from drug addiction and/or living with HIV/AIDS. The goal of the project in Kirovohrad Oblast was to improve the nutrition of project participants. Through this project, which includes breeding Grey Giant rabbits and greenhouse gardening, residents of the Ukrainian Kirovohrad Oblast Rehabilitation Center are experiencing faster rates of recovery. In addition to the therapeutic benefits, the center's residents and staff have used their new skills to increase income for the center and improve their nutrition.

At the beginning of the project, the center purchased and set up a covered mini-farm on which to breed Grey Giant rabbits. The breeding began right away, and the first rabbits were born one month after the farm's installation. In the first months of project implementation, it became clear that the two mini-farms initially planned were not going to be enough to provide meat for the center and generate extra income from the sale of surplus rabbits. To solve this problem, two additional farms were built to house rabbits up to four months of age. The center plans to buy one more mini-farm with money earned from rabbit sales and support from Heifer Ukraine.

Grey Giant rabbits used in the project.

Most of the center's residents have compromised immune systems due to HIV and hepatitis, and need additional vitamins and other nutrients to stave off further illness and exhaustion. In addition to vegetables and fruits grown in the greenhouse, rabbit meat provides important dietary protein. The residents' diets have greatly improved from the highly nutritious meat. Both doctors and residents have noted the improvement in the residents' quality of nutrition and health since the addition of meat to their diets.

Successful rabbit breeding and caretaking are demanding, and the center's residents must follow a schedule to ensure that these demands are met. This responsibility for other living things has brought its own set of benefits. Doctors have noticed a decrease in the residents' recovery times, as well as improved social adaptation.

Selling green vegetables, fruits and berries from the greenhouse and meat and fur from the rabbits has also yielded financial benefits for the center. This endeavor has increased the center's income, making it more self-reliant, while developing entrepreneurial skills among recovering residents. One project goal, to be achieved by 2012, is a 15% increase in the center's income from the sale of animal and plant products, eventually leading to the center's self-sufficiency, with no need for donor funding.

The nature of a rehabilitation center involves the constant rotation of residents, so numerous people are learning and benefiting from the continual Pass on the Gift process of this project. The value of improved nutrition, newly acquired entrepreneurial skills and increased social adaptability gleaned from this project's greenhouse and rabbit enterprises have and will continue to touch so many lives during the time of this project and beyond.

MODULE 3

PRODUCTION SYSTEMS AND ECONOMICS — The Learning Guide

Learning Objectives

By the end of this session, trainees will understand:

- The difference between extensive and intensive production systems
- How to create and develop a planning budget

Terms to Know

- Budget
- Capital
- Economy of scale
- Extensive production system
- Inputs
- Intensive production system
- Investment
- Market
- Micro-credit
- Operating costs
- Recurrent costs
- Return on labor (rate of return)
- Semi-intensive production system

Recommended Demonstrations

- For program staff, develop a planning budget for the proposed rabbit project.
- Pass out a sample of records of receipts and expenses to trainees. Ask them to calculate monthly profits. What is the largest expense item? How can this expense item possibly be reduced?
- Take trainees on a field trip to observe good demonstrations of extensive and intensive operations. Ask farmers which system is most appropriate for them.

Training Group Discussion and/or Take Home Assignment

- Have trainees identify factors of production on their farms. Do certain limiting constraints exist? Can these be overcome?
- If farmers live near a major city, does the regional or urban local market demand for rabbit meat justify intensive—or commercial scale—operations? If not, could rabbit farming be sustained exclusively as a village-scale project using local resources? To emphasize, in either case, discuss why a farmer should initiate a small-scale enterprise.

Sample Visual Aid

FACTORS OF PRODUCTION
CAPITAL – Is cash available to invest and operate a rabbitry?
FEED – Can the farm provide all of the rabbits' diet?
LAND – Is there space to support a rabbitry?
LABOR – Can the family manage the rabbitry?
SUPPORT – Will I need technical advice or other services?
SUPPLIES – Can hutches and equipment be made locally?
TIME – Do I have the time to raise rabbits?

MODULE 3

PRODUCTION SYSTEMS AND ECONOMICS

The Lesson

There are two basic types or levels of meat rabbit production: extensive and intensive systems. The **extensive production system** is also called small-scale, subsistence or backyard rearing. The **intensive production system** is also called large-scale or commercial rabbit rearing. The low-input, extensive system is a small operation that is managed by the family, comprised of perhaps one buck and less than 20 does, and is supported primarily by on-farm resources as a sustainable activity.

Ideally, production costs are kept to a minimum. Low **capital** outlay and/or limited economic risk are critical because poor families largely implement these projects. As well, low **operating costs** are essential (not to mention successful experience) until the farmer can save enough money from sales to possibly later expand the enterprise to 10 to 20 does.

The high-input, intensive system is a larger operation, consisting of several bucks and 50 or more does. It relies more on off-farm resources, such as concentrate feeds, purebred breeding stock, welded wire for cages, hired labor and major **markets**.

This module will focus on the extensive-scale system, which is most appropriate for limited-resource farmers. The following table highlights features of extensive versus intensive production systems.

Table 3.1. At a glance comparison of extensive- and intensive-scale rabbit production systems*

Small-scale family unit (extensive)	Commercial-scale unit (Intensive)
Social	Capitalistic
Many Smallholders	Few Investors
Family Needs	Profit
Low Initial Inputs	Continuous High Inputs
Family Labor	Hired Labor
Simple Technologies	Complex Technologies
Tradition	Rapid Innovations
Locally Available Breeds	Exotic Breeds/Hybrids
Farm Integration	Land Detached
Natural Feedstuffs	Commercial Feedstuffs
Self-sufficient	Infrastructured
Sustainable	Non-sustainable
Flexible	Rigid
Any Market	Urban Market
Any Country	Developed Countries

*Source: Modified from Finzi, A., 2000. Raising rabbits for food security. In Proceedings of the 7th World Rabbit Congress. Valencia, Spain, 4-7 July 2000. Volume B:13-38.

EXTENSIVE PRODUCTION SYSTEM

The beginning farmer should start with a small-scale enterprise, for example five does and one buck. Farm-based resources should support this enterprise, which includes family labor, forage and other feedstuffs (e.g., forage from plots, garden wastes and kitchen scraps) acquired from the farm. The family should have both the interest and the time to successfully raise rabbits. Labor is to be shared by members of the family, and the actual time spent typically totals one hour per day.

To reiterate, the beginning farmer, following training, should not start with more than one buck and three to five does. While the management level skills required will be less than that for an intensive operation (since labor is provided by the family), it is best to gradually learn good management practices before expanding the size of the operation. This "patience period" may take up to one year. On the other hand, the farm may only be able to support a small rabbit unit. A five-doe operation may satisfy the goal of the farmer and future expansion may be unnecessary. In some cases a larger enterprise on a very small farm may not be supported by on-farm resources.

Regardless of the size of the operation, a planning **budget** should be prepared by the program to justify a local rabbit project. In the following table, an example is provided of a planning budget that was developed when the author worked in Cameroon as an employee of Heifer International.

Table 3.2. Five-year budget of rabbit production in Cameroon*

	CFA	$ U.S.
I. COSTS		
Initial Investment:		
Breeding Stock (3 does and 1 buck)	12,000	34.29
Rapphia Palm Cages (8 @ 500 CFA per unit)	4,000	11.43
Sub-Total	16,000	45.72
Recurrent Costs:		
Feed** (500 CFA @ 300 fryers produced)	150,000	428.57
Breeding/Replacement Stock (2 years average production life)	30,000	85.71
New Cages (2 years average length of usage)	10,000	28.57
Miscellaneous: 10% feed costs, feeders, waterers and medications	15,000	42.86
Sub-Total	205,000	585.71
Total Cost (5 years):	221,000	631.43

	CFA	$ U.S.
II. BENEFITS		
Income***: Sale of 100 rabbit fryers @ 2,500 CFA each (2 kg live weight)	250,000	714.29
Consumption****: Home consumption of 200		
Rabbit fryers @ 2,500 CFA each	500,000	1,428.57
Herd Inventory: 3 does, 1 buck	12,000	34.29
Total Income (5 years)	762,000	2,177.15
III. RETURN ON INVESTMENT AND LABOR		
Benefits	762,000	2,177.15
Costs	221,000	631.43
Net Benefit over 5 Years	541,000	1,545.71
Net Benefit/Year	108,200	309.14
Net Benefit/Fryer (541,000 CFA/300 fryers)	1,803	5.15
Cost/Benefit Ratio (221,000:762,00 CFA)	1:3.45	1:3.45
Rate of Return (762,000/16,000 CFA)	47.6:1	47.6:1
Labor***** (estimate 1 hr/day for breeding herd of rabbits and 10 fryers = 365 hrs/year or 40.6 person-days @ 9 hrs/day)	48,720	139.20
Return to Labor (108,200 CFA/40.6 person-days)	2,665	7.61
Opportunity Cost (108,200 - 48,720 CFA)	59,480	169.94

* Adapted from Lukefahr, S.D., and M. Goldman. 1987. Cameroon, West Africa: Economic feasibility of rabbit farming under intensive and subsistence management systems of production. Journal of Applied Rabbit Research, 10:20-25.

** Feed costs include consumption by breeding does, buck and replacement stock.

*** Average production figures assume 20 weaned fryers per doe per annum. Value of rabbit skins, manure and other byproducts is not considered.

**** Assume 1/3 rabbits marketed and 2/3 rabbits consumed of 300 total rabbits.

***** The labor estimate includes all major aspects of rabbit keeping: breeding, feeding, management, record keeping, marketing fryers, establishing forage plots, etc., as provided by family members. NB: Exchange rate of 350 CFA: $1.00 U.S..

Table 3.2 requires some explanation. Breeding stock was acquired via an in-kind loan whereby farmers agreed to later return the same number of rabbits to the program, which were then passed on to a newly-trained rabbit farmer. In other words, the farmer did not have to use his limited **capital** to purchase the animals. Also, many farmers had rapphia palm trees growing on their farms and so did not need to purchase building materials for hutches from the market. Commercial feed was included in the budget because there was a very high demand for rabbit meat which justified this purchase which resulted in an earlier market age of fryers. The **rate of return** and **return to labor** figures are impressive relative to other livestock enterprises that require higher **investment** costs and labor **inputs**.

In an extensive operation, production will generally be low compared to an intensive operation because high quality inputs may not be made available. However, this "**economy of scale**" may justify the lower production so long as production costs are kept low. A 2 kg average fryer weight attained by four months of age is usually a good target, especially if no feed concentrates or supplements are purchased.

Another factor is reliance on technical assistance and other outside inputs. The extensive-level operator is often less dependent on technical services and supplies (e.g., production advice from rabbit experts or veterinarians, pedigreed breeding stock, market information and medications) than an intensive-level operator because of the simpler and low-risk nature of the extensive system.

SEMI-INTENSIVE PRODUCTION SYSTEM

As the extensive-scale operation achieves success, a shift from this production system level to an intensive-scale one may be desirable. However, this shift assumes that it is economically justified based on financial records maintained by the farmer and/or a strong market demand. Regardless of the production system, the farmer should receive training to learn how to keep accurate records of all receipts and expenses, including a record of production and rabbit meat consumption.

Figure 3.1. Record of costs and returns

COSTS			
Date	**Item Bought**	**Number**	**Price $ U.S.**
August 2	Breeding Buck	1	3.00
August 20	Forage Seed	1 kg	1.00
September 10	Scales	1	6.00
RETURNS			
Date	**Rabbit Sales**	**Number**	**Price $ U.S.**
September 12	Fryer	2	5.00
October 25	Breeder	1	2.50
October 30	Fryer	2	5.40

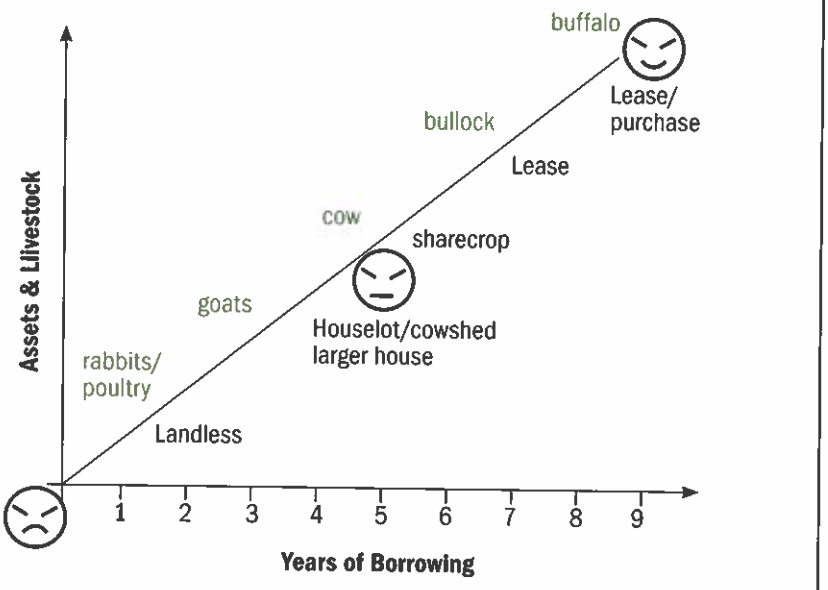
If market prices are high, the income generated from rabbit sales could be used and justified to purchase off-farm inputs, such as concentrate feeds, commercial breeds and welded wire. This transition phase represents a **semi-intensive production system**. Characteristics of both extensive and intensive systems are found in the same enterprise. For example, family labor might be combined with the use of mostly concentrated feeds and wire cages. Also, if prices are high, the family may use the money to buy less costly meat and consume fewer rabbit fryers at home.

However, the economy of scale generally supports one system (extensive or intensive) over semi-intensive production. One exception might be to maintain an extensive-level operation with the ability to rapidly accelerate production supply when the market is more favorable (e.g., seasonal demand) and afterward scale back to a small, extensive operation by selling breeding stock.

Of course, many rabbit farmers will later move on to either a larger rabbit enterprise or even change to a larger livestock species as more capital is

earned and re-invested, including access to more land. In areas where **micro-credit** institutions exist, such as a Grameen Bank-style approach, opportunities may be created that allow poor farmers to use a series of small to large loans as a means of climbing out of poverty, as shown in the following figure.

Figure 3.2. The progression of animal ownership



Source: Modified from Todd, H., 1998. Women climbing out of poverty through credit; or what do cows have to do with it? Livestock Research for Rural Development, 10(3). Accessed: Nov. 18, 2009, from **http://www.lrrd.org/lrrd10/3/todd103.htm**.

INTENSIVE PRODUCTION SYSTEM

This more sophisticated level of production presents greater economic risk, which should never be exposed to poor farmers by a development program. In Europe and in the U.S., intensive, commercial operations that exclusively sell market fryers are only marginally profitable. The farmer is more vulnerable to unpredictable changes in the marketplace. Also, a considerable investment might be needed to either initiate or expand into an intensive operation. Again, limited-resource farmers should minimize economic risk by avoiding this situation altogether.

The enterprise may either be privately owned by one person, or jointly owned through a partnership or cooperative group. In either case, there is usually the need to hire labor, even a manager, to run the operation. This labor pool may need to be trained and given the necessary skills required for optimal production. The operation should be run like a business. Other special inputs may include purchased forage and feed concentrates (or a complete formulated ration, if available), cage wire, feed and watering equipment, medications, office supplies, cages and transportation for marketing.

In intensive production, the rate of mortality may be higher. A higher rabbit population density can contribute to greater risk of exposure and spread of disease. Therefore, disease prevention measures, such as culling, quarantine, sanitation and vaccination, become critical. Another reason for the higher disease rate is management-related: less time is devoted to each rabbit as opposed to in a smaller operation.

A commercial rabbit breeding unit located in Tunisia (left). Rabbit meat is sold mainly to markets in large cities and to hotels. Single or double-decked wire mesh cages, commercial pelleted diets, artificial insemination, etc., were practiced and are typical of intensive operations (right).

The 'Nacional Escuela Cunicultura' located outside Santo Domingo in the Dominican Republic offered rabbit training, as well as sold breeding stock and meat.

An intensive operation can only stay in business as long as a firm market exists. The selling of rabbits to middlemen has often resulted in poor net returns to the owner. It may make good business for the owner to consider selling rabbits through several marketing outlets to diversify product sales. For example, one prominent rabbit project in the Dominican Republic sells dressed fryers, breeding stock and skins to several market sources, as well as offering rabbit training courses to groups. This approach minimizes business risk. More detail on diversification is provided in the Marketing Rabbits module.

STORY FROM INDONESIA

The History of Rabbit Production Development in Indonesia

Rabbits were not common in village households in Indonesia before 1982. The most common animals raised for production were chickens, ducks, muscovies, goats, sheep, cattle and buffalo, horses and swine. Considering that most villagers had an abundant supply of forage but a shortage of animal protein for human consumption, the potential for rabbit production was great.

Lembang, an area recognized for vegetable production, was selected as the site to initiate a rabbit farming program. The project began in 1981 and was supported by the President, His Excellency General Suharto. After the initial project the Directorate General of Livestock Services (DGLS) issued a large number of rabbits distributed mainly to Java, but also to other areas including Papua (West New Guinea). Soon, some areas became central points of rabbit multiplication. A Passing on the Gift-type program was also started. Families who received a package of three does and one buck then returned two packages within a year for redistribution to other families.


Pet kiosks in Indonesia.

In 1982, the Central Research Institute for Animal Science (CRIAS) conducted a survey that reported the program was successful in boosting rabbit production in a very short time. Also, the Flemish Giant, New Zealand White, English Spot, Californian, Australian and Yamamoto breeds were very popular among farm families.

However, interest in rabbit raising soon decreased and rabbit population declined significantly. Results of a second survey in 1988 revealed that the weekly consumption of rabbit meat by farm families was no longer popular, but that cash income was more preferred, despite the lack of strong markets. But rabbit production was stagnant, even though rabbit raising was still popular in a few tourist areas.

In an attempt to popularize rabbit meat for family consumption, and as a source of cash income, the Rex and Satin rabbits were imported and studied by the Agency for Agricultural Research and Development (AARD). Between 1996 and 2000, a crossbreed—called the Reza—partially contributed to the high demand for rabbits as pets because of its short, Rex-type, yet shiny hair. Selling rabbits as pets is now a very popular and lucrative activity.

Between 2004 and 2008, drastic and positive changes occurred for the rabbit industry: markets opened widely; demand for pets, meat and breeding stock became much higher than the supply; rabbit raising became a highly profitable business; and because of Asian 'bird flu', many chicken farmers changed their businesses to rabbits.

An innovative model approach, called 'Kampoeng Kelinci'[R] (Rabbit Village), has been adopted in Indonesia with great success. The model consists of a small breeding unit—a group of 10 cooperating farmers at the start—and in one year at least 40% of households in the village were raising rabbits. Activities include regularly consuming rabbit meat, commercial and social oriented popularization of rabbit farming, and participating in the cooperative-based programs. To date, in addition to the Sichuan province of China, Indonesia is rapidly becoming a center of rabbit production in Asia.

Presently, the aim of rabbit raising at the micro- or family-scale level, has shifted to an income-oriented enterprise. Depending on the area, rabbits are mostly marketed for meat and as pet animals, and a limited number are sold for fur or to meet laboratory needs. Rabbit farming is rapidly growing, not only in numbers of farmers but also in the scale of farming. In 2008, official statistics on the rabbit population were included in the Statistic Record of Livestock Production in Indonesia by the Directorate General of Livestock Production.

Contributed by Dr. Yono Raharjo

MODULE 4

GENETICS AND SELECTION

The Learning Guide

Learning Objectives

By the end of this session, trainees will:

- Understand the basis for choosing a breed or crossbreed for meat production
- Know the importance of protecting local breeds from extinction
- Be able to identify appropriate traits to select in developing good breeding stock

Terms to Know

- Anatomical soundness
- Breed
- Breeding stock
- Culling
- Dam
- Exotic breed
- Generation interval
- Genetic adaptation
- Heritability
- Hybrid vigor
- Inbreeding
- Independent culling technique
- Pedigree
- Physiological soundness
- Selection
- Sire
- Strain
- Upgrading

Recommended Demonstrations

- Take a field trip to a reputable breeding stock farm or station where comparison studies are being made to evaluate breeds and crosses. If such a farm or station does not exist in your area, then visit a farm with quality breeding stock where good records are maintained.
- Compare poor and excellent production records. Samples could be passed out during this demonstration to small teams of participants for their examination and later for presentation to the entire group.

Training Group Discussion and/or Take Home Assignment

- Identify the exotic and local breeds or strains of rabbit that exist in your region. Which type (purebred or crossbred) of rabbit is most easily obtainable and best suited for production for limited-resource farmers?
- Discuss desirable traits for a successful operation. Which traits are most important? How should each trait be most appropriately selected (or culled) by the farmer to achieve genetic improvement?

Sample Visual Aid

HERITABILITY VS. HYBRID VIGOR		
Type of Trait	**Influence of Heritability**	**Influence of Hybrid Vigor**
Reproduction	Low	High
Health	Low	High
Growth	Moderate	Moderate
Feed Conversion	Moderate	Moderate
Carcass/Meat Yield	High	Low

MODULE 4

GENETICS AND SELECTION

The Lesson

Good quality **breeding stock** is a valuable asset to the project and especially to the farmer. While environmental conditions or factors (climate, diet, housing, management, etc.) may be ideal, if the stock is of poor quality, performance will not be satisfactory. In many lesser developed countries, only one or a few common, non-improved breeds or **strains** might exist. Another constraint is that many farmers will have little understanding of how to achieve genetic improvement. These are just a couple of many practical issues concerning genetics. The purpose of this module is to provide basic information for the trainer so that farmers can gain some understanding of the role of proper rabbit breeding and **selection** practices to maintain the genetic quality from the initial stock received and/or to achieve further genetic improvement.

BREEDS OF RABBITS

A **breed** can be defined as a mildly inbred line of animals of common ancestry that shares certain qualities for a limited number of traits or characteristics. For example, the most popular global breed, the New Zealand White, is an albino. Purebred New Zealand Whites will breed true for coat color, but genetic variation exists for virtually all other traits. Hundreds of breeds of rabbits are found in the world, and there are thousands of varieties or strains. Many of these breeds have only been developed for fancy or show exhibition purposes and are not ideally suited as meat production stock. For example, many breeds are either too small or do not have a selection history for production. Another popular meat breed is the Californian. (The Californian breed name is oftentimes misspelled as "California" or "California White.") Both the New Zealand White and Californian breeds were developed in the U.S. These two breeds have been selected and evaluated for meat production traits across many countries and/or geographical regions. Other suitable meat breeds include the Chinchilla, Dutch, Rex and Satin. The reader may wish to refer to the General References list for books that show photos of rabbit breeds and provide a history of breeds (e.g., *Rabbit Production* by McNitt et al., 2000, and *The Domestic Rabbit* by Sanford, 1986). Also, an online resource from France contains a photo gallery of many rabbit breeds (**http://www.cuniculture.info/Docs/indexphoto.htm**).

A New Zealand White rabbit.

A Californian rabbit.

Breeds can be classified according to geographic origin. These breed origin classes are continental, regional, country and local. Examples of continental breeds of origin include: Africa – Baladi and Gabali; Asia – Japanese Large White and Sichuan White; Europe – Dutch and Burgundy Fawn; North America – Californian and New Zealand White; and South America – Criollo rabbits.

Regional breeds may be found in several countries in the same geographic area. For example, the Baladi breed (an Arabic term meaning "native") is found in the Near East/northern Africa. A country breed, or "country population," refers to a breed that exists in a particular country. A local breed might be found in a coastal as opposed to a mountain region of the same country.


S.D. Lukefahr

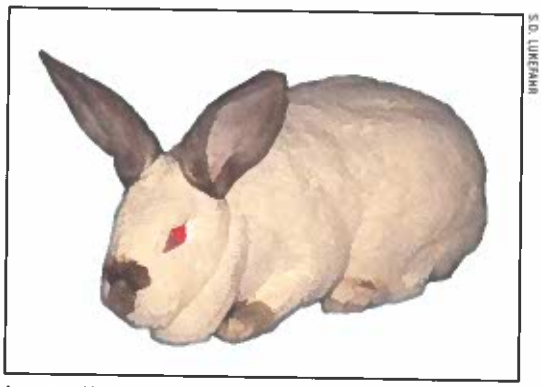
The local Baladi breed of rabbit from Egypt, genetically adapted to the adverse environment.

The word "breed" is often reserved for an improved line of rabbit. This is in contrast to "strain" which is commonly used for non-improved or indiscriminately bred rabbits. In fact, a common misconception or myth is that local strains of rabbits are genetically inferior. Even though there may have been no real genetic improvement made by man, there may have been considerable genetic improvement made through natural selection. Over many generations, rabbits adapt to the local environment, resulting in a rabbit that can successfully reproduce and survive under adverse environmental conditions. **Genetic adaptation** is a trait that is often overlooked, but it does explain the characteristics of small mature body size, small-sized litters, slow growth and less-than-desired meat-type body conformation.

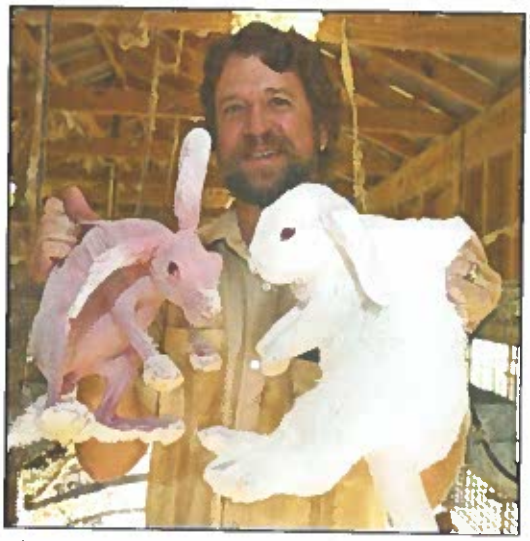
Rabbits that are smaller and less productive have typically been naturally selected under unfavorable environmental conditions (e.g., limited quality feed and high temperature stress). In contrast, imported or **exotic breeds** typically yield disappointing results in the new environment due to their limited genetic adaptation. To date, there is no one breed of rabbit that can be universally recommended. One reason is because there are so many different types of environments (cold, hot, arid, humid, dry, wet, etc.).

At Texas A&M University-Kingsville, where the author is employed, two special rabbit stocks were developed to better cope and adapt to high temperature and high humidity conditions. The first, a breed called the Altex, is a large **sire** breed selected for fast growth rate. Also, Altex rabbits are long-bodied with large ears and thin fur coats. Our studies have

shown that a crossbred fryer sired by an Altex buck and reared by a New Zealand White doe will reach minimum market weight about one week sooner than a purebred New Zealand White fryer. The second is a rare line of genetically furless rabbits. A series of experiments have demonstrated that furless rabbits under hot and humid conditions consume more feed and grow faster than furred rabbits from the same litters. Furless rabbits are simply under less stress; they have lower body temperatures and take fewer breaths per minute than furred rabbits. For more information, access this website (**http://users.tamuk.edu/kfsdl00/rabb.html**).


S.D. LUKEFAHR

A mature Altex rabbit.


S.D. LUKEFAHR

A furless and furred rabbit from the same litter.

EXOTIC BREED INTRODUCTIONS

Imported breeds should first be tested in the new environment before they are released to farmers. This is because exotic breeds may perform differently in the new environment. Alternatively, local strains or breeds should be properly conserved. This means that local strains should be protected from indiscriminate displacement by exotics (imported breeds), which could result in permanent genetic loss called extinction. The loss of local strains or country populations of rabbits has already occurred in many countries, especially in Europe where it is believed that the rabbit first evolved.

If the breed is a new introduction to the country, basic research must be conducted involving a comparison to locally available stocks under similar farm feeding and management conditions. Trait comparisons should be made, and then an overall conclusion made regarding the imported breed's suitability for production as maintained by farmers.

In the rabbit literature, there are numerous reports on breed evaluation experiments. In viewing these reports, it is important to determine whether the experiment was major (involving many rabbits) and whether the recommendations made support the results presented.


S.D. LUKEFAHR

An emaciated purebred New Zealand White rabbit in a remote village in West Africa soon after its importation from a temperate environment in the U.S. in which a commercial pelleted diet was fed.

In general, the performances of exotic crossed with local rabbits are impressive. A combination of various beneficial genetic factors is typically observed in the first generation, or F_1 cross. These factors include genetic

Table 4.1. Sample of comparative studies involving exotic and local breeds and crosses

	TRAIT*				
Country Breed (no. of rabbits)	**LSB**	**SR**	**AWW**	**ADG**	**FMW**
Egypt (261)**					
Baladi Red (BR)	5.6	.43	.34	14.1	1.13
Baladi Black (BB)	6.1	.49	.54	16.4	1.45
New Zealand White (NZW)	4.4	.77	.51	14.5	1.31
NZW♂ X BR♀	4.9	.65	.34	18.9	1.39
NZW♂ X BB♀	6.1	.65	.43	19.2	1.50
Malaysia (435)***					
Californian (CAL)	6.7	.46	.46	-	-
Rex ♂	5.6	.42	.42	-	-
Local ♀	5.2	.52	.40	-	-
CAL♂ X Local♀	6.2	.59	48	-	-
Rex♂ X Local ♀	6.3	.55	.41	-	-

*Traits: LSB = litter size born; SR = survival rate (post-weaning for the study in Egypt and pre-weaning for the study in Malaysia); AWW = average weaning weight, kg, ADG = post-weaning average daily gain, g/d; FMW = final market weight.

Sources: **Rashwan, A.A., K.A. Yamani and A.I. Abd El-Ghani. 1997. Performance of three rabbit strains and their reciprocal crosses in Egypt during summer. *World Rabbit Science*, 5:55-60

***Sangare, N. and O.M. Ariff. 1995. Breed additive and individual heterotic effects on the reproductive performance in three rabbit breeds. *MARDI Research Journal*, 23:75-82.

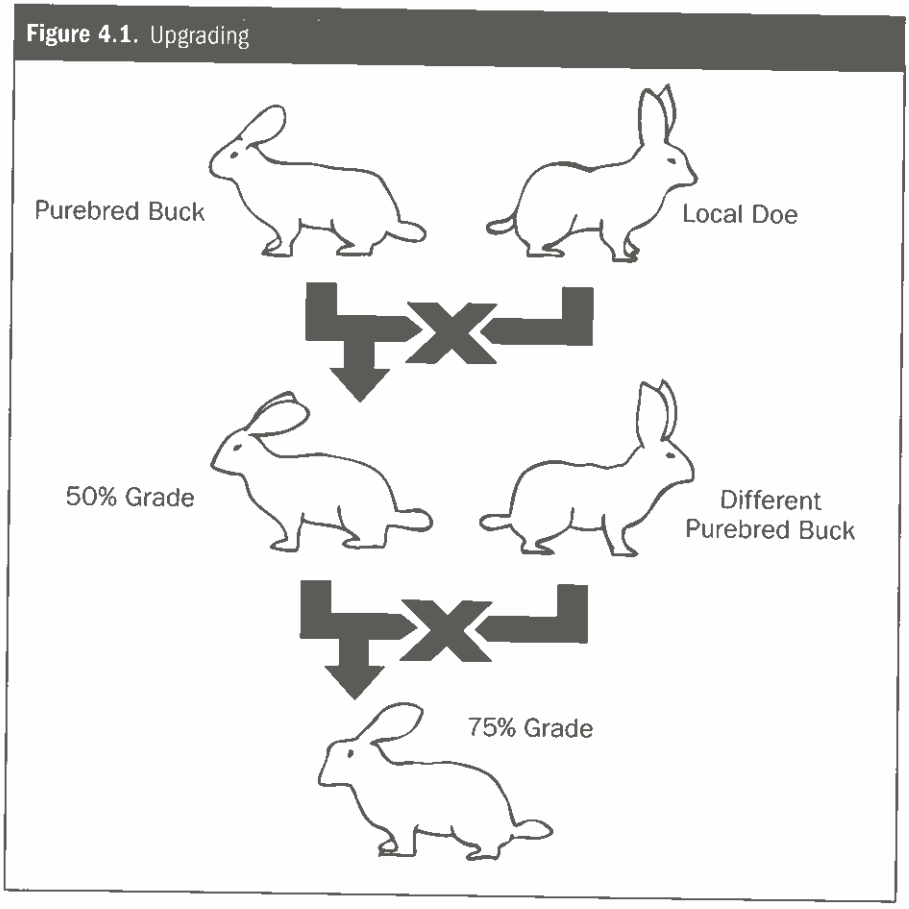
adaptation inherited from the local parental breed and high production inherited from the exotic parental breed. Another factor is **hybrid vigor**. Crosses produced from distantly versus closely related breeds (an example of the former being a Californian-Sichuan White cross) may express more hybrid vigor. This is because greater genetic diversity is represented between breeds, the basis of hybrid vigor. Hybrid vigor generally has a positive influence on production traits, especially those related to reproduction, health and/or disease resistance. However, hybrid vigor is less important for growth and carcass traits.

In general, the F_1 stock may be ideal for usage by farmers. Of course, this assumes that the improved F_1 stock can be obtained on a regular basis and at a reasonable cost from a private breeder(s) or government station. Such breeding centers can also play a valuable role in genetic conservation of local breeds in adequate numbers for future food security.

In developed countries, sophisticated crossbreeding practices are utilized, such as rotational and terminal crossing that involve specialized sire and **dam** lines or breeds. The breed resources and information from good evaluation studies are lacking in most developing countries. If no source exists for obtaining good breeding stock, then the breeding program may be confined to practices appropriate at the farm or village level.

One exception may be **upgrading** (Figure 4.1). Assuming a sound scientific basis for upgrading (no desirable traits represented by the local strain), a strain would first be crossed with an exotic breed. The F_1 offspring (50% desired exotic breed composition) would only be mated to the same desired exotic breed again. Their offspring (now 75% desired exotic breed composition) would again only be mated to the desired exotic breed.

Figure 4.1. Upgrading



Rabbits have a short **generation interval** (as short as six months), so only a few years would be required to "breed up" a local strain to the standards of a desired exotic breed. Overall, regardless of whether local, exotic or crossbred rabbits are used for a project, it is important that they come from a foundation of animals selected for production purposes.

SELECTION PRACTICES

The typical farmer has little understanding of the basis for genetic selection. However, the trainer can provide the essential information needed for the farmer to achieve some genetic progress. Certain traits are more determined by genetics than other traits. Some traits are said to be more "heritable" than others. In other words, more genetic variation exists for some traits but not others. For example, traits relating to reproduction and health or survival are generally lowly heritable (<15%), whereas growth,

feed conversion and carcass traits are generally moderately (15, 50, 40%) to highly heritable (>40%). For a trait of reproduction, such as litter size, environmental factors are more important than genetic factors; thus, such traits have low **heritability**. The reason is that many environmental factors can influence litter size, such as age of doe, season, air temperature, shelter type, change of diet and health management.

Farmers should be taught to pass over rabbits with traits that are not highly heritable because very little, if any, genetic improvement will occur. Instead, indirect selection would be more appropriate. To illustrate, a farmer sets a minimum **culling** level of say three kits weaned per litter. In other words, does with at least two litter records are candidates for culling if an average of less than three kits is calculated. Because such does fall below the culling standard, they would be culled from the herd and sold or consumed for meat. This indirect selection practice is called the **independent culling technique**. "Independent" because this culling decision does not depend on how an animal performs for other traits.

Traits that are moderately to highly heritable could be directly selected for genetic improvement whereby real genetic improvement is anticipated. Selection for live market weight is generally recommended. Desirable market rabbits typically gain weight rapidly, have greater appetites and convert feed to meat more efficiently than lower performing rabbits in the same contemporary group (i.e., a group of litters born within one week, being exposed to the same environment). These higher performing rabbits make good candidates for selection as herd replacements to improve the stock. However, these rabbits should also be inspected for signs of physical defects that may be inherited, such as malocclusion ("buck teeth"), deformed legs and inverted eyelids. It is also important for farmers to know that the number of traits to be selected should be limited. If too many traits are being selected, the overall selection effort may be diluted because, for example, some rabbits will be superior for some traits but inferior for others, and hence little, if any, genetic progress may occur.

This selection approach assumes certain conditions. The farmer needs access to an accurate scale. If a farmer does not possess a scale, perhaps a rabbit club or project group could obtain one to be loaned out to members when needed. Good production records need to be kept. Also, **inbreeding** should be avoided. Close relatives, such as siblings and parents, should not be inter-mated. Hence, **pedigree** records are useful.


A. PINO

Note the large ears of the mature rabbit to the right. The photo was taken in Tunisia where daytime temperatures frequently exceed 40 °C.

In the following table, under typical adverse conditions posed in many developing countries,

an optional emphasis could be made on traits that relate to **anatomical soundness** and functionality of performance that may be more important to limited-resource farmers. The rationale is that a breeding rabbit must be anatomically sound and be adaptable or functional in physiological trait expressions. It is not presumed that farmers must select all these traits as shown in the table, but rather that young replacement stock can be screened for some of these traits (via the independent culling technique) considered important, as well as on the basis of their parents' merit.

Table 4.2. Characteristics of anatomical and physiological soundness of local rabbits in tropical and arid regions

Anatomical soundness	Small to moderate mature size/large body surface area (possibly minimizes nutrition stress when the diet quality is poor/stress to high ambient temperature and/or relative humidity)
	Large ears in proportion to body size (effective means of coping with heat stress)
	Sound leg and feet structure (essential when reared on rustic hutch floors)
	Fur qualities (less dense, thin texture or diameter, and short fur to alleviate heat stress)
	Meat qualities (light to moderate rather than excessive muscling is less likely to lead to nutritional stress in fryers and in breeding stock)
	Number of functional teats (no less than six to eight)
	Well-developed testicles and scrotum
	Light versus dark body coat color may be advantageous
	Absence of genetic defects (splayed legs, malocclusion, etc.)
Physiological soundness	Adaptability to climate – Basal metabolic function (e.g., normal pulse and respiratory rates and body temperature)
	Adaptability to sub-optimal diets (high forage intake/appetite and good digestion efficiency)
	Adaptability to hutch confinement (resistance to stress associated with boredom and/or inactivity)
	Docile temperament or behavior
	Resistance to disease and parasites (under proper basic feeding and sanitary conditions, local rabbits are noted for their hardiness and good health)
	Litter size/kit survival (survival is enhanced in small to moderate sized litters)
	Body condition (vital to maintain while doe regularly produces litters [maximum of four litters/annum in adverse environments])
	Moderate milk production (risks of mastitis are presumably reduced if stock is not selected for high milking ability)
	Slow to moderate growth rate (reduced risk of enteritis/enterotoxemia is usually observed in fryers fed on high fiber/low energy diets on small farms)

Source: Lukefahr, S.D., 1998. Review of global rabbit genetic resources: special emphasis on breeding programs and practices in lesser developed countries. *Animal Genetic Resources Information*, 23:49-67 (FAO, Rome).

Lastly, good records are an absolute must if genetic progress is to be made. Basic record keeping forms for does and bucks are provided in Figures 4.2 and 4.3. Farmers can exchange good quality, healthy and unrelated bucks periodically to avoid inbreeding. Inbreeding can reduce herd vigor and performance. As project incentives, club awards can be given to farmers who demonstrate through good records the best herd performance results in a year's time.

Figure 4.2. Doe record card

DOE RECORD CARD

Name or Ear No.:				Born:					Cage No.:			
Sire:				Dam:								
Served By	Date	Tested	Kindled	Number of Young					Jrs. Saved		Weight	Remarks
				Born	Left	Added	Raised	Died	Bucks	Does		

Figure 4.3. Buck record card

BUCK RECORD CARD

Name or Ear No.:						Cage No.:					
Born:		Sire:				Dam:			Weight 2 Mos.:		
Doe Served	Date	Litter Size	Weight	Jrs. Saved		Doe Served	Date	Litter Size	Weight	Jrs. Saved	
				Bucks	Does					Bucks	Does

STORY FROM CAMEROON

Using Local Skills and Resources via Appropriate Technology

The author's first job after completing graduate school was as the small livestock specialist for Heifer International in Cameroon from 1983 to 1985. Dr. Lukefahr's assignment was to develop a viable meat rabbit program for impoverished families in the Northwest province.

Early in this position, he was amazed at the quality of furniture made from the local rapphia palm plant, which is widespread in West Africa. Because the rapphia produces very hard and straight branches, it seemed that it could be ideal material for construction of rabbit hutches. The author was previously familiar with a filmstrip, "Rabbit Meat is Good," developed by World Neighbors, that showed farmers in Zaire that used palmwoods for hutches.

One day, in the village of Nkwen, Lukefahr was introduced to a local carpenter, Simon Forben. Forben was self-employed and his shop was the veranda in front of his mud brick house. He sold his rapphia products along the roadsides and in Bamenda town in the open market. Lukefahr discussed the need for hiring a carpenter to construct demonstration rabbit hutches using inexpensive local materials. Lukefahr then shared a simple blueprint for the dimensions and basic features of a standard rabbit hutch. Forben's eyes twinkled as he knew what Lukefahr would ask next. He agreed to build the rapphia hutch prototype. Lukefahr gave him an advance to purchase the palmwood materials and an appointment was made for a visit several days later.

When Lukefahr inspected the rapphia wood hutch, it was amazing how sturdy the structure was. In time the prototype was perfected to produce: a duplex hutch unit with two sides, including simple gates at the top; placement of a wooden partition in the middle that could be inserted to separate the litter from the doe at time of weaning; proper distance between floor sticks (the width of a standard pencil to allow for manure to fall through the gaps, but not newborn kits); ease of sanitation and/or manure removal below the hutch floor; adequate ventilation; etc. The middle partition could be removed to allow the doe and litter total hutch access, whereas the partition was inserted when it was time to wean the litter.

A local carpenter in Cameroon who is contructing a model rabbit hutch made entirely from rapphia palmwood.

The hutch dimensions were approximately 182 x 152 x 46 cm. The hutch was also elevated such that the floor of the hutch was approximately 30 cm above the ground. The reason was to promote ventilation and ease of manure removal.

Forben used only three tools: a hammer made of guava wood used to gently pound "bush nails" through the rapphia sticks; a saw made from a curved coffee wood stick to which a commercial hacksaw blade was mounted; and a pocket knife used for stripping the rounded top and bottom edges of rapphia sticks so they could be firmly stacked prior to being fastened together with the bush nails of various lengths. The completed hutch was made entirely of rapphia wood.

In the first of many rabbit training course events, Lukefahr would take Forben with him to villages for him to demonstrate start-to-finish steps in hutch construction. Forben felt a great sense of pride in sharing his skills with others. Later, the trained farmers would have their hutches inspected. This activity was one of several incentives developed to ensure that farmers were properly trained and prepared to later qualify for receiving their loan of rabbit breeding stock. By two years' time, this hutch model became the standard in villages throughout the province. However, the major lesson of this story is about the importance of using appropriate technology – in this case, local carpentry skills and use of renewable building materials by limited-resource farmers to construct rabbit hutches.

MODULE 5

HOUSING AND EQUIPMENT

The Learning Guide

Learning Objectives

By the end of this session, trainees will:

- Be familiar with requirements and equipment for appropriate housing and management of rabbits
- Be able to identify a suitable site for housing rabbits

Terms to Know

- Hutch
- Nestbox
- Nocturnal
- Rabbitry

Recommended Demonstrations

- Visit demonstration farm(s) to study shelter designs.
- Construct a proper hutch as part of a training hands-on lesson. Compare this to a poor hutch design.
- Show different types of nestboxes, feeders and waterers.

Training Group Discussion and/or Take Home Assignment

- Is a shelter for rabbits necessary for your own farm? If so, where is the best place to build and position the shelter? What factors should be carefully considered in making these decisions?
- What types of building materials could you use for making hutches, nestboxes, feeders and waterers? Could refuse materials be used as well? Can the use of commercial wire be justified?

Sample Visual Aid

PROPER HOUSING PROTECTIVE MEASURES	
Element	**Measure of Stock Protection Through Housing**
Cold	Avoid damp grounds and direct exposure to wind
Heat	Ample shade, ventilation, narrow shelter width
Rain	Extended roof, covers or curtains for hutches
Wind	Shelter with siding, fence, wall or shrub border
Sun	Shade, extended roof or siding, trees or vines

MODULE 5

HOUSING AND EQUIPMENT

The Lesson

Compared to more common livestock species, rabbits were domesticated recently, possibly as recent as 400 years ago. As such, the rabbit still possesses many instinctive behaviors and habits. For instance, the doe is very territorial, requiring a separate quarter. Rabbits feed mostly at night (**nocturnal** feeders). Rabbits are easily alarmed and become distressed when improperly managed, often resulting in injury or death. In confinement rearing, rabbits are entirely dependent on the farmer for their care and well-being. For best production results, it is first necessary that a private and comfortable housing site be designed and built. The site chosen for rabbit raising is an important decision, as is the type of equipment used. In this lesson, the housing requirements and equipment needs of rabbits are discussed.

CHOOSING A SUITABLE SITE

The **rabbitry** (a place where rabbits are raised) site chosen should provide protection from the elements (cold, heat, rain, sun and wind). A shelter, trees, vines, or **hutch** roof and siding can provide shade to protect the rabbits from direct sunlight. Rearing of rabbits in dark or dimly lit quarters can cause problems, as light is essential for normal reproduction and growth development. Vitamin D, an essential nutrient from the diet, is only produced by the body in the presence of adequate light.

If a shelter is used, it should be positioned so that the front and back sides of the hutches are facing prevailing breezes to provide essential ventilation without drafts. Rabbits should not be exposed to strong winds or storms. A fence, earthen wall or shrub row may serve this purpose as windbreaks. Bamboo or grass curtains, sack cloth, canvas or plastic sheets can be placed over the hutches in the event of a storm. The rabbitry site should be located on a well-drained site and the premises regularly cleaned to maintain good respiratory health. Rabbits should not be raised over solid cement floors because ammonia odors from non-absorbed urine can cause major respiratory health problems, such as pasteurellosis, which involves infection of the respiratory system. In cold climates, dry grass hay or straw should be provided as bedding to allow rabbits to stay warm.

S.D. LUKEFAHR

A local-style rabbit shelter in the Dominican Republic.

S.D. LUKEFAHR

A local-style rabbit shelter in Ghana.

P.R. CHEEKE

A local-style rabbit shelter in Indonesia.

A local-type shelter can usually be constructed at minimum cost by using native woods and thatch grass, bamboo or used zinc sheets for roofing and/or siding. Conventional building materials may be used if desired. Regardless of the construction type, the shelter should be narrow (no wider than 6 m) to facilitate good natural ventilation, humidity control and prevention of the accumulation of gaseous odors. If wire cages are used, they should not be stacked or tiered since this normally contributes to ventilation and sanitation problems.

Various places may be used for housing rabbits. These could include the following: a shed or building; alongside the veranda of a house; an unoccupied room of the compound; a shelter over a fish pond; under large trees; against an embankment; underground burrows or even in a cave; or more commonly, in a self-contained hutch. Allowing rabbits to dwell underground is a traditional practice in arid countries, such as Egypt and Tunisia. This provides a cooler environment for production. One potential health hazard, however, is the greater risk of infectious parasites (e.g., coccidiosis) due to direct exposure of rabbits to contaminated ground. It would also be difficult to catch the rabbits and to manage newborn litters.

However, it is possible to design a special hutch that takes advantage of cooler temperatures below ground. A rabbit scientist from Italy, Dr. Alessandro Finzi, has developed such a housing system, which he has perfected over 25 years. Basically, using cement or mud bricks, the hutch is usually built into the ground or into the side of an existing embankment. The front of the hutch is usually made of local wooden materials, which includes a feeder, a waterer and a gate. This system can be very inexpensive to produce; in some cases, mesh or welded wire is not necessary. For several years, Dr. Finzi was a consultant to the Food and Agriculture Organization of the United Nations (FAO). One of his contributions to the FAO was the development of a manual that is available at: **http://www.fao.org/ag/AGAinfo/themes/documents/ibys/**. The manual describes several of his rabbit housing systems.

A farmer in Cameroon using a housing system for rabbits developed by Dr. Alessandro Finzi.

Another system is displayed in which hutches consist of underground cells made of clay pots, smaller clay pots are used as the nests in the second row, a mat roof made of reeds provides shade, and a tank to the left serves an automatic watering system.

RABBIT HOUSING

A breeding doe rabbit should have access to a hutch having dimensions of 70-80 cm by 90-100 cm (less than 1 m^2) area of floor space. The hutch should be about .5 m in height. Breeding bucks can be housed in smaller hutches (e.g., 75 cm by 75 cm). A project in Peru cleverly designed buck cages, such that the floors were round, being made from circular barbecue grills, which makes it easier for bucks to mate with does. A stocking rate of 10 fryer rabbits per square meter (or simply 1000 cm^2 per fryer) of floor space area is adequate. Twenty or more fryers can be reared in large pens to minimize labor.


S.D. LUKEFAHR

Use of a round barbeque grill as the floor in buck cages in Peru.


S.D. LUKEFAHR

A sturdy rabbit hutch in Zimbabwe made mostly from wood materials and limited wire.

Construction materials for hutches can consist of wood or wire, or both materials. In certain cases, stonework, cement or mud bricks may be more appropriate. If wood is used, it is important to know that rabbits are wood-gnawers by instinct. Although wood supplies are usually more obtainable and considerably less expensive than wire, wooden hutches may have to be replaced more frequently. However, wood may be the most feasible for the farmer. Imported wire is costly, although it does generally provide a more secure and sanitary environment for rabbits. A compromise commonly seen is the limited use of wire. Often wire is used only for the front of the hutch, mainly for viewing ease. Some projects provide all-wire cages to trained farmers, along with breeding stock, as a starter rabbit package. It is planned that farmers will save some of their income earnings to later replace wire cages. An excellent online resource, *Rabbit Housing Manual* (**www.suagcenter.com**), provides detailed information on how to construct cages, hutches and sheds. This publication is a must-read.

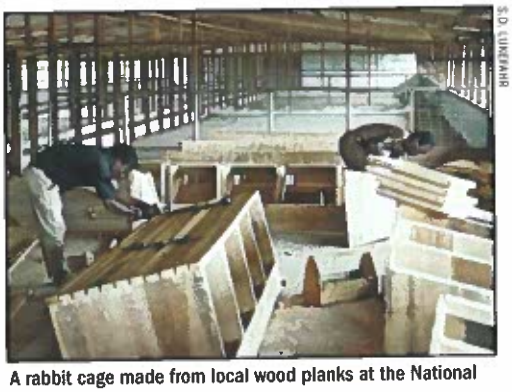

P.R. CHEENE

A rabbit cage made from bamboo in China.


S.D. LUKEFAHR

A rabbit cage made from rapphia palmwood in Cameroon.

Palmwoods, bamboo and "bush" woods are examples of very suitable low-cost native materials for constructing durable hutches. Following training, some skill is required, which should be gained through experience, to choose the best sticks or poles that are strong, straight and of the desired diameter. Otherwise, the loss of newborn kits through the hutch floors, accumulation of manure and feed wastes, development of deformed feet and legs, and even escape of stock can result. Gaps between floor sticks or woven bamboo strips should be no larger than 2 cm. The hard, outer cortex layer of palmwood



S.D. EUKEARIR

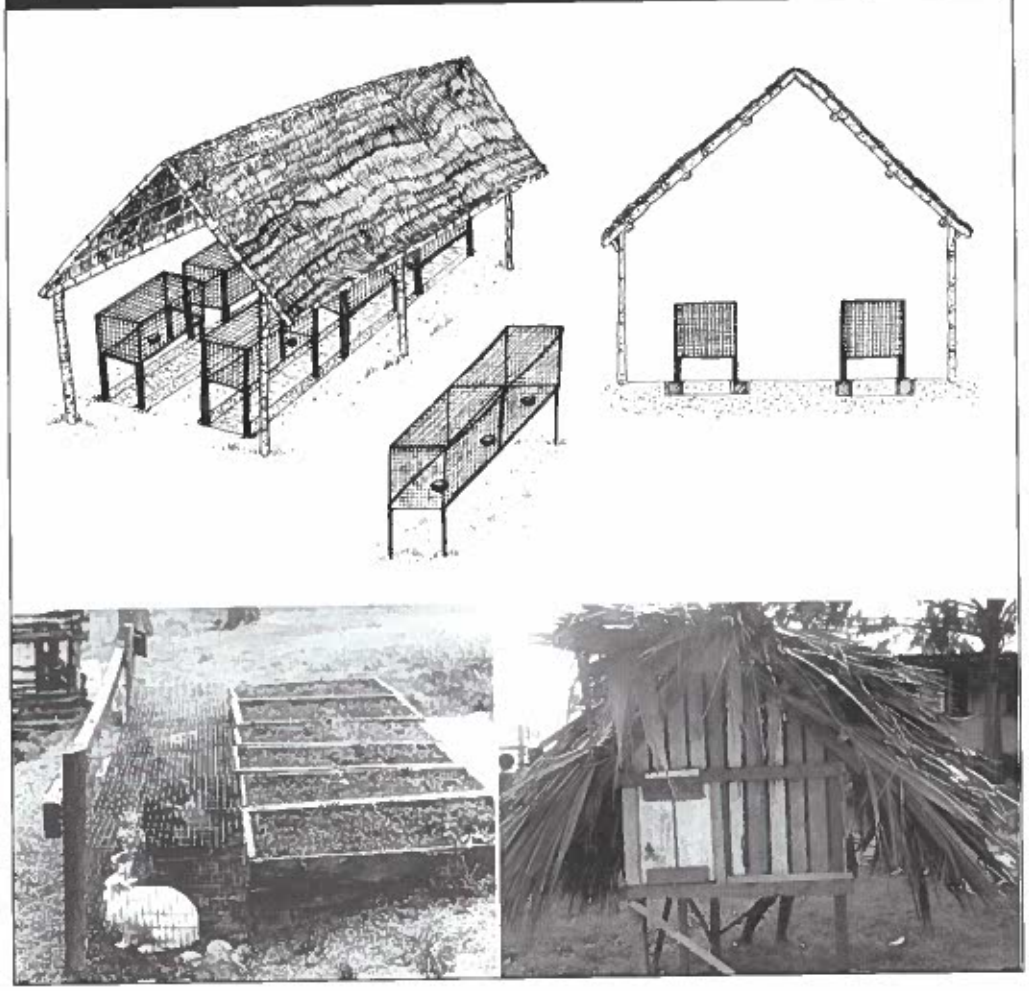
A rabbit cage made from local wood planks at the National Rabbit Project in Ghana.

J.L. MCNITT

A rabbit cage made from woven wood strips onto a wooden pole frame and with thatch grass for roofing in Malawi (note the metal hoods on the legs used as rat and snake guards).

or bamboo should only be exposed to the rabbit to minimize damage due to gnawing. Some excellent wooden hutch designs are available. Designs for wire cages are more widely available. Figure 5.1 provides basic housing types.

Figure 5.1. Rabbit housing types



NESTBOXES

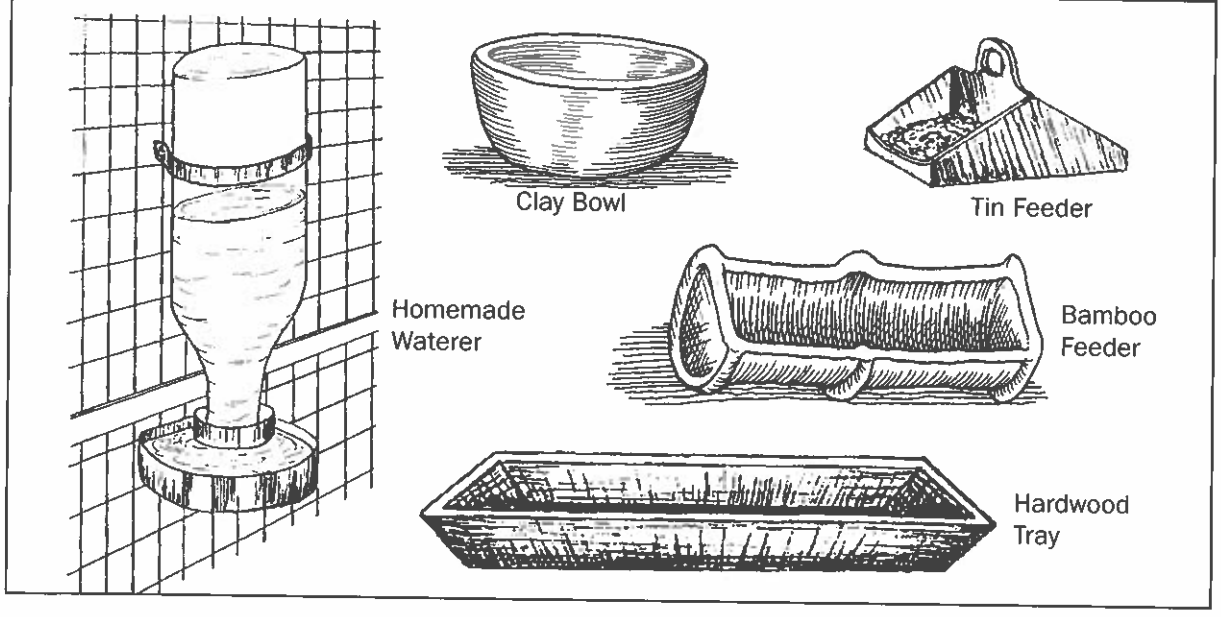
Suitable dimensions include 30 cm x 40 cm x 25 cm (width, length and height). A **nestbox** top is not necessary. The nestbox should only be large enough for the doe to comfortably enter, build the nest and nurse the litter. Otherwise, an oversized nestbox may instinctively be used by the doe for two purposes – an area for the litter and an area for defecation and urination. Plywood (5-10 mm thickness) could be used, or palmwoods, bamboo boxes, aluminum tins, clay pots or woven baskets of the above dimensions. For more privacy, the nestbox could be an enclosed wooden chamber as a permanent part of the hutch. An example of suitable nestbox dimensions is shown in the discussion on the management and purpose of the nestbox, given in the Reproduction and Managing the Rabbitry modules.

A suitable nestbox made from plywood.

FEEDERS AND WATERERS

Various types of containers as feeders and waterers (bottles, crocks, tins, etc.) may be used at little or no cost. These can also be made from bamboo sections and earthen crocks. All feed and water equipment must be accessible to the rabbit, spill-proof (Figure 5.2) and kept clean. Forage should be tied in bundles or placed in a manger to prevent contamination with feces, urine and spoilage. Salt tins may also be used. Simple feeding and watering equipment sources are described in detail in books and manuals in the General References list. Information is also available on automatic watering systems.

Figure 5.2. Feeders and waterers



PREVENTION OF THEFT AND PREDATOR LOSSES

Perhaps nothing is more frustrating to the farmer than having a valuable or favorite rabbit stolen by thieves or mutilated or killed by predators. Fortunately, there are many ways to minimize such losses. These include choosing the rabbitry site near the main family compound; placing the rabbitry in a secure shed or a room in the house; building a fence around the rabbitry (the fence should not block breezes needed for proper ventilation); training the family dog to guard the rabbitry; placing locks on the hutches; and tying bells, chimes and other alarming gadgets to the hutches.

S.D. LUKEFAHR

A rabbit hutch in Poland made from locally-cut wood, scrap materials, and limited wire, and with a guard dog as an effective measure against thievery and predation.

STORY FROM GUATEMALA

Increased Food Security and Community Development

Neighbors Manuel Cu Ca'al and Manual de Jesus have built a friendship on commonalities. First of all, these two Guatemalan farmers share a first name. Secondly, they are both fathers to six children. Finally, they have both discovered sustainable ways to improve their families' livelihood since becoming associated with Heifer International's FUNDAMENO Food Security Project for the Q'eqchi' Maya Communities of the Alta Verapaz. The FUNDAMENO Food Security Project began in 2003 and is helping to improve the nutritional and economic situation of area communities by providing them with rabbits, turkeys, goats, worms and training. Through this project, the overall agricultural production in this region continues to be improved through the incorporation of sustainable agricultural practices, such as worm composting, the use of rabbit manure as fertilizer, crop diversification and tree nursery establishment.

The neighbors, who lived on opposite sides of the same hill, met through the project when Manuel de Jesus and his wife Elvira were members of the first pass on group. They immediately began using their worms for composting and rabbit manure for fertilizer. As a result, their vegetables, especially tomato plants, began to look and taste remarkable. Their first attempt at rabbit breeding was also a success; their original rabbits produced enough offspring to pass on in a very short amount of time. Manuel Cu Ca'al and his wife Aurelia were original project group members and have completed several pass ons since. In fact, they were the first original project family to complete the required pass on of five rabbits (four females and one male) to their neighbors on three separate occasions.

Manuel Cu Ca'al and Manuel de Jesus are good friends and promote the development of their communities.

With six children each, this project has had a tremendous impact on the nutrition of both Manuels' families. They have easy access to rabbit meat and the healthy vegetables that rabbit manure, used as fertilizer, helps to grow. Now in a position to sell the rabbits they breed and vegetables they grow, both families have enjoyed an increase in their incomes, enabling them to purchase other food that will further diversify their diets. The older children have been able to learn valuable skills related to rabbit breeding, and the younger children pay close attention, just waiting until they are old enough to participate. This has truly been a project that the entire family can take part in.

Key elements of this project are cooperation, teamwork and sharing. The communities share not only livestock, but experiences, solutions to problems and opportunities for new market outlets. The market for rabbit meat is growing and is not near saturation! Communities can easily cooperate to market their products—rabbit meat and vegetables grown with the help of rabbit manure as fertilizer—without fear of driving another's prices down. These elements have also been important in the friendship shared by Manuel Cu Ca'al and Manuel de Jesus. Neighbors from different sides of one hill have discovered much common ground and enriched each others' lives. Manuel Cu Ca'al and Manuel de Jesus are good friends and promote the development of their communities through one project. Today, both Manuels aspire to improve their small farms and amplify their production of rabbits, both for their own consumption and to sell to increase their income.

MODULE 6

FEEDS AND FEEDING

The Learning Guide

Learning Objectives

By the end of this session, trainees will:

- Understand how proper feeding practices are necessary to raise healthy, productive rabbits
- Be familiar with suitable feed sources and basic dietary requirements
- Be familiar with basic feeding tips
- Be familiar with various plants that can be fed to rabbits
- Be familiar with uses of leguminous plants as forage

Terms to Know

- Coprophagy
- Crude fiber/Crude protein
- Farm crop residues
- Feed concentrates
- Forage
- Forage plot
- Free-choice
- Gross energy
- Herbivorous monogastric
- Hindgut
- Legumes
- Manger
- Monogastric
- Nutrient
- Palatability
- Ruminant
- Silage
- Supplement

Recommended Demonstrations

- Observe proper feeding practices on a demonstration farm or visit a research station where forages are being grown and evaluated.
- Invite an agronomist or experienced farmer to demonstrate forage plot establishment as a hands-on activity.
- Identify a wide variety of suitable forage species for rabbits in the region.
- Identify garden and kitchen "wastes" that can be used for feeding rabbits.

Training Group Discussion and/or Take Home Assignment

- As a group, make a list of plant foods that can be fed to rabbits. Next, organize this list into nutrient classes (i.e., energy, fibrous versus protein feeds). Does it appear that a commercial concentrate source will be needed? If so, is this feasible?

- Discuss the many uses of leguminous shrub and tree species. (Hint: as forage or fodder, as shade, as a windbreak, as nitrogen fertilizer or in alley cropping, as firewood, as a source of income, etc.). Are certain adaptable legumes available in your region that could be used to support rabbit farming?

Sample Visual Aid

SIMPLE AND BASIC FEEDING TIPS
1) Supply only fresh or processed needs - to avoid spoilage
2) Offer a wide variety of foods daily - to meet nutrient needs
3) Provide forage and water at all times - to increase production
4) Ensure easy access to feed and water - to encourage intake
5) Limit intake of concentrates - to prevent disease
6) Supplement the diet – to provide minerals

MODULE 6

FEEDS AND FEEDING

The Lesson

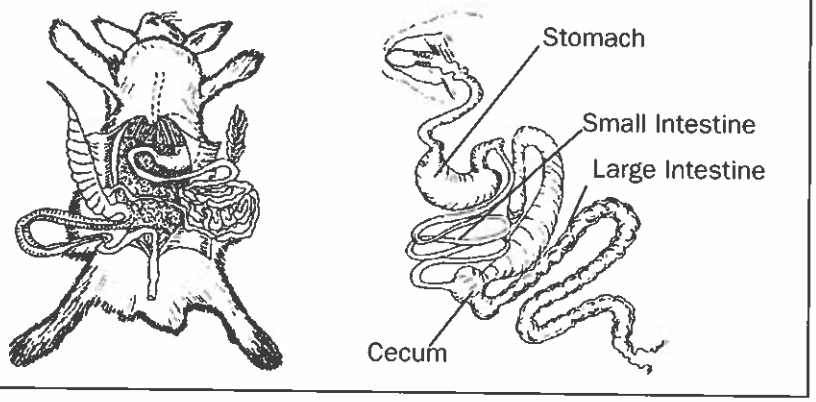
The adage, "You are what you eat," simply explains the importance of nutrition. Proper nutrition allows the rabbit to maintain good health and be productive and profitable for the farmer. Poorly nourished rabbits will appear unthrifty and may not be very productive. Unfortunately, in some cases, farmers provide only one or a few species of grass to their rabbits as the sole diet source and provide no water. The same farmers cannot understand why the rabbits are unproductive. Good training is essential.

Through basic experience and/or training, as well as some planning, the farmer can learn how to properly feed rabbits. It is not always practical to provide a nutritionally balanced or complete diet for rabbits reared under subsistence conditions on small farms. In fact, in most cases it will never be known whether or not the diet being fed is nutritionally balanced. However, there are certain basic measures that can ensure the rabbit's good health and support a reasonable productive level (e.g., four litters in a year in does and 20 grams of daily body weight gains in fryers). This module will focus on basic and general measures of feeding success.

NUTRIENT REQUIREMENTS

Rabbits are classified as **herbivorous monogastrics** or pseudo-ruminants because of their digestive anatomy and function (Figure 6.1), which allows them to subsist on a fibrous diet. **Forages** provide essential fiber. Rabbits do not efficiently digest fiber and unlike **ruminants**, they directly utilize the protein found in fibrous plant foods.

Figure 6.1. Simplified digestive anatomy



As stated previously, it is not always practical to attempt to provide a nutritionally balanced or complete diet for rabbits. To do so requires a fully equipped nutrition laboratory that has the capability to analyze feed samples. Despite this, it is at least possible to target nutrient needs using a basic approach. This approach involves categorizing groups of foods

according to nutrient availability. Classes of **nutrients** are carbohydrates, fats, protein, minerals, vitamins and water. If the farmer provides certain feedstuffs that approximately supply these nutrients as required on a daily basis, then reasonable production should be expected. Daily requirements for the major nutrients are presented in Table 6.1.

Table 6.1. Requirements of key nutrients by rabbits

NUTRIENT	GROWING RABBITS	LACTATING DOES
Crude protein (%)	15.5-16	17.5-18.5
Digestible energy (MJ/kg)	2,200-2,300	>2,500
Crude fiber (%)	16-17	>13
Acid detergent fiber (ADF, %)	18-20	>15
Acid detergent lignin (ADL, %)	>5	4-4.5
Starch (%)	12-14	15-25
Calcium (%)	0.9-1.0	1.1-1.2
Phosphorus (%)	0.55-0.60	0.55-0.60
Vitamin A (IU/kg)	8,000	10,000
Vitamin D (IU/kg)	1,000	1,000
Vitamin E (IU/kg)	20-25	30-50

Source: Xiccato, G. and Trocino, A. 2008. Nutrition and development of rabbits. In: Cerolini, S.; Marzoni, M.; Romboli, I., Schiavone, A.; and Zaniboni, L. (Eds.) Poultry and rabbit production. pp. 481-502. *Le Point Vétérinaire Italie*, Milano, Italy.

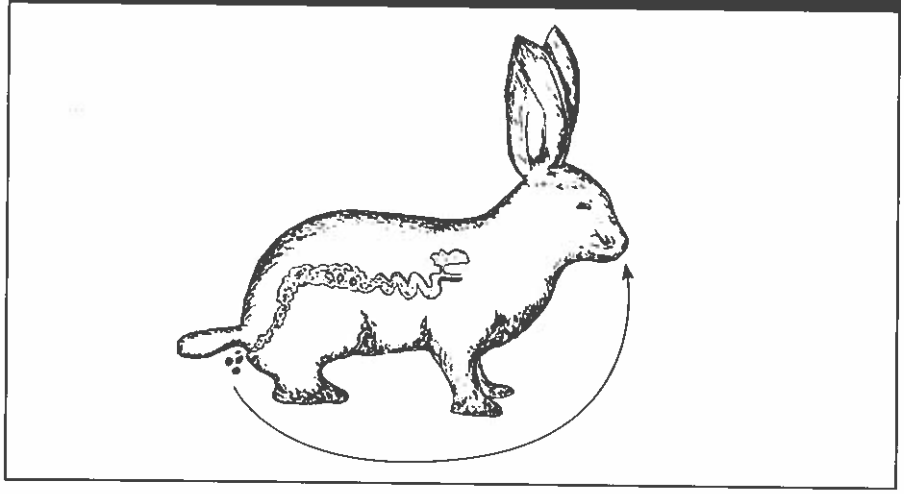
Dietary protein sources include **legumes**, oil seed meals, processed cereal grains and animal product meals. Legumes can usually be grown on the farm. The latter three protein sources can be obtained from the processing plant or market, although at a cost. Many farmers do well by feeding legumes (procured from forage plots or other farm sources) to rabbits year-round.

Energy feed sources from carbohydrates and fats are often more readily available than are protein sources. Carbohydrates include sugars, starch (common in grains) and fiber. Energy feeds include, for example, animal and vegetable oils, cereal grains and byproducts, fruits and vegetables, and roots and tubers. Substitutions can easily be made throughout the year. One recent innovation is the preparation and feeding of molasses blocks as an energy **supplement**. Various reports on molasses blocks can be obtained from an internet search. However, the farmer should know that feeding a diet low in fiber and high in energy (e.g., high grain content) or a finely ground concentrate diet (such as poultry or swine mash) can result in high mortality due to intestinal disorders, such as enterotoxemia (refer to Disease Control module).

The feeding of molasses blocks to growing rabbits.

Minerals and vitamins can be supplied from farm or commercial sources to meet these smaller but essential nutrient requirements (Table 6.1). Minerals required in larger quantities (macro-minerals) include calcium, phosphorus, magnesium, sodium, potassium and chlorine. The major vitamins needed are Vitamins A, D and E. Protein and carbohydrate dietary sources, fed in good variety, may largely meet the mineral and vitamin requirements. Through the practice of **coprophagy** (Figure 6.2), vitamin K and the B vitamins are not required in the diet because these are synthesized in the cecum, or **hindgut**, by microbes. Also, rabbits do not require vitamin C. Supplementary mineral or vitamin sources include bone meal, common salt, trace mineralized salt, vitamin pre-mix, etc. Mineral and vitamin deficiency and toxicity signs as observed in livestock, including rabbits, may be found through an internet search.

Figure 6.2. Recycled nutrients from the hindgut



Water is an absolute must for rabbits. Although the rabbit may adjust its water intake by the moisture level of the diet (especially if high moisture forages are fed), water is still needed. Basically, a rabbit will drink 120 ml per kg of body weight per day. Insufficient water intake can lead to digestive problems, dehydration and low milk production. Water must be clean and available at all times.

PROPER FEEDING PRACTICES

Rabbits should be provided with all the fresh or processed forage (i.e., **free-choice** or full feeding) they can consume in a 12-hour meal period. This means that rabbits should be fed twice daily, morning and evening. The morning meal should be lighter than the evening meal, since rabbits eat mostly at night. A doe or weaned fryer may consume 400-500 g of fresh forage in a 24-hour period. A wide variety of foods (e.g., grasses, legumes, weeds, garden and kitchen wastes) should be offered at each meal. Also, as a guide, an approximate ratio of three parts grasses (or in combination with other non-legume plant foods—garden, kitchen and table wastes)

to one part legumes should be attempted in preparing each meal. This practice is to ensure that rabbits receive an adequate intake of protein from legumes, since legumes generally have higher protein content and/or are more digestible than grasses.

Feed must be easily accessible to the rabbit. Forage should either be tied in bundles and suspended above floor level or placed in a **manger**. Commercial or farm compounded concentrate, kitchen and table scraps, and salt or mineral and vitamin supplements should be fed in bowls or crocks large enough so that mature stock will have no difficulties eating the supplement. If concentrate is given in addition to free-choice forage, it should be limit fed (about 50 g per day) to prevent diseases that result in diarrhea or even death. If salt is given, it could either be provided at the level of 0.5% of the total dry weight of the diet, or offered free-choice. If a wide and nutritious variety of farm-based feedstuffs are provided in the diet on a daily basis, commercial concentrates may not be needed.

PRIMARY FEED SOURCES

It is necessary to present information on suitable feed sources and on basic dietary requirements. Feedstuffs for rabbits can be obtained from a variety of sources. These include wild, indigenous plant stands; cultivated **forage plots**; **farm crop residues**; farm surplus foods; agricultural byproducts; kitchen wastes; and market sources. The farmer might rely mostly on only one or two of these sources, or on several, depending on local factors. Ideally, the farm should produce most, if not all, of the feedstuffs used for feeding rabbits in order to be sustainable. From France, an excellent web-based resource of information on rabbit production in the tropics is available at: **http://www.cuniculture.info/Docs/Elevage/Figur-Tropic/chapitre3/plantes-00-Composition.htm**, which features a photo gallery with nutritional information on many species of plants (grains, crops, grass and legume forages, etc.) suitable for feeding rabbits. In addition, the applied journal *Livestock Research for Rural Development* (**www.lrrd.org**) has a free text search feature (e.g., enter "rabbits" and "Leucaena") in which the user can locate many useful articles on feedstuffs for rabbits and also basic information about plant species, which is beyond the scope of this book.

Wild, indigenous plant stands are a common source of feed for rabbits. Although a variety of native plants (e.g., grasses, legumes or weeds) may be chosen, many species are unknown. Common weeds, such as black jack (*Bidens pilosa*), kenaff (*Hibiscus sp.*) and pigweed (*Amaranthus sp.*), are known to be highly palatable. Nonetheless, more time is required to collect wild forages, the quality of the forage may be poor, the forage may not be accepted due to poor **palatability** and the forage may only be seasonally available. Especially if children collect the forage there is the risk, too, that toxic poisonous plant species might be accidentally fed. Thus, the parent as manager should closely inspect all collected forage.

A cultivated forage plot on the farm is ideal. Here, the farmer can plant the species recommended by local experts, manage the plot for best yield results, and harvest and feed the forage at the proper time. Because there is considerable variation in yield among species and climates, it is difficult to provide a general guide as to the size of a forage plot. Nonetheless, a range of 25 to 60 m^2 per breeding doe is provided in Table 6.2 as a guide.

The evaluation of forage species for rabbit feeding is an area of considerable potential benefit to the farmer. Informative reports on this subject are available from the literature as shown in the table below that was based on forage production in Indonesia.

Table 6.2. Composition of tropical forages (dry matter basis)

FORAGE SPECIES	GROSS ENERGY (kcal/kg)	% CRUDE PROTEIN	% FIBER		% CALCIUM	% PHOSPHORUS
			ADF*	NDF*		
Woody legumes						
Albizia falcata	4326	16.3	26.4	38.0	0.65	0.17
Calliandra calothyrus	4756	21.8	29.1	44.7	1.71	0.18
Leucaena leucocephala	4206	21.9	21.8	35.0	1.34	0.21
Sesbania formosa	4469	19.9	20.8	34.1	0.73	0.37
Sesbania sesban	4254	17.8	29.1	35.4	0.75	0.37
Non-woody legumes						
Cassia rotundifolia	3991	15.0	47.0	59.3	0.76	0.25
Centrosema pubescens	3885	21.4	35.3	51.4	0.74	0.23
Desmodium heterophyllum	3752	13.4	37.1	48.5	0.73	0.22
Neonatonia wrightii	3442	13.1	43.3	55.8	1.52	0.23
Pueraria phaseoloides	3872	15.6	39.9	50.7	0.74	0.36
Stylosanthes guianesis	3107	14.8	33.1	41.6	1.24	0.22
Grasses						
Brachiaria brisantha	2820	6.7	36.8	59.3	0.47	0.16
Chloris gayana	3705	7.6	44.6	70.2	0.30	0.18
*Panicum maximum***	3537	5.8	48.7	69.4	0.33	0.19
*Panicum maximum****	3585	6.6	47.1	66.2	0.70	0.21
Paspalum plicatulum	4230	6.5	44.7	65.1	0.50	0.15
Pennisetum purpureum	3824	12.0	38.2	61.4	0.29	0.36
Setaria splendida	2629	6.9	39.7	55.4	0.46	0.20
Agricultural byproducts						
Manihot esculenta (tops)	4804	16.8	28.2	38.9	1.76	0.28

*ADF and NDF: acid detergent fiber and neutral detergent fiber.
**Panicum maximum cv Green Panic.
***Panicum maximum cv Guinea.

Source: Raharjo, Y.C.; P.R. Cheeke; N.M. Patton; and K. Supriyati. 1986. Evaluation of tropical forage and by-product feeds for rabbit production. I. Nutrient digestibility and effect of heat treatment. *Journal of Applied Rabbit Research*, 9:56-66.

Ideally, an established plot should be ready for harvest by the time the farmer first obtains rabbits. This requires good planning by the project. In general, it is a good idea to wilt the forage in open sunlight for 12 to 24 hours to remove much of the water content. This will improve its nutritional value. However, if rabbits prefer consuming fresh versus wilted forage, then it is better to feed it fresh because it is more important that rabbits eat a lot. Another advantage of maintaining a forage plot includes using surplus forage to make high quality hay for dry season feeding. Another potential form of processed forage is **silage**, especially in areas with a prolonged dry season. However, silage making is not a simple process.

A mixed grass-legume stand could improve the quality of the diet as opposed to feeding only grasses. Legumes provide nitrogen to the soil which benefits the grass species. Legumes can climb the taller grass species for increased light exposure. This symbiotic relationship is a common practice in crop production. One example of this is the bean and maize inter-cropping in Central America. The legume species might be a vine, a small shrub or a tree, such as *Leucaena leucocephala* and *Stylosanthes guianesis*.

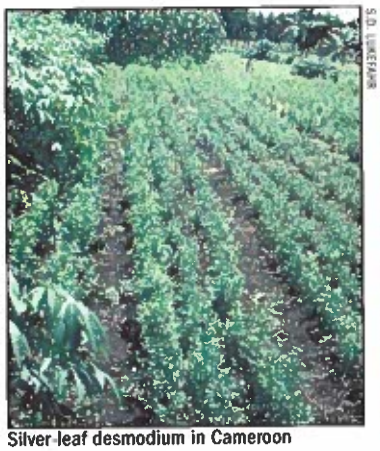
A series of photos of plant feedstuffs for rabbits:

A forage plot in Cameroon containing Guatemala grass (*Tripsacum andersonii*).

Elephant grass (*Pennisetum purpureum*) in the background and African iodine (*Aspelia africana*) in the foreground in Cameroon.

Guinea grass (*Panicum maximum*) in Ghana.

Alfalfa in the Dominican Republic (*Medicago sativa*).



Silver-leaf desmodium in Cameroon (*Desmodium heterophyllum*).

Lablab in Uganda (*Dolichos lablab*).


S.D. LUKEFAHR

Leucaena in Brazil (*Leucaena leucocephala*).


S.D. LUKEFAHR

Peanut hay dried as forage in Zimbabwe (*Arachis hypogaea*).


S.D. LUKEFAHR

Berseem clover in Egypt (*Trifolium alexandrinum*).


M.E. KENTOR

Bermuda grass in Haiti (*Cynodon dactylon*).


S.D. LUKEFAHR

Sweet potatoes in the U.S. (*Ipomoea batatas L*).


S.D. LUKEFAHR

Kitchen vegetable wastes fed to growing rabbits at a school kitchen in Guatemala.

There are general benefits to feeding several forage species. A study in Vietnam (Table 6.3) fed molasses blocks (15% soybean meal, 25% cassava root meal, 20% rice bran, 5% minerals and 35% molasses) with guinea grass, sweet potato vines and water spinach as forages to growing rabbits. Sweet potato vines and water spinach may contain more than 25% crude protein. Growth rate was improved when either sweet potato vines or water spinach, or both, were fed with guinea grass.

Table 6.3. Feed intake and growth performance of rabbits fed sweet potato vines (SP), water spinach (WS), or a combination with or without guinea grass (GG)

	DIET					
Trait	**WS**	**WS-GG**	**SP**	**SP-GG**	**WS-SP**	**WS-SP-GG**
Feed intake, g DM/day						
Water spinach	48.0	36.1	0.00	0.00	33.0	24.3
Sweet potato	0.00	0.00	44.3	26.8	23.6	15.7
Guinea grass	0.00	40.2	0.00	43.9	0.00	33.6
Molasses block	74.3	73.5	67.2	76.3	68.1	73.8
Total DM	122	149	112	148	125	147
Crude protein	20.5	21.8	23.9	24.8	25.4	25.3
Growth performance						
Initial live weight, g	980	940	925	970	930	950
Final live weight, g	2700	2890	2530	2900	2760	3060
Weight gain, g/day	21.9	26.4	21.1	26.7	23.1	27.2
DM feed conversion	10.7	8.23	7.68	7.26	6.21	7.03

Source: Doan Thi Gang, Khuc Thi Hue, Dinh Van Binh and Nguyen Thi Mui. 2006. Effect of guinea grass on feed intake, digestibility and growth performance of rabbits fed a molasses block and either water spinach (*Ipomoea aquatica*) or sweet potato (*Ipomoea batatas L*) vines. In: Workshop-seminar "*Forages for Pigs and Rabbits*," *MEKARN-CelAgrid*, 2006 August, Phnom Penh, Cambodia, 191-203. **http://www.mekarn.org/proprf/gang.htm.**

Farm crop residues are only seasonably available, but can still be an important feed source. Examples include harvest wastes (leaves, peelings and/or vines) from beans, cassava, maize, sweet potatoes, peanuts and vegetables. The feeding of raw cassava and potato leaves, cabbage and soybeans, or other plants containing toxins, however, should only be done after processing to remove toxins, if practical. One rule of rabbit feeding is that foods containing toxins requiring processing for human consumption should also be processed for rabbits. Another simple strategy is to always mix several plant food sources for each feeding so as to minimize toxin concentrations. Leucaena contains the toxic amino acid mimosine and should not be fed to rabbits for extended periods at more than 10% of the total dry weight of the diet.

Farm surplus foods such as bananas, mangoes, papayas and sweet potatoes may be fed when these food sources are either available beyond domestic or market needs, are damaged or highly perishable, or would otherwise go to waste. Sometimes it may be good to process certain waste foods, such as drying peanut (groundnut) leaves after harvest into high quality hay as a protein supplement for dry season feeding.

Agricultural byproducts result from industrial processing of farm products. Examples include brewer's dried grains, citrus pulp, rice and wheat brans, in addition to copra (coconut), cottonseed and palm kernel meals. This list could also include animal byproducts, such as dried blood, bone and fish meals. These feed sources are usually obtained directly from the processing plant or from the market. Their costs may fluctuate depending on supply and demand.

Kitchen wastes can be a reliable source of food for rabbits, but the supply may be limited. Brans, hulls, husks, plant parts and peelings rendered from meal preparation, as well as table refuse (e.g., stale bread or tortillas), can be fed to rabbits. If these are cooked with salt added, both acceptance (palatability) and digestibility can be improved. Except for forages, these feed supplements should be placed in bowls or crocks to avoid contamination and removed within 24 hours to prevent spoilage.

Market sources include animal **feed concentrates** and complete diets, usually manufactured by a feed company. The use of commercial poultry or swine grower mash can be cost-effective (if the rabbit market price is high) in terms of increasing fryer growth. However, slower gains and poorer feed efficiency due to lower palatability and excessive feed wastage of dry mashes, as compared to pellets, have been reported. Complete, formulated diets or pelleted diets for rabbits are not found in many developing countries. Even if available, cost or transportation problems might prevent their use by many rural farmers. Commercial producers can more readily justify using complete diets.

One exception is the purchase of small equipment units: a feed grinding machine (cost of about $2,800 U.S.) and a small pelleting unit (cost of about $2,600 U.S.). These estimates include costs of the engine, transportation and custom taxes (F. Lebas, personal communication). These purchases that are capable of producing one metric ton (1000 kg) of pellets have been justified for rabbit farmers who live close to large cities or market outlets in which there is a strong demand (high price) for rabbits.

A rabbit program in each country should develop a master list of suitable feeds for rabbits. The following table shows such a sample list from Uganda.

Table 6.4. Suitable local foodstuffs for rabbits in Uganda

PLANT	SCIENTIFIC NAME
Legume forages	
Calliandra	*Calliandra calothyrus*
Desmodium	*Desmodium distortum*
Lablab	*Dolichos lablab*
Leucaena	*Leucaena leucocephala*
Pigeon pea	*Cajanus cajan*
Sesbania	*Sesbania sesban*
Grass forages	
Brachiaria	*Brachiaria decumbens*
Elephant grass	*Pennisetum purpureum*
Guinea grass	*Panicum maximum*
Kikuyu grass	*Pennisetum clandestinum*
Star grass	*Cynodon dactylon*
Setaria	*Setaria sp*
Weeds	
Amaranthus	*Amaranthus dubius*
Aspelia	*Aspelia africana*
Blackjack	*Bidens pilosa*

PLANT	EDIBLE PART
Garden/kitchen refuse (protein source)	
Beans	Leaves
Cowpeas/soybeans	Leaves
Groundnuts	Leaves/hulls
Garden/kitchen refuse (energy source)	
Cassava	Dried roots
Maize (corn)	Grain
Millet/sorghum	Grain
Sugarcane	Stalks
Sunflowers	Seeds
Potatoes/tomatoes	Tuber/fruit
Sweet potatoes	Vines/tuber
Yams	Tuber
Garden/kitchen refuse (fiber source)	
Maize (corn)	Leaves/husks
Millet/sorghum	Leaves
Fruits – surplus or non-marketable (energy source)	
Avocado	Avoid skin
Banana	Avoid peelings
Jackfruit	Avoid shell
Mango/papaya	Avoid skin
Passion fruit	Avoid seedpod

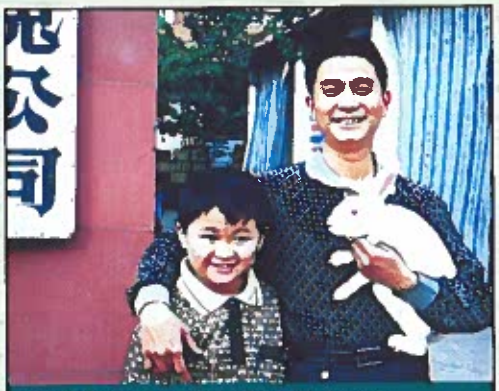
Source: Lukefahr, S.D., 1998. Rabbit production in Uganda: Potential versus opportunity. *World Rabbit Science*, 6(3-4):331-340.

STORY FROM CHINA

The "Rabbit King"

Well-known throughout China as the "Rabbit King," Ren Xuping's life has not always been so regal. Xuping grew up in Dayi County, Sichuan Province. When he graduated from junior middle school in 1981, his parents could not afford to send him to senior high school. Only 13, he was not yet strong enough to work in the rice fields with the rest of his family. When Xuping's father brought home two rabbit does for him to take care of, he did so gladly. One doe was pregnant and soon had eight offspring, which he sold at the local market for 12 yuan ($1.45 U.S.). This event would change the course of Xuping's life and empower him to assist countless others to improve their own lives.

With that initial profit of 12 yuan, the young entrepreneur realized that his return would increase significantly if he had more breeding rabbits, so he excitedly embarked on the business of rabbit raising. Every day, he went into the fields with a sickle and gathered green forage to feed his rabbits. He took extra special care of them and, in 1982, earned 2,600 yuan ($314 U.S.).



Mr. Ren Xuping "The Rabbit King" with his son.

In 1984, Heifer International discovered Xuping while looking for experienced rabbit breeders to start its program in China. To improve the quality of his stock, Heifer gave him a loan of 48 Californian and New Zealand breeding rabbits, as well as technical training and support. By 1986, Xuping had a rabbit farm with 1,600 cages, and his entire family helped take care of the rabbits. Eventually, rabbit forage replaced crops on the family's land. With a firm belief in the value of people helping each other, Xuping holds Heifer International's Passing on the Gift requirement in high regard. He completed his pass on of 240 female offspring in 1986 and has since passed on over 40 generations of rabbits and the training necessary for others to replicate his successful business practices. In addition to gifting rabbits to other farmers in his community, Xuping has also donated breeding rabbits to organizations that help farmers, such as the Science & Technology Committee, Women's Federation, and the Youth League of Dayi County.

To further share knowledge about his tried-and-true techniques, the "Rabbit King" started the Xuping Rabbit Training School in 1990. Students have traveled from China, North Korea, Nepal and India to learn from him. He has used earnings from his business, Xuping Rabbit Breeding Company, to build a six-story, 1,700 m^2 training facility that can accommodate 400 students. More than 80,000 trainees have been taught at his facility, and over 120,000 people have learned from Xuping via correspondence classes. After attending the training school, many students become successful rabbit breeders in their own communities and educate others.

MODULE 7

REPRODUCTION

The Learning Guide

Learning Objectives

By the end of this session, trainees will:

- Be able to accurately sex rabbits to distinguish between a buck and a doe
- Be familiar with the breeding process
- Understand the difference between estrous and estrus and anestrus
- Be familiar with the stages of gestation
- Be able to evaluate adequate milk intake for kits
- Be familiar with a suitable breeding schedule

Terms to Know

- Anestrus
- Breeding schedule
- Cross-fostering
- Estrous cycle
- Estrus
- False pregnancy
- Gestation
- Infertile
- Kindling
- Kit
- Lactation
- Libido
- Moulting
- Nest quality
- Ovulation
- Palpation
- Sterile
- Weaning

Recommended Demonstrations

- Sexing mature and young rabbits.
- Mating rabbits on a demonstration farm.
- Consider sacrificing a 15-day pregnant doe to demonstrate the size and location of the fetuses. The meat can be prepared to feed the trainees.

Training Group Discussion and/or Take Home Assignment

- Why is successful reproduction the key to successful fryer production for meat? What factors can affect production?
- It is not wise to expect a doe to produce more than four litters in a year in unfavorable environments. Discuss reasons why this is so.
- Why is palpation a useful skill in rabbit production?

Sample Visual Aid

CAUSES OF INFERTILITY		
Age	Management	Poor Feeding
Disease	Moult	Season/Temperature
False Pregnancy	Physical Condition	Sterility

MODULE 7

REPRODUCTION

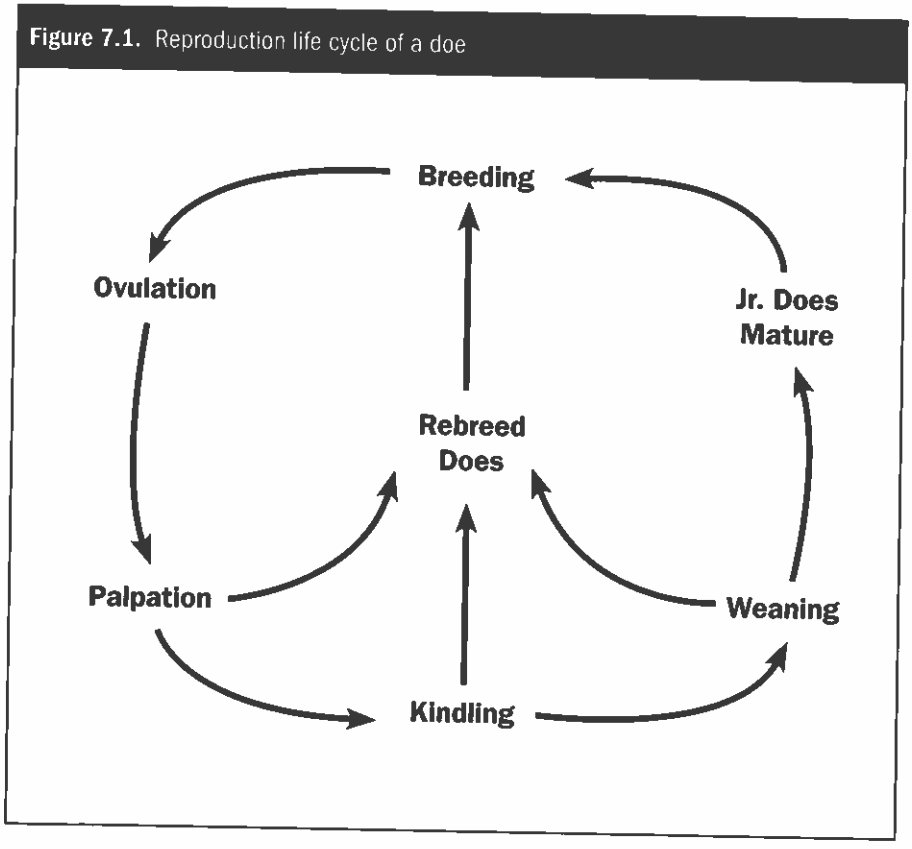
The Lesson

Without reproduction in rabbits, there will be no meat for the family dinner table or extra income from sales of surplus fryers. Reproduction entails several components, such as fertility, litter size born, **nest quality**, milk production, and litter survival to **weaning** and harvesting age. Therefore, it is easy to see why successful fryer production relies largely on successful reproduction. The farmer must approach reproduction in a realistic and logical manner, which requires good initial training.

AGE AT FIRST MATING

Rabbits are first ready for reproduction largely according to age, breed, climate, diet quality and especially body weight. Rabbits of small breeds (Dutch and dwarfed breeds) may be bred at four to five months, medium breeds (Californian and New Zealand White) at five to six months and large breeds (Blanc du Bouscat and Flemish Giant) at seven to eight months of age. However, these age figures reflect ideal conditions. Body weight rather than age is more important in determining when a rabbit has developed well enough to begin reproducing. Obviously, a poorly fed rabbit will mature slowly. As a guide, a rabbit representing a medium-sized breed should weigh a minimum of 3 kg before first mating. A reproduction life-cycle diagram is shown in Figure 7.1

Figure 7.1. Reproduction life cycle of a doe



SEX DETERMINATION

The farmer should learn to distinguish between a buck and a doe. This can be learned through demonstration during a training course. There is little difficulty in sexing mature rabbits. The farmer can adopt the "work-your-way-backward" approach over time until even young stock can be accurately sexed. The mistake often made is not applying sufficient but gentle pressure on the genitalia (penis or vulva).

A six week-old male rabbit

A mature male rabbit

A six week-old female rabbit

A mature female rabbit

MATING

In mating rabbits, it is necessary to first make sure that the buck and doe are free of signs of disease (discussed later in the Disease Control module). A diseased rabbit could spread an infection to other rabbits through mating. A buck should have well-formed testicles. Also, rabbits should be bred during the cool times of the day when they are more active.

The doe should always be taken to the buck's cage for breeding. This is because the doe is highly territorial; any strange rabbit is usually not welcomed in her cage, that is a place to rear her litters. The pair should be left together and observed for no more than five minutes. After mounting the doe, when the buck suddenly falls to one side (usually making a snorting sound in the process), a service has occurred. One good service is adequate.

If a service does not take place during this time, return the doe to her cage and try again in one or two days. Under no condition is it good to leave the pair unattended. First, it will not be known when or if a service took place, and second, the pair could fight, causing serious injury (such as castration and torn ears).

Contrary to popular belief, the doe is not capable of becoming pregnant all the time. Basically, the doe has an **estrous cycle** of 17 days, consisting of a 14-day **estrus** and a three-day **anestrus** period. Anestrus is the period when new eggs are being developed.

Through the physical stimulation of mating, a doe in estrus will release her eggs about 10 hours later. This process is known as **ovulation**. If the doe is

unwilling to mate, she is probably in anestrus. Wait one or two days and try again.

The color of the vulva is often a reliable indicator of estrus or receptivity. A doe with a reddish colored and swollen vulva and with a glistening, moist surface are better signs than a pale or greyish colored and non-swollen vulva that appears dry.

If a successful mating occurs, record the date of service and the buck used (refer to record forms in Genetics and Selection module). Occasionally, a doe may urinate following mating. This does not matter since the site of ejaculation in the vagina is forward or anterior to the site of urination. A forced mating, whereby the doe is restrained so as to allow the buck to service the doe, should only be used as a last resort. The practice of artificial insemination is not feasible for most farmers and is beyond the scope of this book.

The buck may be used again two days later. Two services (one good service for each of two does) per day followed by a day of rest can be used in larger operations. This amounts to 365 total services per year; hence, the **breeding schedule** dictates the effective buck-to-doe ratio for the herd. Regular matings ensure good buck fertility. Only one buck is needed for a 30-doe operation. Of course, this assumes that the buck always displays good **libido** or sex drive. Fat or sluggish bucks should be culled from the herd. They make great stews.

PALPATION

The rabbit's pregnancy or **gestation** period is usually between 30 and 32 days. Shorter pregnancies are common in large-sized litters while longer pregnancies are common in small-sized litters. Pregnancy in the doe can be determined by abdominal **palpation**. The advantage of palpation mostly is in the savings in feed and labor in otherwise caring for a non-pregnant doe. A doe found to be open (not pregnant) should be immediately returned to the buck for a re-mating.

Palpation as a management tool, however, requires considerable skill, which can only be accomplished through much practice and some degree of talent. Competency in palpation is achieved by a good understanding of the anatomy of the female reproductive tract and the various stages of fetal development, the application of firm yet gentle pressure when searching for fetuses and lots of practice. Perhaps the best way to learn how to palpate is, again, the work-your-way-backward approach. Near full-term pregnant does can first be tried. The fetuses are located throughout the enlarged uterus, which covers much of the lower abdominal area. The fetuses are also fully formed and moving. Gradually work down to a 15-day pregnancy where the fetuses are marble-sized, close together and located

below the pelvic region. Later, try a 10-day pregnancy involving pea-sized fetuses. Palpation should only be demonstrated to progressive farmers and not to trainees because of the high skill level involved. Also, it cannot be overemphasized that one must be very gentle when performing a palpation.

Abdominal palpation to determine pregnancy in the doe.

INFERTILITY CAUSES

There can be numerous causes for infertility. **Sterility** – permanent infertility – is one cause, although it is somewhat rare. Does or bucks which continually fail to reproduce, while other rabbits in the same herd have normal reproduction, should be culled. Only two or three consecutive **infertile** matings should be allowed before the decision to cull the animal is made. Another cause of infertility is **false pregnancy**, a condition which is usually the result of a mating accompanied by ovulation but without fertilization. Even though the doe is known to be non-pregnant upon palpation, she may refuse service when re-mating is attempted. Generally, false pregnancy lasts for about 17 days. It is interesting that in extreme cases, the doe will even later pull fur, build a nest and produce milk. Prior to first mating, a doe should live in its own hutch or cage for at least one month. This is because when does mount one another it is possible that one or both does may ovulate and enter the state of false pregnancy. Does that repeat this abnormal condition should be culled.

A rabbit in poor to fair body condition (i.e., underweight due to loss of flesh), or one that appears to be **moulting** (shedding of fur), should not be bred. The cause of this condition could be related to stresses of past reproduction, dry season, inadequate diet, disease, etc., and could possibly be corrected through proper management. High temperature stress can also reduce fertility levels. This topic will be covered in the Managing the Rabbitry module.

NESTBOX PROVISION AND KINDLING

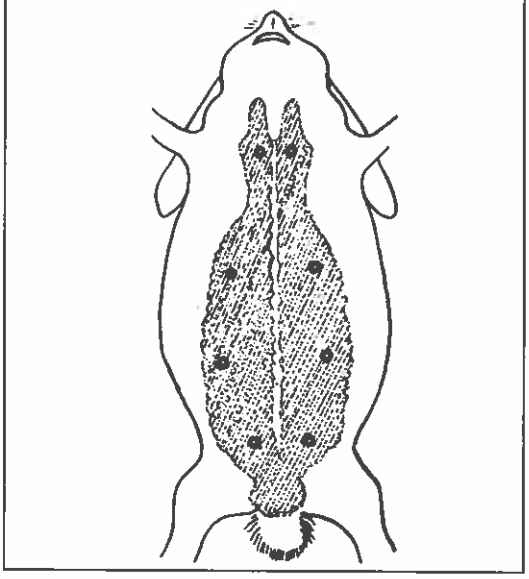
A pregnant doe should be given a sanitized nestbox on the 28th day following mating, to give the doe about three days to build a nest and develop desired instinctive maternal behaviors. The nestbox should contain dry bedding material, such as fine-stemmed grass hay, shredded paper, bush cotton or hulls, and wood shavings. The doe will combine her own fur with the bedding materials to provide a warm, absorbent nest for the litter. During this time, she will be busy scratching inside the box, which is an expression of her instinctive burrowing behavior. Add more material if she removes it from the nestbox.

Do not disturb the doe when she is giving birth (**kindling**). After the doe leaves the nestbox, promptly remove any stillborns, afterbirths (placentas) or blood-soaked bedding from the nest that can attract insects and predators. (Causes of early litter mortality will be addressed in the Managing the Rabbitry module.) Count the number of young and enter this on the record form. Make sure to cover them back with fur and shut the gate to the cage. Average litter size at birth varies from three to four **kits** for small breeds raised in adverse environments to 10 to 12 kits for medium and heavy breeds raised in favorable environments.

EARLY LITTER CARE

A good management approach is to have at least two litters born no more than four days apart. A management practice referred to as **cross-fostering** can then be used. In this practice, kits from large litters are transferred to smaller litters to minimize competition for milk. In other words, if one doe produces 10 kits and the second four kits, three kits could be fostered to the second litter so that both does now have seven kits each. Try to transfer kits that are similar in size. The doe(s) usually will not mind the transfer or addition of kits. Although most does have eight teats or nipples (Figure 7.2), a doe should be allowed to rear no more than nine kits in order to produce a thrifty litter. This practice results in more uniform development of kits among litters, and is important in marketing of fryers.

Figure 7.2. Location of the nipples and size of the mammary glands during lactation



NURSING AND LITTER DEVELOPMENT

Newborn rabbits are born naked, blind and deaf. They depend entirely on the doe for protection and nourishment in order to survive. The best way to determine whether or not a doe is nursing her litter is to inspect the kits. Bulging stomachs and content kits are obvious signs of proper mothering. Continue this brief daily inspection of the litter until the nestbox is removed by about day 21. Unlike cats and dogs, the mother neither spends time

laying with her young, nor does she retrieve her young.

A doe normally nurses her litter only once a day. The kit must consume a large volume of milk at this time. Fortunately, the milk is very rich or concentrated in nutrients. Average daily milk production may change from 100 to 300 g depending on the stage or days into **lactation**. The total 21-day weight of the litter is an excellent indicator of cumulative milk production of the doe or her milking ability.

By one week of age, kits will have a new coat of fur. By day 10, their eyes have opened. From two to three weeks of age, the kits are crawling, nearly hopping and searching for solid plant food. Less milk is produced by the doe once the litter reaches three weeks of age. By this time, the litter will continue to become more independent by consuming more solid food up to weaning age. On a four litter per doe per year breeding schedule, the litter can be weaned at two months of age. The doe can be re-bred on the same day.

BREEDING SCHEDULE

The choice of a breeding schedule is an important decision. It is generally recommended that a doe be allowed to produce only four litters per year under subsistence conditions in a stressful environment. This is because the general environment (combination of climate [arid or tropical], nutrition and management factors) cannot adequately support high and regular levels of reproduction. In addition, the genetic quality of the stock may be less than desired. It may also be a good option to consider producing more litters in the most favorable season, and taper off production in the less favorable season (usually the dry season).

Under more favorable conditions it may be possible to allow the doe to produce six or even more litters per year, but only as environmental conditions improve, such as quality of the diet, breeding stock and management. Also, an improved shelter may be provided that offers better comfort to the stock. As a new rabbit farmer gradually gains experience and improves his management skills, it may be possible in the course of a year to attempt to produce an additional litter per doe. Table 7.1 shows a breeding schedule for producing four, five or six litters per doe per year.

Table 7.1. Breeding schedule for 4, 5 and 6 litters in a year

BREEDING SCHEDULE FOR 4,5 AND 6 LITTERS IN A YEAR			
Litters per Doe per Year	**Age to Wean Litter***	**Time to Rebreed Doe**	**Litter Interval****
4	2 Months	2 Months	3 Months
5	1½ - 2 Months	1½ Months	2½ Months
6	2 Months	1 Month	2 Months

* Based on months of age of litter.
** Litter interval is the time between litters of the same doe. Interval is reduced if no misconceptions occur between litters.

STORY FROM HAITI

Promoting Entrepreneurial Opportunities through Rabbit Production

In January 2007, I participated in a farmer-to-farmer program through Partners of the Americas, an American non-governmental organization funded largely by USAID. On my first visit, I observed that prior volunteers had made a great deal of progress. All of the rabbits were fed a variety of legumes, forages, grasses, fruits and vegetables. Leucaena and sweet potato vines were the most frequently used forages. Commercial feed from the Dominican Republic was found to be deficient in vitamin A, causing hydrocephalus in newborns. We switched these larger rabbitries to a combination of pellets and forage, which eliminated the problem.

Participants from a village-based rabbit project in Haiti proudly display their breeding stock.

By far, the biggest problem I observed was the poor condition of the cages. Haitians have a difficult time locating enough cage wire in Haiti or the Dominican Republic. Adequate wire must be purchased in the United States with help from Friends of Haiti for Grand Boulage. However we did see several cages built under James McNitt's tutelage. James McNitt, Ph.D., is a Rabbit Production Specialist and Professor of Animal Science at the Southern University Agricultural Research and Extension Center in Baton Rouge, Louisiana. These cages were the best and cleanest.

While the rabbits were mostly healthy, there were many problems. All were fed on the cage floor—a major cause of feed waste and coccidiosis transmission. Few rabbits had water available, and we saw several cases of mange. The Haitians were treating the mange with Ivomec injections; however, as a result, meat blemishes and overdosing were common. We also saw ear mites, which we suggested treating with a mineral oil/Ivomec mixture. We taught them how to trim teeth to correct cases of malocclusion. We provided instruction on proper hygiene to address staph infections in young rabbits, and eye washing in response to conjunctivitis. Snuffles (a contagious respiratory disease) was also an issue.

The most outstanding observation during these trips was the eagerness with which the Haitians took to rearing rabbits and the quality of their questions during lectures. Over the last two years, we have succeeded in importing good quality cage wire, water bottle nipples, cage building tools and funds to educate people in new areas of the country. These improvements have reduced kit losses, increased conception rates and improved conformation or physical condition. In 2008, the family rabbit production units averaged 120 rabbits sold (earning $775 U.S.), consumed 41 rabbits and lost 132 rabbits. While there is still room for improvement, these sums are significant for a population in which 75% of the people earn less than $1 U.S. each day. Also, production costs are nearly zero. The initial step-up costs per production unit, which includes a wire cage, two female rabbits, one male rabbit, water bottle nipples, group training (including meals, transportation, etc.) and follow-up visits by a trained technician, are about $200 U.S.

The current focus is on reaching out to people in new areas and educating more producers in other villages as supplies become available. Students showing natural leadership tendencies are identified and encouraged to become trainers. Marketing rabbit meat is the next major focus that we will venture into. In 2008, restaurants made up 23% of rabbit meat sales; hotels accounted for five percent, and private families were responsible for 72%. In the future, we plan to increase sales to hospitals, restaurants and hotels through chef demonstrations and promotions.

Reported by Myriam Kaplan-Pasternak, D.V.M.

MODULE 8

DISEASE CONTROL

The Learning Guide

Learning Objectives

By the end of this session, trainees will:

- Identify healthy and unhealthy signs in rabbits
- Identify prophylactic measures for controlling disease
- Be familiar with different disease groups
- Be familiar with the guide to disease diagnosis and treatment chart

Terms to Know

- Autopsy
- Coccidiosis
- Enteric diseases
- Enterotoxemia
- Mange
- Morbidity
- Parasitic diseases
- Pathogen
- Prophylaxis (prophylactic)
- Reproductive diseases
- Respiratory diseases
- Sanitation
- Snuffles
- Sore hocks
- Vaccination (vaccinated)
- Viral diseases

Recommended Demonstrations

- Observe signs of healthy and unhealthy rabbits on a farm(s).
- Observe clear cases of ear mites or other common diseases.
- Inspect a liver(s) from a healthy rabbit and from one that had signs of coccidiosis.

Training Group Discussion and/or Take Home Assignment

- Why is prevention rather than treatment a better approach to disease control? Discuss farmer practices that can prevent many diseases. What diseases are common to the region?
- Review the five disease groups as presented in this module. Discuss the common preventative and treatment measures that pertain to each group.

Sample Visual Aid

A HEALTHY VS AN UNHEALTHY RABBIT	
Appetite	Good feed intake vs decreased to none
Behavior	Alert and active vs dull and inactive
Body Blemishes	No external signs vs abscesses and discharges
Body Weight	Good size for age vs loss of weight
Bowel Movements	Normal feces vs diarrhea
Fur Condition	Soft and glossy vs rough and dull
Respiratory	Normal Breaths vs rapid/mucus from nasal

MODULE 8

DISEASE CONTROL

The Lesson

A disease condition can be defined as a state of abnormal health. However, it is sometimes difficult to determine whether a rabbit has normal or abnormal health. It is not uncommon for a rabbit to appear in the best health one day, only to be found sick or even dead the next. However, this situation is true of all livestock. For some diseases there may be little warning, for others the signs may linger for some time. Some signs are common for several diseases, but each has different causes and sometimes even different treatments.

Fortunately, the rabbit is basically a healthy animal when the farmer consistently carries out simple disease preventative measures. Unlike the more common livestock species, in general, rabbits are not routinely **vaccinated** for certain devastating diseases, nor are medications required on a preventative (**prophylactic**) basis in order to maintain good health. The purpose of this module is to emphasize practical prophylactic measures and/or simple treatments that the farmer can use to control diseases in rabbits.

SIGNS OF HEALTH IN RABBITS

A healthy rabbit appears active, alert and is in good body condition. A good manager regularly inspects each rabbit. The rabbit should normally be responsive to the manager, for example, hopping to or back from the gate or possibly into the nestbox, waiting eagerly at the feeder, and stomping the hutch floor to communicate to other rabbits.

A healthy mature rabbit consumes 400 to 500 g of fresh forage per day, has normal bowel movements, drinks 120 ml of water per kg of body weight per day, has a body temperature of 38.9°C (102.1°F), takes about 46 breaths and has 205 heartbeats per minute.

SIGNS OF DISEASE IN RABBITS

A well-managed rabbitry should seldom experience serious losses from disease. This is because disease incidence can be kept to a minimum through sound preventative measures. Here it is critical to be able to recognize early signs of health problems. Early signs of disease include: decreased feed intake; loss of body weight; inactivity or lethargy; dull appearance; rough coat; diarrhea; rise or drop in body temperature; labored breathing; weak pulse, and external wounds. A good manager takes immediate and proper action in responding to the early signs of poor health or injury in a rabbitry.

DISEASE GROUPS

Most diseases can be organized into six groups: digestive, parasitic,

reproductive, respiratory, skin, and viral. In addition, there are certain conditions that are at the behavioral level that appear in Table 8.1: "A guide to disease diagnosis and treatment" that appears at the end of this module. This approach of organizing disease groups can enhance the farmer's understanding of disease control management.

Digestive diseases

This group of diseases affects the organs of the gastrointestinal tract, especially the cecum, intestines, and the liver. Mucoid enteropathy generally refers to **enteric diseases** (entero - meaning intestinal). Signs of intestinal disease may include diarrhea or a clear, mucus-like, gelatinous stool; decreased feed appetite; weight loss; depression or lethargy; bloating; sub-normal temperature; rough coat; dehydration; and teeth grinding. Affected fryers may continuously act thirsty at the water source (sign of dehydration). **Coccidiosis**, a parasitic disease group, shares several of these same signs.

A faulty diet or **sanitation** problem is usually the cause of intestinal and/or cecal ailments. Feeding a diet high in energy and low in fiber often leads to constipation, resulting in most of the signs of disease (refer to Feeds and Feeding module). This type of diet, or the effect thereof, may cause harmful microbial changes in the intestines and cecum, or hindgut. In fact, numerous microorganism species dwell in the hindgut. Some microbes are beneficial to the rabbit while others are pathogenic or disease-causing.

A specific enteric disease called **Enterotoxemia** (commonly known as overeating disease) often causes profuse diarrhea (sometimes even sudden death within 12 to 24 hours time without diarrhea signs) due to the production and release into the bloodstream of lethal toxins produced by microbes, usually bacteria (*Clostridium perfringens*). Feeding hay when the problem is first observed is the most practical way of providing short-term relief. Treatment with antibiotics (e.g., oxytetracycline) in the water can also be effective, if feasible. However, one problem with the use of antibiotics is that besides killing the undesirable microbes that are the cause of the disease, even the desirable microbes that are beneficial to the rabbit may be killed off, which can result in death of the rabbit. The best measure is prevention by feeding a proper diet that is high in fiber and low in grain content.

There are two enteric diseases that are especially difficult to treat successfully: epizootic rabbit enteropathy (ERE) and rabbit colibacillosis. These diseases have mostly been reported in Europe, but can potentially occur in any environment. The definitive cause of ERE is not well understood, whereas rabbit colibacillosis is caused by E. coli. However, like most enteric diseases, young rabbits after weaning are most susceptible, and signs are similar as observed for other enteric diseases. Treatment with use of antibiotics is not always effective. Again, proper feeding and sanitation practices must be emphasized. A good reference for detailed information

is the book *Recent Advances in Rabbit Sciences* (Maertens and Courdert, editors), which is included in the list of General References.

Parasitic diseases

Parasitic diseases mainly are coccidiosis, ear and skin **mange**, other skin disease and tapeworms. A coccidiosis infection is due to a protozoan parasite. Several species of this parasite are found in the rabbit, but only one species that invades the bile duct and liver is of real concern. Common signs of coccidiosis include lack of appetite, weight loss and diarrhea. However, these observed signs are common to other diseases as well. The best way to confirm or diagnose the disease is to examine the liver for white spots (indicative of damage due to coccidia). This disease is transmitted through the ingestion of feces infested with immature coccidia. Hard feces (as opposed to soft feces which are normally consumed at night) should always fall through the floor of the hutch, or be removed within a 24-hour period. This will effectively break the disease cycle. A coccidiosis outbreak is often the result of poor floor design and/or sanitation.

A number of sulfa-based drugs (e.g., amprolium and sulfaquinoxaline) may be used to treat coccidiosis, but these should not be given on a preventative basis. Coccidiostats used for treating poultry are often used for rabbits, but may not be approved by the government for use in rabbits. These medications can usually be added to the feed or water source. For example, sulfaquinoxaline can be administered at the rate of 1 g per liter of drinking water. Precautions should always be taken to properly follow dosage rate and treatment and withdrawal period instructions.

Ear and skin mange are caused by external parasites called mites. Ear mange is more prevalent than skin mange, and is due to a different mite species. A crusty or scab-like build-up is first seen inside the base of the ear. This is the best time to treat the disease; otherwise, the mites will quickly spread throughout both ears. Since mites travel from one rabbit to another, it may be wise to treat all mature stock at the same time. Most any oil source (e.g., mineral, clean engine and vegetable) is effective in drowning the mite. A simple solution is to mix 4 parts of oil to 1 part of iodine.

Skin mange, also called sarcoptic mange, is usually observed in poorly managed rabbitries with sanitation issues. Signs include a rough coat and hair loss and reddening or inflammation of the face (around the nose, eyes and ears) and on the neck or back. The common ear mite will usually not cause these signs, so skin mange should be suspected. If practical, the affected stock could be dipped in a 0.5% malathion solution. This disease is difficult to treat, and many remedies have been attempted. As a last resort, a slaughter and burning policy may be used. Good sanitation and quarantine practices may minimize the likelihood of spreading this disease. However, prevention is the key.


S.D. LUKEFAHR

Mange of the ears.


S.D. LUKEFAHR

Mange of the skin of the face.

Abscesses, ringworm and **sore hocks** are examples of diseases that afflict the dermis or skin. Abscesses, as well as wry neck and conjunctivitis (weepy eyes in young kits), are oftentimes due to a pasteurella infection. The same prophylactic measures discussed in this section apply here. The wound may be cleaned with iodine or an antiseptic solution. Ringworm, also called favus, is characterized by circular losses of hair, leaving crusty sores on the body. This fungal disease is highly contagious. Young rabbits are the most susceptible. Ringworm can be spread from humans to rabbits, or vice versa. Measures of prevention are limited. Treatment is simple: application of iodine to the affected sores. If the entire herd is involved, it may be necessary to consult a community animal health worker or a veterinarian.

Another skin condition is sore hocks, which is a common malady of rabbits raised on wire floors. The abrasive and rigid wire surface can wear the fur from the foot pad. Bacterial and fungal organisms can further complicate the problem by infecting open sores. A mat, rug or plywood section (about 600 cm^2 area) will provide temporary relief. For heavy breeds of rabbits, a flat board or mat could serve as a preventative measure. The most effective long-term genetic strategy is to select replacement stock with thick fur density on the foot pads, as this is a heritable characteristic.


J.I. MCNITT

A rabbit with sore hocks.

Tapeworm infestation like skin mange is not a common problem and is usually observed in rabbitries with poor sanitation. Signs are similar to those observed for coccidiosis. Contamination from dog feces may cause tapeworm in the rabbitry. The rabbit is the intermediate host for the dog tapeworm (*T. pisiformis*). Dogs should not be allowed to enter the rabbitry where the equipment, feed or water supply might become contaminated.

The problem can largely be prevented through proper feeding and sanitary practices. There is no practical treatment for this disease.

Reproductive diseases

Mastitis, metritis, orchitis, pregnancy toxemia and rabbit syphilis are **reproductive diseases**. Mastitis is a bacterial infection of the mammary or milk glands. The hutch or nestbox can become infested, usually due to poor sanitation in herds with a major mastitis incidence. The glands first become inflamed (hot to the touch) and later become abscessed. The doe may show little interest in feeding, and may refuse to nurse the litter because of the pain involved. The most effective treatment is penicillin injection (1 cc), but for the average farmer this may not be affordable or available. Instead, the farmer could wash the wound with an iodine or antiseptic solution. If the case reappears, it is best to cull the doe; her offspring should not be saved as replacements.

Metritis and orchitis are infections of the uterus and testicles, respectively, usually due to Pasteurella bacteria. The disease is highly contagious and there is no effective cure. The uterus and testicles may be swollen or abnormally large in size, and an elevated temperature may be detected. The doe may discharge pus in her urine. Every time an infected rabbit breeds, its mate can become infected. Does discharging pus in the urine and bucks with an unusually enlarged testicle(s) should be promptly culled from the herd. This timely measure will minimize this problem. Proper sanitation practices can also help reduce the incidence of metritis and orchitis.

Pregnancy toxemia is also known as ketosis in other livestock species. Although not usually a common problem for subsistence rabbit producers because it involves overweight does, the outcome is often death. A doe normally begins to reduce her feed intake prior to kindling. If a doe is obese, her body fat is used for supplying energy. In this metabolic process certain compounds known as ketone bodies are released into the bloodstream, which are toxic to the doe. These toxins interfere with normal function of the liver. Prior to death, the doe may abort and later go into convulsions or a coma. An **autopsy** reveals a yellow-colored liver. This disease can largely be prevented through proper feeding management.

Rabbit syphilis, also known as vent disease, and spirochetosis, another bacterial condition, are two more reproductive diseases although they are relatively uncommon. Swelling, irritation, scab formation and blisters usually appear on the genitalia or vent region. Infected stock may have reduced fertility. This is a contagious disease. A veterinarian can confirm the disease by identifying the **pathogen** (a spirochete) under a microscope. The disease can be eliminated by penicillin injection. Use of broad-spectrum antibiotics might be effective, as well. Affected stock should not be bred unless the signs have vanished for some weeks.

Respiratory diseases

Snuffles and pneumonia are two specific **respiratory diseases**. The general disease name is pasteurellosis, after the common bacterial organism. The lungs and/or upper respiratory tract are infected. Signs may include nasal discharge (pus-like substance); labored breathing; bluish-colored lips, ears and eyes in albinos; and a posture where the head is tilted back. The rabbit is deprived of sufficient oxygen due to fluid accumulation in the lungs. These signs are in response to the pasteurella organism, poor environmental conditions, or both. A highly productive or stressed rabbit is especially vulnerable to pasteurellosis. The farmer should know that the Pasteurella organism, once prevalent in respiratory tissues due to poor ventilation, can spread to other areas of the body leading to other infections (e.g., metritis and orchitis).

Pasteurellosis is a highly contagious disease. Mortality incidence can be alarming if prophylactic measures are not strictly followed because there is no effective cure for pasteurellosis. The best measures are a proper housing environment, strict culling of infected stock and good sanitation.

Improper airflow or drafts, high air ammonia, high humidity (over 75%) and fluctuating temperature levels can pose a serious threat to the respiratory health of the herd, especially if an oversized building with solid concrete floors is used. Narrow buildings or sheds facilitating good ventilation, particularly in hot and humid regions, are essential to control pasteurellosis (refer to Housing and Equipment module).

Viral diseases

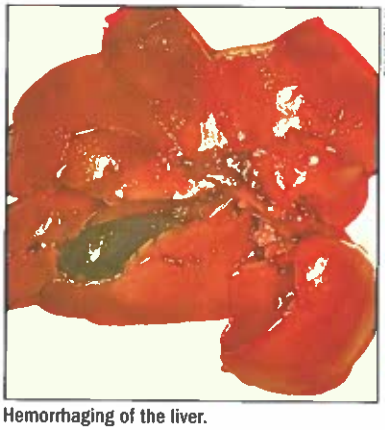
Viruses cause myxomatosis and viral hemorrhagic disease (VHD), also known as Rabbit Calcivirus Disease (RCD). These are potentially devastating diseases; fortunately, most rabbit farmers may never experience either disease. These two diseases can be distinguished visually in that for Myxomatosis there is extensive swelling of the ears, eyelids and lips and also redness of the eye. For both diseases, signs include: an elevated temperature (>40.5°C); drop in feed intake; convulsions; and sudden death. For VHD, hemorrhaging of the internal organs is evident.

Wild rabbits (reservoir) may harbor the myxomatosis virus, but the disease is often spread to domestic rabbits (host) by mosquitoes (vector). Preventative measures and treatment measures are limited. A veterinarian can confirm the disease based on the above signs, as well as through histological findings using a microscope.

VHD is a recent disease and was first reported from China. In addition to the above signs, massive hemorrhaging of internal organs (e.g., kidneys, liver and spleen) is observed upon autopsy. VHD has a high **morbidity** rate, spreading rapidly through the herd. Cases may range from mild to acute

to pera-acute forms; in the latter case all rabbits die from the disease. Breeding stock should not be imported from countries or regions known to have a VHD problem. Rabbits that suffer from VHD or myxomatosis should be destroyed and the carcasses should be burned or buried. In some European countries a vaccine is available and is routinely used by rabbit farmers for both myxomatosis and for VHD.

Rabbits showing signs of Viral Hemorrhagic Disease (also known as Rabbit Hemorrhagic Disease, RHD): blood on the nose of a rabbit that died suddenly.



Hemorrhaging of the liver.

Hemorrhaging of lungs.

The following table describes how to use a health care guide for identifying diseases in rabbits. However, common health problems and treatments may differ by region. Always consult local animal health professionals.

DISEASE DIAGNOSIS AND TREATMENT

Table 8.1. A guide to disease diagnosis and treatment

HEALTH PROBLEM	COMMON CAUSES AND CHARACTERISTICS	OTHER SIGNS	PREVENTION	TREATMENT
In this column, a common clinical sign of disease, or a common problem, will be listed such as: · Abnormal behavior · Digestive · Parasitic · Reproductive · Respiratory · Viral	In this column, the diseases or conditions that may cause the sign or health problem in column one will be noted. Remember that in your area there may be other causes of health problems that are not listed here.	This column lists most of the signs of the disease. Your rabbit may not have all the signs, but only some of them. Observe your animal very carefully to determine all of the visible signs of the disease. Then use this column to help make the correct diagnosis.	Here are the suggestions for good management, which will help prevent the disease. Remember it is always less expensive and more effective to prevent a health problem than to treat one.	There may be alternative treatments for each of these conditions. While it is always good to consult an animal health worker or veterinarian, this may not be possible in remote areas. Local remedies and local knowledge healers can sometimes be of great assistance.

(Adapted from the Heifer International book: Raising Goats for Milk and Meat)

HEALTH PROBLEM	COMMON CAUSES AND CHARACTERISTICS	OTHER SIGNS	PREVENTION	TREATMENT
Abnormal Behavior	**Broken back** · Physical injury	· Paralysis · Dragging of hind legs · Filthy vent area	· Avoid sudden fright in rabbits	· No treatment · Culling of affected animals
	Buck teeth (Malocclusion) · Cause is usually genetic	· Over-grown teeth · Problems eating	· Inspect teeth in replacement animals	· Clip teeth to normal length with pliers, but eventually cull animal
	Cannibalism · Several possible causes, such as poor diet or sanitation, or sudden fright	· Doe kills and sometimes eats the offspring, usually at birth	· Good quality diet · Proper sanitation · Calm environment	· Does should be culled if practice is repeated
	Dystocia · Difficult birth, usually involving a doe that is late or several days overdue in kindling	· Delivery of large-sized kits, sometimes over 100 g, from small litters (less than 4 kits)	· Not possible to prevent	· Cull does that consistently produce small litters
	Splay leg · Cause is usually genetic or may be due to an injury	· Legs that bow out abnormally	· Select for sound leg structure in replacement animals · Proper cage flooring	· Cull animals with this defect, consume or sell for meat
	Wry neck · Cause is usually a bacteria (Pasteurella) that has infected the inner ear	· Twisting of the neck in a side-ways posture	· Same measures as shown for Pasteurellosis	· No effective treatment · Culling of affected animals
Digestive Diseases Common to growing rabbits soon after weaning	**Enterotoxemia** · Caused by a bacteria, *Clostridium perfringens*, which proliferate on low fiber, high energy diets	· Dehydration · Poor appetite · Diarrhea · Enlarged cecum · Death within 12 to 24 hours	· Provide a high fiber diet · Limit grains in the diet	· Give fine-stemmed hay or fibrous forages · Antibiotics may have limited effectiveness
	Epizootic Rabbit Enteropathy · Cause unknown	· Bloating · Poor appetite · Watery feces · High death losses	· Batch breeding system · Strict sanitary measures	· Bacivet · Tiamulin · Zinc-bacitracin
	Rabbit Colibacillosis · Caused by a bacteria, *Escherichia coli*	· Weight loss · Poor appetite · Dehydration · Diarrhea · Hemorrhages on linings of the cecum and intestines	· Minimize weaning stress, such as removing the doe rather than the litter from the rearing cage	· Antibiotics may have limited effectiveness

HEALTH PROBLEM	COMMON CAUSES AND CHARACTERISTICS	OTHER SIGNS	PREVENTION	TREATMENT
Parasitic Diseases	**Coccidiosis** · Caused by a protozoa, *Eimeria stiedae*	· Small white spots (micro-abscesses) on the liver · Diarrhea · Weight loss	· Daily cleaning of cage floors · Cage floors that allow for feces to immediately fall to the ground	· Amprolium · Monensin sulfate · Sulfa-quinoxaline
	Ear mange · Caused by a mite, *Psoroptes cuniculi*	· Crusty, scab-like matter inside the ear	· Good sanitation · Routine application of an oil solution to ears of all adult rabbits	· Oil solution drops to the ears · Ivermectin (200 micrograms/kg body weight)
	Skin mange · Caused by a mite, *Sarcoptes* species	· Rough coat and hair loss · Inflammation of the face (around the nose, eyes and ears) and on the neck or back	· Good sanitation · Routine application of an oil solution to skin of all adult rabbits	· Dipping rabbit in a 0.5% malathion solution
	Ringworm · Caused by a fungus, *Microsporum* or *Trichophyton* or genera	· Circular patches on body devoid of fur	· Proper sanitation	· Iodine · Griseofulvin (5.5 milligrams/kg of body weight
	Sore hocks · Cause may be due to genetics, poor floor design, or a foot infection	· Loss of fur on the foot pads · Lesions or scabs may be evident	· Select replacement animals with thick fur of the foot pads · Smooth cage floors · Provide a flat board for the rabbit	· Apply iodine or ointment
	Tapeworms · Caused usually by *Taenia pisiformis*	· Destruction of liver · Cysts containing larvae found in abdomen · Diarrhea · Weight loss	· Proper sanitation · Keep dogs away from forage plots and from rabbitry	· Medications used for other livestock species although treatment may not be practical
Reproductive Diseases	**Mastitis** · Caused by infection of the milk glands, usually a bacteria is involved	· Swollen udder · Hot to the touch · Pain · Poor appetite · Abscessed with pus	· Strict sanitation · Good ventilation	· No effective treatment · Culling of affected animals
	Metritis · Caused by a bacterial infection, usually Pasteurella or Staphylococcus, highly contagious	· Swollen uterus · Pus discharge from vent · Sometimes an elevated temperature	· Strict sanitation · Good ventilation	· No effective treatment · Culling of affected animals

HEALTH PROBLEM	COMMON CAUSES AND CHARACTERISTICS	OTHER SIGNS	PREVENTION	TREATMENT
Reproductive Diseases (Continued)	**Orchitis** · Caused by a bacterial infection, usually Pasteurella, highly contagious	· Enlarged testicle(s) · Sometimes an elevated temperature	· Strict sanitation · Good ventilation	· No effective treatment · Culling of affected animals
	Pregnancy toxemia · Cause is a metabolic condition involving rapid breakdown of body fat	· Obesity · Abortion · Poor appetite · Convulsions · Yellow-colored liver	· Avoid over feeding or fattening of breeding stock	· In some cases, an oral dose or injection of glucose may be effective
	Syphilis · Cause is a bacterial infection, also called Spirochetosis, contracted during mating	· Abortion · Swelling of testicles · Blisters or scab formation	· Prevent contact with affected animals as condition is highly contagious	· Penicillin
Respiratory Diseases	**Pasteurellosis** · Caused by bacteria, Pasteurella, commonly called "Snuffles", prevalent in rabbitries with poor ventilation	· Labored breathing · Sneezing · Head tilted back · Bluish-colored lips, ears, and eyes in albinos · Nasal discharge of pus	· Good ventilation reflecting proper housing design · Condition is highly contagious so infected animals should be culled	· No effective treatment · Culling of affected animals
	Pneumonia · Usually caused by bacteria, Pasteurella	· Same signs as shown above for Pasteurellosis · Fluid in lungs	· Good ventilation reflecting proper housing design	· No effective treatment · Culling of affected animals
Viral Diseases	**Myxomatosis** · Cause is a virus, often spread by mosquitoes · Wild rabbits may also serve as a vector	· Elevated temperature (>40.5°C) · Extensive swelling of the ears, eyelids and lips · Redness of the eye · Drop in feed intake · Convulsions · Sudden death	· Difficult to prevent · Seasonal when mosquitoes are present, so placing screens may help, if practical · Spraying with insecticides · Prevent wild rabbits from entering the area · Vaccination	· No effective treatment · Culling of affected animals
	Viral Hemorrhagic Disease (VHD) · Cause is a virus	· Similar signs as shown above for myxomatosis · Hemorrhaging of internal organs, such as the intestines, kidneys, liver, and spleen	· Avoid importation of stock from countries with VHD · Quarantine of animals showing signs · Vaccination	· No effective treatment · Culling of affected animals

STORY FROM EL SALVADOR

Rabbit Production – Large and Small

This project was started to assist in development of a rabbit industry in El Salvador by providing training and assistance to farmers, students and other technical persons. The main goal was training participants to build cages entirely of welded mesh wire. Because of the shortage of lumber and its resulting high cost, these cages, at about $9 U.S. each, are more environmentally friendly and less expensive than those constructed of lumber, chicken wire and hardware cloth.

Several formal training sessions were presented in various locations and to diverse groups. Topics included an introduction to rabbit production, housing, diseases, genetics, a hands-on cage building training session, practice in rabbit processing and a round table discussion.

In the first year of the program, Juan Carlos, the Secretary/Treasurer of the rabbit producer's association who had no rabbits, listened avidly and took copious notes. At one point during a field trip, he pointed out a location on a nearby hillside that he said was his farm. A year later he had a farm in operation with 200 producing does and was selling 100 to 150 dressed fryers each week to four stores in one of the supermarket chains. He was paid $1.90 U.S. per 0.45 kg while the store sold the whole carcasses for $2.45 U.S. per 0.45 kg. All of his rabbits are in all wire cages and are fed the local feed (which costs $7.50 U.S. per 45 kg) mixed half and half with Purina feed from Guatemala ($10.45 per 45 kg). He says the quality of the local feed is insufficient to maintain the level of production that he needs but the cost of the feed from Guatemala is too high for him to make a profit.

On the other end of the scale, Don Concepcion in Tamasha has about six breeding does. He participated in training sessions and learned about using local green feeds for his rabbits. He and four other farmers in the area sell rabbits to a restaurant at the entrance to El Impossible National Park. They sell about 16 rabbits producing 0.9 kg to 1.8 kg carcasses each month at $2.30 U.S. per 0.45 kg. If they have rabbits they can't sell, they eat them. They like to use the commercial feed, but when they feed it as a sole diet to all the rabbits, the sales cover the cost of their feed but do not leave enough money to buy more cages and expand their production. They felt the commercial feed was necessary because it helped their litters to survive. To keep the feeding value of the commercial feed while making the feeding regime affordable, they now use the commercial concentrate for the does but finish the fryers on green feeds and milo. This has allowed them to make a profit and consider adding more cages and breeding does.

Rabbits being fed banana leaves in an all wire cage

Breeder barn with Californian and New Zealand White does at Granja don Bosco

Rabbits feeding on Hibiscus flowers and leaves.

Story contributed by James I. McNitt, Ph.D.

MODULE 9

MANAGING THE RABBITRY

The Learning Guide

Learning Objectives

By the end of this session, trainees will:

- Be familiar with the different elements of rabbit production and how they work together for proper rabbitry management
- Understand the importance of proper record keeping
- Be familiar with proper handling techniques
- Identify ways to manage temperature stress
- Be familiar with proper sanitation practices

Terms to Know

- Labor resources (human factor)
- Quarantine
- Scattering
- Temperature stress

Recommended Demonstrations

- Demonstrate proper hutch and equipment sanitation.
- Show how to correctly handle small and large rabbits.
- Visit a well managed farm to demonstrate how good records (e.g., performance and health, financial and meat consumption records) benefit the enterprise.

Training Group Discussion and/or Take Home Assignment

- If either cold or high temperature stress on rabbit fertility and/or survival is a problem in your region, discuss the various ways of minimizing this problem through good management.
- Discuss the importance of quarantine in protecting a farmer's stock from diseases. Testimonies can be given from farmers visited who had disease problems caused, in part, by lack of quarantine measures.
- Make a list of the many management skills that can improve reproduction and marketing success. Emphasize that these skills require months, even years, to effectively develop.

Sample Visual Aid

PROPER HUTCH SANITATION MEASURES		
1	Prepare disinfectant solution	Follow instructions carefully
2	Remove rabbits from hutches	Place in clean hutches or baskets
3	Dry brush hutch and equipment	Remove all debris and wastes
4	Apply disinfectant solution	Set for one hour or more
5	Rinse hutches and equipment with water	Wash away disinfectant
6	Once dry, return rabbits	Provide fresh feed and clean water

MODULE 9

MANAGING THE RABBITRY

The Lesson

How can meat rabbit production most benefit the family when limited resources exist? Following training, the farmer will apply his/her new knowledge to the management of basic on-farm resources, as well as capital and labor. **Labor resources** address the human factor, the most important of the three basic resources that involve planning and decision making, but also the role of shared family labor. Good management skills take years to develop. Land or environmental resources (e.g., land space, feed and water sources, and natural materials for hutches and equipment) reflect the whole farm unit. If a rabbit operation is to be sustainable it must be largely, if not entirely, supported by the farm. Realistically, this will take time to develop, but it is still a meaningful goal.

Another approach to management entails a focus on the separate rabbit production elements—environmental, genetic, health, nutritional and reproduction—but also on how they should be integrated through management. The manager's decision on choice of housing, breed, diet and breeding cycle will affect the level of production. An imported breed, for example, may require a special diet and management skills beyond the capabilities of the rural farmer.

The human element must also be considered. Will a high demand for family labor, during times of planting and harvest, interfere with labor requirements to manage even a small-scale rabbit operation? This module will address special problems or real-life situations posed by these basic elements, including labor and on-farm resources, from a management perspective.

ENVIRONMENTAL MANAGEMENT

The important role of proper conservation management of farm resources is discussed in the Whole Farm Integration module. Special problems involving environment include alleviating or even preventing high and cold **temperature stress** and infertility by use of artificial lights.

High temperature stress reduces fertility, as well as general growth and reproductive performances. Prolonged exposure to high temperatures in excess of 30°C often results in buck fertility problems. The buck may mate readily and service the doe, but pregnancy does not occur. Poor ventilation and high humidity can aggravate the problem.

Through management, there are various ways of minimizing the adverse effects of high temperature stress on rabbit performances. These measures include, for example: using young, more active bucks (6-9 months of age); mating early or late in the day when ambient temperatures

are coolest and when mating activity is greatest; providing ample shade and ventilation; supplying cool drinking water; soaking the ground below the hutches for evaporative cooling; and inserting dampened cloths or burlap sacks in the hutches. Several of these measures may be combined for more effective relief. In extreme cases, such as in arid environments, rabbits may be allowed to burrow underground (refer to Housing and Equipment module).

In contrast, in very cold climates it is a traditional practice (e.g., Poland and Russia) not to breed rabbits during the winter months. The rationale is because quality feeds are not available and because newborn kits are highly vulnerable to cold exposure. Instead, the focus is to rear the rabbits in hutches on deep straw inside of comfortable barns that are dry and free from drafts. Sometimes even mature does are placed together in one large hutch, which is acceptable so long as the does do not fight. The mature rabbits would only be fed a less nutritious, maintenance diet, using feedstuffs such as hay, stored vegetables and kitchen scraps.

In the Mediterranean region where the rabbit evolved, the least fertile season is the winter because of the shorter daylight period. This is of little concern in equatorial regions. In enclosed rooms or buildings, artificial lights or lamps may be needed. The artificial light period could either be maintained to that of the longest day in a year, or to a 16:8 hourly light-to-dark period. For more consistent herd results, the light source should be distributed uniformly over the stock. Fluorescent tubes are more energy efficient than standard incandescent bulbs or lights and are ideal. The minimum level of luminosity should be 30-40 lux. This practice can contribute significantly to steady year-round reproduction in temperate regions.

GENETIC MANAGEMENT

The breeding stock is the basis of production success. Basic record-keeping, using simple pedigree and production forms (shown in Genetics and Selection module), are good management tools of selective breeding. With these records, the farmer can identify the best parents to save offspring as herd replacements.

The farmer may be illiterate, but children attending school may be assigned the duty as record keepers. During the rabbit training course, the importance of keeping basic records must be emphasized. Otherwise, even literate farmers may tend to be reluctant to maintain records. It does take an understanding of the usefulness of records, and some discipline, to maintain good records.

In terms of genetic management, inbreeding usually occurs when either poor or no pedigree records are kept. The use of the same buck is over-

extended to involve mating to his own daughters, for example. Too, the farmer may be ignorant on the adverse effects of inbreeding such as a decline in fertility and health. Farmers keeping good records should simply exchange unrelated and healthy bucks, at least once a year.

It is useful to individually identify rabbits. This will avoid confusion in record-keeping. Methods of permanent identification include ear tattooing, ear notching, and use of ear rings or tags (metal wing bands). A clean needle and ink can be used to tattoo. After using the needle to mark the unique identification code in the ear, ink is rubbed in with cotton or a cloth. Such permanent identification is preferred over numbering hutches or writing on cards that are attached to hutches or outside feeders. However, both identification systems may be used together.

HEALTH MANAGEMENT

There is no substitution for close daily observation of the stock for early detection of signs of disease. Of foremost importance the farmer must be familiar with his stock. Each rabbit behaves differently. When a rabbit is sick, its behavior will change. It will be less active and responsive to the manager. Feed and water intake will be reduced. Usually, these are the first clues of an oncoming disease.

Some examples of signs of disease include diarrhea, scratching of the ears (ear mites), loss of fur on the foot pads (sore hocks), and rapid breathing (pneumonia). The farmer should know that diarrhea is not a disease, but rather is a sign of a specific disease, such as Coccidiosis or Enterotoxemia. Discharges under the hutch (e.g., mucus, puss, bloody or runny stool, and aborted kits), are additional warning signs that should be looked for on a daily basis. Through practical training and/or experience, the manager will improve upon the skills necessary to readily identify an early disease sign so that prompt treatment can be applied to prevent a small outbreak from becoming a major one (see Disease Control module).

Two important areas of health management include quarantine and sanitation. **Quarantine** is a measure of protecting a herd from a disease introduced from new stock, such as pasteurellosis and skin and ear mange. Quarantine involves establishing an isolated or holding area for new stock, well away from the main rabbitry, ideally in a separate shed or building.

The new stock is observed for disease signs daily for about a two-week period. These observations and the care and feeding of the new stock should be done by one person and only after working in the main rabbitry. This is because people can carry disease organisms from infected to healthy rabbits. Other persons should not enter the quarantine area. The new stock should be handled only when necessary. Following the two-week period, if the new stock appears healthy they may be introduced into

the main rabbitry. However, quarantine also involves animals from within the existing herd, such that any suspect animal is promptly moved and is placed into an isolated area for close observation and possible treatment.

Sanitation practices also ensure proper health management of the herd. Cleanliness and proper feeding are the two most practical and cost-effective ways of disease prevention. Daily chores (preferably done in the morning) should consist of removing feed wastes and bedding and carrying these materials to the compost pile, well away from the rabbitry to minimize fly-related problems. Then, hutches, feeders and waterers should be thoroughly brushed. Fresh feed and water should be provided to the stock afterward.

Equipment should be sanitized on a regular weekly basis. A clorox solution (1 ml per liter of water) makes an excellent disinfectant solution, as does Cresyl and Izal commercial products. Proper sanitation steps are highlighted in the learning guide of this module.

NUTRITION MANAGEMENT

In terms of land resource utilization, the farm should provide most, if not all, of the feedstuffs required to support rabbit production the year-round. This requires sound planning. For example, during the most favorable season of feed availability, surplus feeds should be harvested and processed, and then stored as high quality hay for feeding in the dry season (discussed in the Feeds and Feeding module).

Hay-making is a practical approach to forage conservation. After sun-drying, the hay can be stored in bags, bundles, baskets, or be loosely stacked in the eaves of the shelter or compound. A wise farmer will figure on the quantity of feed needed for the dry season.

Another potential form of processed forage is silage. Silage is especially suited for areas with a prolonged dry season. An internet search will provide practical information on the basics of silage making. One reality is that the balance and type of feed resources will shift according to season.

Despite all the best planning, if insufficient feed is available for the dry season, it may be wise to simply discontinue breeding and maintain the stock on a lower plane of nutrition. Once climatic conditions become favorable and adequate feed supplies become available, normal breeding and feeding activities may be resumed.

Since rabbits are basically nocturnal eaters, they will require a larger meal made available in the evening. Because they must be fed and watered daily, during feeding time the farmer should closely observe the stock for changes in health-related behaviors.

REPRODUCTION MANAGEMENT

When handling rabbits one should always be gentle. Quick movements or rough handling can frighten the rabbit, resulting in a struggle that may injure both the rabbit and the handler. One should wear protective clothing when handling rabbits because a struggling rabbit can sometimes inflict deep scratches and bites. Rabbits that are consistently handled gently will result in gentle rabbits.

Open the cage slowly, and gently touch the rabbit before lifting. Never lift rabbits by the ears or legs as this may cause permanent injury. For a medium or heavy weight rabbit, grasp a fold of skin over the shoulder and lift, holding the rabbit against your body with its head under one arm, with your forearm extended along the side of the rabbit and your hand under its rump for support. For a small rabbit or fryer, you may lift and carry comfortably without injury by grasping the loin gently but firmly, with the heel of the hand toward the tail of the animal.

Handling rabbit

Handling rabbit

Reference to breeding management and/or the breeding cycle is made in the Reproduction Module. On a four litter per year cycle, the litter is born after a one-month gestation period and weaned two months later. The doe is re-bred on or near the same day that weaning takes place. The intensity of breeding depends on many factors including market demand, environment, diet, herd health, stock quality, and most important, the managerial ability of the farmer.

Prior to mating, both the doe and buck should be examined for any health problems. During palpation the doe is physically handled. She can be examined again at this time for health problems, such as mastitis, pasteurella or snuffles, sore hocks, and ear mites. These routine examinations of breeding stock are good management practices.

Management of the nest box is critical for reproduction success. The doe first makes a nest from available materials (e.g., hay, leaves, and paper). A few hours before birth she usually pulls her own fur to complete the maternal nest. Shortly after birthing time the farmer should check the doe

to prevent loss from **scattering**, which is when kits are born outside the nestbox. It is also important that the doe forms a central nest in which the kits are all together.

Young does need particular attention. The doe may sometimes scatter the kits outside the nest, or will fail to clean the kits properly. The farmer should check the newborn kits to see if the placenta has all been removed (normally the doe consumes this).

Fostering may be necessary if the doe has more kits than she can adequately feed. A limit of eight or nine kits is reasonable. Excess kits can be given to does with fewer than eight kits assuming that does were bred as a group only a few days apart. Fostering is more successful if the kits are transferred to litters of similar sized kits. If a foster mother is not available, and all kits of a litter are not being fed, the smallest, weakest kits should be sacrificed. Check daily to see if the kits are being fed. Their bellies should be full (like a balloon) and the milk can even be seen through the belly or gut wall. Also check to see that the doe is not defecating or urinating in the nest.

Generally, the kits themselves maintain the nest environment. However, if the weather is unusually cold or hot, the farmer may have to adjust the nest accordingly by adding or removing nesting material. Surplus fur from nests may be collected and stored in bags for later use. When the kits' eyes are open and they begin to leave the nest (about 21 days of age) it is time to remove the nest box from the cage, since it can be a source of contamination. Kits start eating forage by 21 days of age.

Common causes of early litter mortality include poor health, faulty feeding, improper housing, poor mothering ability, lack of water, and predation. Failure to correct a mortality problem when the cause is known is a sign of poor management. Specific causes have been discussed previously. Poor mothering ability is commonly observed as cannibalism. Here, the doe may have been frightened, was provided with an unsanitized nest box, was malnourished, or is just a bad mother (i.e., may be genetic). If feeding, health and housing measures are sound, and the doe repeats to devour or maul her next newborn, the doe should be culled from the herd.

If commercial concentrated feed is available and is justified economically, weaning can be done as early as 28 days. However, under adverse environments and/or subsistence production conditions, this early weaning practice is not recommended. Instead, weaning should be delayed to two months of age. Weaning is usually accomplished by moving the litter to a clean hutch. By three months of age, weanlings should be sexed, males and females being separated into different pens. If fighting is later observed, fryers should be further reduced in number (involving additional

hutches), harvested or sold for breeding or meat at that time. Replacements should be placed individually in hutches by no later than four months of age. In about two months' time or depending on body weight, replacements will be ready for breeding.

PROCESSING FRYERS

Harvesting of rabbits for meat should be performed by a properly trained or experienced person and as humanely as possible. First, only healthy rabbits should be harvested for food. No animal that has died from unknown causes should be used for human consumption. Second, it is important to kill the animal as quickly as practical to minimize anxiety. Ideally, within seconds of being removed from its rearing cage, the rabbit should be stunned. The steps are as follows:

1) Gently hold the rabbit upside down by its rear feet and deliver a quick blow to the neck (directly behind the head) with a short stick. The blow will render the animal unconscious.
2) Slit the throat with a sharp knife to sever the jugular artery. If desired, the blood can be collected for feed to livestock or added to the compost pile.
3) Cut through the skin between the Achilles tendon and leg bone above each rear foot. Then insert a hanging stick through the cuts so as to hang the stick from a rope or wire from which the carcass is suspended.
4) Make a circular cut around the base of each rear leg. Next, make a V-shape cut with the knife from each rear leg to the pelvic or crotch region. Carefully pull the skin away from the rear legs.
5) Take the knife and cut through skin from the crotch to the rib area. Be careful not to puncture the abdomen.
6) Gently pull the skin down over the body to the neck and forelegs.
7) Sever the fore feet with the skin away from the carcass.
8) If it is desired to leave the head with the carcass, gently cut the skin away from the head and cut at the base of each ear. If not, cut through the neck to separate the head from the carcass.
9) Take the knife and open skin from crotch to sternum.
10) Reach into the abdomen and remove the internal organs (bladder, spleen, cecum and intestines).
11) Leave kidneys and kidney fat in the body cavity.
12) While liver is still attached, remove the gallbladder by stripping away from the liver with index finger and thumb.
13) Remove the liver, rinse and place in a clean container. When marketing whole fryers, return the liver to the body cavity before packing and/or sale.
14) Locate the diaphragm. It may be desired to leave the heart and lungs in the chest cavity. If not, cut through the diaphragm and remove the heart and lungs.
15) Thoroughly wash carcass inside and out with clean, cold water.
16) Keep the meat in a cool, clean place away from flies and other contaminants until ready for cooking.

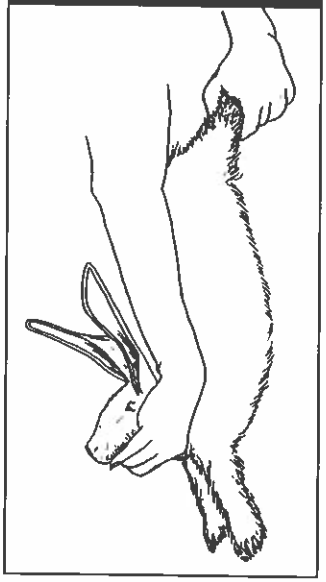


Figure 9.1. Quick and humane method of killing a rabbit

STORY FROM GHANA

Ghana's National Rabbit Project

From the capital city of Accra to northern areas bordering on the Sahel, the catchy jingles sing out from Ghana's radios and television sets. "Get the Rabbit Habit!" "Make the Bunny Money!" "Grow Rabbits, Grow Children." Along the roadways and in public squares, this kind of advice is blazoned across colorfully illustrated billboards and posters.

A highly effective sign that promotes meat rabbit production in Ghana.

The advertisements are part of a nationwide campaign for Ghana's National Rabbit Project, which promotes backyard rabbit breeding as a means of increasing meat supplies at low cost. Though the country now produces all of its own rice and nearly enough corn to meet requirements of its 9 million people, there is still a chronic shortage of meat. When animal products do find their way to market, they are priced far beyond the means of the majority of the population.

The campaign can be credited to the director of Ghana's National Rabbit Project, Newlove Mamattah. Mamattah, a former educator who was interested in rabbit breeding for nearly 40 years, began his work in his own backyard.

In 1972, Mamattah established "Rabbit for Food for the Millions" on a 32-hectare farm at Kwabenya with an initial stock of 80 breeding animals. By the end of 1977, the nation's first national rabbit census counted 13,948 rabbits owned by registered breeders throughout the country.

The development of hybrids yielding more meat was a prime objective of the project. The Swiss government provided 120 rabbits to get Mamattah's project under way, and other exotic breeds came from Australia, Belgium, the Netherlands, New Zealand and the United States. Though Mamattah's project generated much interest, Ghana's Ministry of Agriculture did not give it any support.

But in 1974, Joseph Ascroft, a professor of communications in the School of Journalism at the University of Iowa, arrived. Ascroft came to Ghana as part of a project through the United Nations Development Programme and the UN Food and Agriculture Organization with Ghana's Ministry of Agriculture. One of the first duties was to find projects in need of communications support. Believing in Mamattah and his rabbits, Ascroft persuaded the ministry to focus on the endeavor before tackling other projects to which they were committed.

But Ascroft realized the project would not go very far without the ministry's support.

A scheme was devised to persuade officials to back Mamattah. A reception was held to honor a retiring commissioner of agriculture and welcome his successor. Catering being among the responsibilities of the Information Support Unit, Ascroft asked Newlove Mamattah to prepare some rabbit dishes. When the officials ate the rabbit meat, they dropped any reservations about eating rabbit.

Since then, the project has grown enormously. Now, the call for breeding stock is enormous. Hybrids are sold to farmers only after they have attended a three-day comprehensive course in rabbit breeding and care and following an inspection of their premises. With its limited resources, the National Rabbit Project is unable to keep pace with demand.

Source: Anonymous. 1979. Africa Report. Jan. - Feb. 1979. p.47-48.

MODULE 10

MARKETING RABBITS

The Learning Guide

Learning Objectives

By the end of this session, trainees will:

- Identify ways to help develop local markets
- Identify potential market outlets
- Be familiar with pricing strategies
- Understand the importance of product promotion

Terms to Know

- Demand
- Market price
- Middlemen specialization
- Profitability/Rate of return

Recommended Demonstrations

- Interview a business manager(s) that either sells or at least is interested in selling rabbit meat.
- Visit a central farm (rabbit or poultry) or holding station engaged in collective marketing.

Training Discussion and/or Take Home Assignment

- Invite a marketing specialist to discuss effective marketing strategies that may apply to selling rabbits in your area.
- Make a list of potential market sources. Discuss the sources that would appear to be the most promising.
- Speculate on what method of presentation or recipe would make rabbit meat acceptable by one's family or neighbors.

Sample Visual Aid

POTENTIAL MARKET SOURCES FOR RABBITS		
Cafeterias	Hotels	Restaurants
Farmer Markets	Open Markets	Roadside Vendors
Hospitals/Labs	Private Sales	Schools/Universities

MODULE 10

MARKETING RABBITS

The Lesson

Is there a market for rabbits? This must be the first question raised by a farmer deciding whether or not to start a rabbit enterprise. A real economic incentive should be associated with any alternative agricultural activity. Of course, if the potential **profitability or rate of return** of the rabbitry is not high, many farmers will not be interested. In fact, a good program will conduct a market feasibility study to determine whether a rabbit project is the best solution for the community.

In many countries, stable markets for rabbits or rabbit meat do not exist. The main reason for this is tradition. Because the rabbit was domesticated only about 400 years ago, the dissemination of rabbits to other countries has occurred in only the past few decades.

The market is the link between production and consumption. However, if the market link does not exist, this issue alone should not prohibit an otherwise promising rabbit project from being started. Instead, it will take much effort through good planning, patience, and time to develop a strong market.

Whereas in some countries, market outlets for rabbits are not well developed, it must be emphasized that numerous families benefit from rabbit meat being inexpensively produced on their farm for domestic consumption. Conversely, China is a major exporter of rabbit meat, although the national consumption level is low. In other words, Chinese peasants generally recognize rabbit raising as a lucrative farm activity, not as an important domestic meat source.

This issue may be settled based on the primary goal of the planned or present rabbit project. If the program goal is to reduce protein malnutrition then markets for rabbit meat become a less important consideration. Instead, program emphasis would be on production success and increased consumption of rabbit meat at the household and/or village level. A related objective of the program might be to develop or expand market outlets for rabbits. Marketing points and strategies will be addressed in this module.

DEVELOPING LOCAL MARKET DEMAND

In areas where rabbits are rare or have recently been introduced, it is appropriate to first create a local or rural-based **demand** for rabbit meat. Conducting rabbit training, developing rabbit management competency, and encouraging household consumption of rabbit meat should be the first priorities of the program. If well executed, these activities can serve as demonstration to other families in the village(s) who are not presently keeping rabbits. The best demonstration is to have a rabbit farmer invite

neighbors to share a rabbit meal using a local recipe. Know that any rabbit market begins with serving rabbit meat on the family dinner table.

Later, neighbors can be shown how inexpensive it can be to raise rabbits for meat. When others see how much the family enjoys raising rabbits, how often they eat rabbit meat, and hopefully how the children appear to be healthier, others will want to raise rabbits.

Festive or ceremonial occasions, such as births, graduations and weddings, are usually a good opportunity to surprise guests with tantalizing dishes of rabbit meat. These neighbor-to-neighbor tactics are often highly effective in creating strong awareness and interest in rabbit farming. Soon, rabbits may begin to appear in local traditional markets. Usually live rabbits are brought in baskets so that farmers may barter or trade rabbits for other foods or needed household items.

The local demand for rabbit meat and breeding stock can be developed if well planned. At regular rabbit club meetings, for example, a program on how to develop a local rabbit market for the community can guide farmers. Although some time will be required to develop good demand for rabbit meat in the village, local markets should first be developed before large-scale and/or urban-based marketing activities, or even export markets, are sought.

POTENTIAL FORMAL MARKET OUTLETS

Once the local demand in rural areas is well developed, the project may decide to conduct a market questionnaire or survey in urban areas (Table 10.1). Conducting a good market survey requires careful planning and organization. Various wholesale or retail businesses may be contacted. These could include restaurants, hotels, supermarkets, school cafeterias, street vendors and fresh produce markets. Basic questions may pertain to sales volume (i.e., How many rabbit fryers would you be interested in buying each month?), sales price, potential client (national or foreigner), product form (live or dressed fryer or cut-up and packaged, cooked, etc.) and delivery arrangements.

Women selling rabbits at a local market in Egypt.

Fryers in an open market in Tunisia.

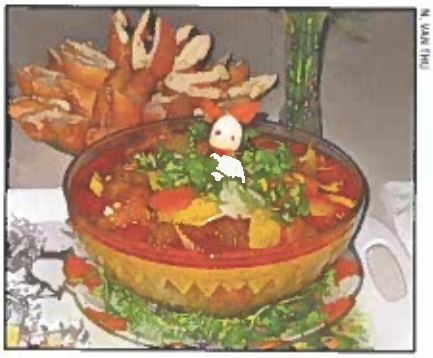
Rabbits being processed at a plant in Vietnam. It is a tradition to consume the skin and head of livestock.

Rabbits are commonly sold by vendors along city streets in Indonesia.

Rabbits being transported by mule and wagon to markets in Argentina.

Children eating rabbit meat at a school cafeteria in the Dominican Republic.

A local stew dish in Cameroon with rabbit meat.



A savory local rabbit meat dish in Vietnam.

A regional rabbit meat dish served at a hotel near Mexico City.

Table 10.1. Acceptance of rabbits and rabbit meat

MEAT	TOTAL	RELIGION		PLACE OF INTERVIEW		
		Christian	Muslim	Household	Breeder	Market
Interviewees	118	54	62	33	58	27
Question: Do you know rabbits?						
Answers	98	39	57	28	45	25
"known"	93	39	52	27	45	21
% of answers	95	100	91	96	100	84
Question: Did you ever try rabbit meat?						
Answers	81	34	47	22	36	23
"tried"	58	28	30	15	36	7
% of answers	72	82	64	68	100	30
Question: Maximum price acceptable for a rabbit?						
Answers	62	31	31	18	36	8
Mean price (FCFA)	1,160	1,157	1,162	1,072	1,306	700

Source: Hoffmann, I.M., S. Kobling, C.-H. Stier, and Chr. F. Gall. 1992. The potential of rabbit meat marketing in Bobo-Dioulasso, Burkina Faso. *Livestock Research for Rural Development. Volume 4(1)*, Retrieved November 23, 2009, from **http://www.lrrd.org/lrrd4/1/hoffmann.htm**.

Once the results are analyzed, a clear determination of the potential demand and/or volume capacity should emerge. If the survey results are not encouraging, perhaps urban-based marketing should be considered at another time. In contrast, if the results are encouraging, then the project should gradually take further steps to establish urban-based marketing. Only a limited number of interested businesses should first be tried. This will allow some time for the project to first organize the rural-to-urban marketing link between producers and consumers. Naturally, there will be problems at first in obtaining uniform fryers from different farms, handling and transportation arrangements, settling on prices, etc., but these can be overcome with time, effort and coordination.

In some cases, for example, a seriously interested hotel business manager might be given one or two fryers to try in the kitchen and serve to guests. The manager will appreciate the gift and the guests are usually delighted by the rabbit meal and will request that it be placed on the menu. The program should also provide simple to prepare rabbit meat recipes to business managers.

MARKETING COORDINATION

On a village basis, farmers may bring their fryers to a central farm or holding station, or have them collected in baskets, boxes or special transport cages from their farms on the same day as scheduled marketing. The **market price** should have previously been agreed upon. The program's market coordinator may arrange for transport to the market destination point(s). Handling of live fryers is obviously more simple and practical than shipping highly perishable dressed meat. Live rabbits can be comfortably transported even over long distances if they are protected from the elements. Food and water should be made available.

Once the business manager receives the fryers, they should be promptly dressed and then properly stored until cooked. The manager pays the previously agreed upon price to the coordinator, who in turn carries payment back to the farmers. It is proper to deduct a reasonable handling and transportation fee from the farmer's cash receipt, based on either the number or weights of rabbits sold. Written records of all business transactions should be kept on file by the program coordinator. It is wise to do business with several firms to reduce risk.

In time, this marketing model can be expanded to include local coordinators (usually rabbit farmers themselves) from several villages where rabbits are produced. Project networking of this nature can be very rewarding to all rabbit producers concerned. It can pave the way for developing a thriving regional rabbit farmer's cooperative.

If large-scale marketing is involved, it may be best to do business on a

contractual basis. This is often mutually beneficial; farmers feel more secure about the market and the business manager is more confident about receiving a steady fryer supply. The manager may request that the fryer's or fryers' weight falls within a limited range, are healthy and free of blemishes, or be custom slaughtered on delivery. In turn, the farmers may receive a better price for the large volume and uniform fryer supply. These developments reflect a growing and prospering industry. A marketing specialist may be hired as a consultant by the program to offer advice in this area.

At this advanced stage of rabbit market development, there may be opportunities for **middlemen specialization** so that fryers may be picked-up from local holding stations or individual farms. This development may encourage large commercial (more than 20 does), intensive production rabbit farms, particularly those located close to the urban marketing outlets. Another advanced activity that may be tried for more widespread consumer appeal is the development of rabbit meat products, such as frankfurters, hams, jerky and sausages.

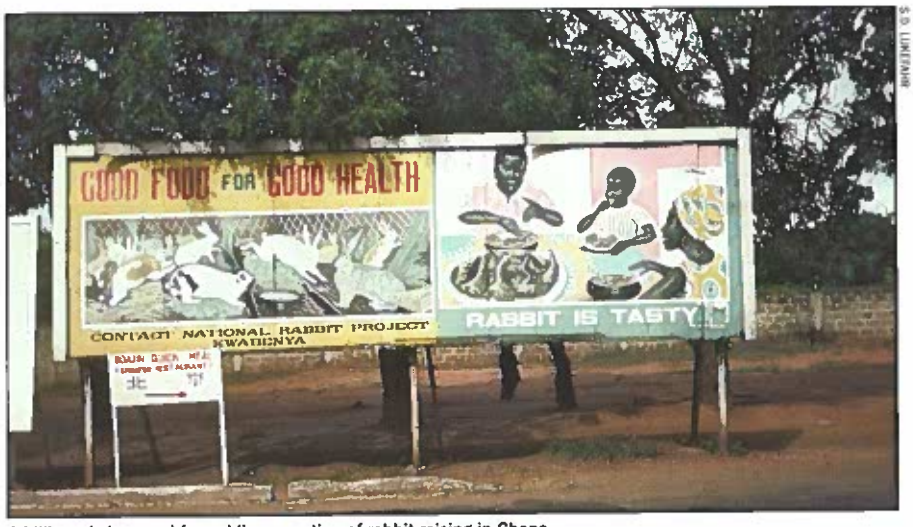
STRATEGIC PRICING

The market price paid by the consumer for rabbit should be competitive with other meats. If this is not the case, consumer demand cannot be expected to increase. The program should have information on production costs, and then set a realistic price range that represents a profit for the farmer and a good buy for the consumer. Inflated prices do not support long-term successful marketing goals and may even be counter-productive, tempting farmers to sell more and consume less rabbit meat. One simple approach is to sell rabbits at a price lower than that of broiler chickens. There are two reasons for this. First, production costs are invariably lower for rabbits compared to chickens. Broilers are fed costly cereal grains that are in high demand to feed people. Second, lower prices stimulate greater consumer demand. The survey as a marketing tool could be used to measure changes in sales in response to different pricing levels. Again, a marketing specialist may need to be consulted.

PRODUCT PROMOTION

Effective promotion of any product ensures a better future market. Ghana has served as a classic case of successful promotion of rabbit meat production. Mass media measures, such as newspapers, radio and television, roadside billboard signs and appealing slogans (e.g., 'Grow Rabbits-Grow Children', 'Operation Feed Yourself' and 'Make the Bunny Money') have been highly effective in creating national awareness. The National Rabbit Project of Ghana had received strong government support.

Most people have never eaten rabbit meat. Too, the family may not know how to properly prepare a rabbit meat dish. Recall that rabbit meat is very



S.S. LIKEMANI

A billboard sign used for public promotion of rabbit raising in Ghana.

lean. It is not like a broiler chicken where the meat is typically cooked with the skin with some fat between the skin and meat. If rabbit meat is cooked too fast at high temperatures (especially when placed on a grill), the meat can become dry and tough. The result could be disappointing. Local recipes that involve lean meat such as game could be substituted with rabbit meat.

Favorite local recipes generally are more acceptable than exotic recipes. For example, in many African cultures, a savory stew recipe using rabbit meat could be served to trainees or guests. In Asia, stir-fried and spicy soup dishes are used. Whereas in Latin America, after first marinating the rabbit meat, a basted barbeque or grilled dish is popular.

As a reference, numerous rabbit meat recipes can easily be obtained by doing an internet search. However, you may wish to first try the recipe before serving to guests.

In addition, nutritional information (refer to Benefits of Farming Module) and recipes can be developed into a flyer or brochure and supplied by the local market coordinators to business managers for distribution to their customers. Cooked samples may even be offered for tasting, for example, at businesses where whole fryer carcasses are sold, or at restaurants where rabbit is featured on the menu. Competitive rabbit cook-offs held at public places are also encouraged. These promotional tactics provide an opportunity for people to taste rabbit meat, many for the first time. If people find that they like the taste of rabbit meat, market demand will certainly increase. You are on your way to market success!

GLOSSARY OF TERMS

Anatomical soundness – Normal body characteristics that are suitable for production, such as long ears, body capacity or size, and thick foot pads.

Anestrus – The time period when a female rabbit's new eggs are being developed and is incapable of becoming pregnant; about 3 out of 17 days in her estrous cycle.

Animal-agroforestry integration – Combination of an animal enterprise with forest tree production whereby nutrients are recycled to minimize costs.

Animal-aquaculture integration – Combination of an animal enterprise with fish production whereby nutrients are recycled to minimize costs.

Animal-crop integration – Combination of an animal enterprise with crop or forage production whereby nutrients are recycled to minimize costs.

Animal-animal integration – Combination of two or more animal enterprises whereby nutrients are recycled to minimize costs.

Autopsy – An examination to determine cause of death.

Breed – An ancestral or pedigreed line of animals with similar characteristics.

Breeding schedule – The time between mating of a doe so as to allow, for example, 4, 6 or 8 litters per year.

Breeding stock – Animals used for breeding.

Buck – A male rabbit.

Budget – A written document for financial planning.

Capital – A outlay of cash for investment or expenditures.

Coccidiosis – An internal parasitic disease caused by protozoa which are single-celled animals, mostly found in the liver.

Compost – A collection of animal manures and other organic material that is allowed to decompose for use to improve various soil properties.

Coprophagy – The consumption of a rabbit's own soft feces produced by the cecum, which allows for a second cycle or round of digestion and nutrient absorption. Hard feces are not consumed.

Cross-fostering – Exchanging newborn kits between does to minimize litter size, to subsequently improve uniformity in fryer weights.

Crude fiber - Carbohydrates that are less digestible by animals. Hays and straws are sources of fiber, called roughages.

Crude protein – Total amount of protein in the diet measured by the nitrogen content. Proteins contain amino acids which are essential to animals.

Culling – To sell an undesired mature, breeding rabbit for meat.

Dam – A female parent.

Demand – The willingness of a consumer or patron to use a product, such as seeking and purchasing rabbit meat at a marketplace.

Doe – A female rabbit.

Economy of scale - A point or threshold whereby the number of breeding does (units) results in a favorable advantage in terms of purchases and/or profit.

Enteric diseases – A broad class of digestive diseases that affect the intestines. "Entero" is Latin for intestines.

Enterotoxemia – A disease associated with an excess intake of energy from carbohydrates and the bacteria, *Clostridium perfringens*. Also known as overeating disease.

Enterprise – A unit of economic organization or activity.

Estrous cycle – The 17-day period where eggs are produced. The doe is capable of becoming pregnant about 14 of these days (estrus), and is incapable (anaestrus) about 3 of these days.

Estrus – A state of "heat" where a doe is capable of becoming pregnant. Her eggs are ready for fertilization.

Exotic breed – An imported breed from another country.

Extensive production system – A subsistence or backyard rabbit enterprise largely supported by farm-based resources.

False pregnancy – An abnormal physiological state in which the doe shows certain signs of pregnancy without actually being pregnant. This condition usually lasts for 17 days.

Farm crop residues – Byproducts from crops, such as husks, leaves, peelings, and vines that are suitable feeds for livestock.

Feed concentrates – A nutrient dense and highly digestible prepared feed that is high in protein and/or energy and low in fiber.

Forage – Plants cultivated in plots that are grown as feed for animals, which are either hand- or machine-harvested or allowed to be directly browsed or grazed.

Forage plot – An area of land that is planted with recommended forage species, being methodically harvested and fertilized for feeding to livestock, and that is usually protected with a fence to prevent direct grazing by other animals.

Free-choice – Providing ample feed so that the animal can consume as much feed as it desires. Also referred to as full feeding or *ad libitum*.

Fryer – A young rabbit raised for meat.

Generation interval – The time between consecutive generations (i.e., generation turnover), which in rabbits is as short as 6 months.

Genetic adaptation – A quality or characteristic whereby a local or indigenous breed has evolved in its environment.

Gestation – The total time or length of pregnancy, usually 30 to 31 days.

Gross energy – Total amount of energy in the diet. This measure includes all digestible and indigestible feed contents.

Herbivorous monogastric – Animals with only one stomach but with an enlarged cecum. The cecum allows the animal to process a diet that consists largely of roughage or fibrous feeds, such as grass and legume forages.

Heritability – A measure of the importance of genetics for a trait. Heritability values range from 0 to 100%.

Hindgut – Region of the digestive tract following the stomach, primarily the small and large intestines and cecum.

Holistic approach – Consideration of all the aspects of production, not restricted to only one aspect or element.

Hutch – A complete cage for rabbits that can be set outdoors without being placed under a roof or inside a shed.

Hybrid vigor – The beneficial result of crossbreeding whereby trait performance (e.g., reproduction and health) generally improves due to genetic diversity between parental breeds.

Inbreeding – Mating of close relatives, such as siblings and parents; as a consequence production generally declines.

Independent culling technique – A trait in which a minimum standard is set for removing a breeding animal from the herd, for example, if the litter size average for at least three litters is less than three kits. This method is used for lowly heritable traits.

Infertile – A rabbit temporarily incapable of fertility.

In-kind – Consisting of something (as goods or commodities) other than money.

Inputs – Component of production (as land, labor, or raw materials).

Intensive production system – A commercial rabbit enterprise largely supported by off-farm inputs.

Investment – The outlay of money usually for income of profits.

Kindling – The act of giving birth.

Kit – A young rabbit under weaning age.

Labor resources (human factor) – To utilize family or hired persons to work in a business.

Lactation – A technical term for milk production.

Legumes – Plants, including trees that have bacteria on their roots that allows them to convert nitrogen in the air into high protein forage as feed for livestock.

Libido – Sex drive or the interest to mate.

Litter – The offspring produced at one birthing.

Mange – A condition of the ears or skin that involves an external parasite that results in scab formation or rough skin with hair loss.

Manger – A trough or open box in a cage or hutch designed to hold feed or fodder for livestock.

Market price – The value of an animal or product at the time of sale.

Market – Local, national or international places organized to buy and sell products. For rabbits, these products would be meat, skins, etc.

Micro-credit – The provision of small loans from a lending institution, such as for capital needed for a farmer to start a small animal enterprise.

Middlemen specialization – An individual person or group of business specialists who, for example, purchase weaned animals from farmers and transport to market to sell to a business manager.

Monogastric – Animals with one stomach. Chickens, pigs and humans are monogastrics, for example.

Morbidity – Rate of spread of disease through a herd.

Moulting – Shedding of fur.

Nest quality – The desired combination and placement of dry material (e.g., hay) and fur to support the newborn litter.

Nestbox – Usually a wooden box that is provided for the doe to prepare a nest in which to give birth to her litter.

Nocturnal – An activity that occurs mostly at night, such as feeding.

Nutrient – An element in the diet that supports life.

Off-farm Inputs (resources) – The purchase of supplies (e.g., commercial feed, fertilizer, and construction materials) from a market source.

Operating costs – The purchase of supplies needed to run a business once it is established.

Ovulation – Release of eggs from the ovaries of a female rabbit.

Palatability – Acceptance of a feed ingredient or diet by a rabbit.

Palpation – Determination of pregnancy by feeling with the hand and fingers the abdominal region of a doe.

Parasitic diseases – A malady or condition (internal or external) triggered by an organism, such as a fly, mite, or worm species.

Pathogen – An organism capable of causing a disease in the host animal.

Pedigree – A record of the ancestry of an animal, usually going back at least three generations.

Pelts – Tanned skins from rabbits or other animals.

Physiological soundness – Normal body functions that are desirable for production, such as normal body temperature and respiration rate in hot temperatures and calm disposition.

Profitability/Rate of return – A thriving business in which returns from sales exceed costs.

Prophylaxis (prophylactic) – A measure to prevent the incidence or spread of disease, usually more effective than is a treatment once a disease occurs.

Quarantine – A measure of protecting a herd from a disease by isolation of a suspect animal or entire herd, followed by a period of close observation and testing.

Rabbitry – A place where rabbits are raised.

Recurrent costs – Operating costs that are regularly made in a business, such as feed, equipment, medications, and labor.

Reproductive diseases – A malady or condition triggered by an organism that affects an organ(s) of reproduction.

Respiratory diseases – A malady or condition triggered by an organism that affects an organ(s) of the respiratory tract.

Return on labor (rate of return) – The total cash receipts realized over a period of time considering labor invested in an enterprise.

Ruminant – Animals with four stomach parts, including a rumen. Cattle, sheep and goats are ruminants, for example.

Sanitation – The state of or process to maintain cleanliness, such that the spread of disease is minimized.

Scattering – Newborn kits either born or found outside the nest.

Selection – The process of choosing young animals that will be saved for breeding in an attempt to genetically improve a desired trait(s).

Semi-intensive production system – A production system with certain aspects found in both extensive and intensive systems.

Silage – Preserved forage made from the process of fermentation. Silage may be stored for long periods of time.

Sire – A male parent.

Snuffles – A disease of the respiratory tract that is caused by the bacteria *Pasteurella multocida*. A common sign is sneezing and discharge of pus from the nasals.

Sore hocks – Open sores on the foot pads, usually associated with rabbit raising on abrasive wire floors.

Sterile – A rabbit permanently incapable of fertility, usually rare.

Strain – A family or line of rabbits found in a locality or region.

Supplement – A feed ingredient or diet rich in certain nutrient(s).

Temperature stress – Adverse physiological effects to an animal or herd caused by high ambient temperature, predisposing animals to heat stroke and infertility.

Upgrading – A breeding process involving the "grading-up" of local stock, usually achieved by using sires of a desired exotic breed for several successive generations.

Vaccination (vaccinated) – The administration of a biological agent, usually by injection, that causes the animal to be immune to certain diseases.

Viral diseases – A malady or condition triggered or spread by a virus.

Weaning – The act of separation of the litter from the dam (mother).

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*Address of publisher of book, manual or journal given in brackets; please contact author or publisher to request a publication.

APPENDIX A-INFORMATION REQUEST FORM

GENERAL INFORMATION

NOTE: This form should be completed by the group members. "You" (plural) refers to the group members.

1. Name of Group:_____
2. Address:_____
3. Where is the proposed project located?_____
4. Telephone number (if any):_____
5. Name of person submitting this information: _____

   Relationship of this person to the project group:_____
6. In what type of activity does your (plural) group wish to involve Heifer International (examples: training, livestock, agroforestry, etc)?

   _____

   _____

HEIFER INTERNATIONAL CORNERSTONES

Important features of any group that Heifer International would consider

PARTICIPATION/COOPERATION (Background of your Organization)

7. When did your group come together?

   _____

   _____

   _____
8. Why did your group come together? (include in your answer the problems your group/project hopes to solve. For example, the need for: employment opportunities; dairy products for the family; safe, chemical-free food; improved land use; income; youth activity; improved soil fertility; future security; the feeling of self-reliance; etc. Use separate paper if you need to.)

   _____

   _____

   _____
9. Does your group have any by-laws (set of rules for meetings), mission statements, or policies, etc.?

   ❒ No ❒ Yes If yes, please include copies.
10. How often does your group meet?_____ How many people generally attend?_____

11. How many people are members of your group? _____

_____ men over 18 years old _____ women over 18 years old _____ people under 18 yrs

12. What activities has your group done so far?

_____

_____

_____

_____

13. List your group's leaders below. (For example: chairperson, treasurer, secretary.)

Name	Title	Sex (M/W)	Occupation

14. How was the decision to apply to Heifer International made, and how did you learn about Heifer International? Include in your answer all the people who played a part.

_____

_____

_____

_____

GENUINE NEED

15. What type of people does your group hope to involve in the project (be specific if your group works with people who have special needs)?

_____

_____

_____

ACCOUNTABILITY

16. Does your group keep records or other documentation of activities? _____ If so, what sort? (For example: financial records, minutes of meetings, by-laws, mission statements.)

_____

_____

_____

INTEGRATED ANIMAL AGRICULTURE

(Farm management/Integration of animals into the farming system)

17. How much agricultural land do most group members have available to them (on the average)?_____

18. How far from most homes is the water for the animals?_____

19. What kind of veterinary care, if any, is available for the animals (traditional medicine/private government)?

20. What are the major benefits that your group hopes to get from this project? (For example: is it for milk products, income, meat/fish, eggs, draft labor, manure, hides/fur, future security, wool/hair, breeding, honey, status, improving the environment, family employment, youth activities, group formation, other?) List these benefits with the most important first:

PASSING ON THE GIFT

Heifer International requires that each family who receives an animal/training in turn passes on an offspring or knowledge to another family.

21. How will the requirement to Pass on the Gift work with your group? (For example: describe how this idea of sharing resources is common among your people, or in what ways it will it be a new idea.)

22. Explain anything that might make Passing on the Gift difficult.

TRAINING

23. What training do you think the group members will need before and after receiving animals?

24. Will your group be able to find someone to provide this training?

25. How many in your group have experience with the type/s of animals you are requesting?

ENVIRONMENTAL IMPROVEMENT

26. Mark any of the following that are important environmental problems in your area?

- ❒ soil that doesn't produce as much as it used to
- ❒ not enough firewood and building materials
- ❒ not enough land to support the families living there
- ❒ soil erosion
- ❒ bad water
- ❒ not enough water
- ❒ no water supply
- ❒ any other problem _____

27. Is your group doing something about any of these problems?_____ If so, how?

SELF RELIANCE

Heifer International gives direct financial and technical support for a limited time, after which your group must rely on its own or other sources.

28. Describe the ongoing contributions that the group members can make to the project (For example: materials, time, money, labor, skills.)

29. What other sources of financial or technical support does your group have?

FAMILY INVOLVEMENT AND GENDER CONCERNS

30. How are men, women, the elderly and youth involved in your group's activities?

31. How are the different family members in your group involved in taking care of the animals they already own?

NUTRITION AND INCOME

32. How serious are the following problems in your area?

Problems	Serious	Moderate	Not a Problem
Shortage of food			
Malnutrition (poor health as a result of poor nutrition)			
Bad quality food			
Good quality food too expensive			
Unemployment			
Low incomes			
Seasonal unemployment			

Other problems (explain):_____

_____

_____

_____

33. Is there a reliable, nearby market for the surplus animals or animal products (if there are any)? _____

If so, where is this market? _____

_____

34. How far is this market from your groups' village/town?

_____

_____

_____

ADDITIONAL INFORMATION

35. Is there any other information you think Heifer International should know about your group or village/county/area?

_____

_____

_____

_____

LOCAL INFORMATION NEEDS (questions added by the Country Representative)

Heifer Project International

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Asia and the South Pacific

China

Chuxin Hilly Area Livestock Development Project

PROJECT HOLDER

Dayi County Rabbit Association

Approval Date: December 29, 2006

BUDGET [1]

	2007	2008	2009	Total
Livestock & Freight	34,545	36,558	24,503	95,606
Horticulture & Freight	0	0	0	0
Agricultural Equipment & Supplies	13,962	14,742	10,138	38,842
Travel & Vehicle Operations	4,579	4,579	4,579	13,737
Training	13,597	15,123	13,902	42,622
Technical Services & Evaluation	9,591	11,478	13,365	34,434
Personnel & Benefits	4,226	4,830	5,434	14,490
Office Expenses & Services	3,560	3,119	3,119	9,798
Capital Expense	0	0	0	0
Other	0	0	0	0
Program Dev & Supervision	37,043	39,850	33,068	109,962
Program Support & Evaluation	21,371	22,990	19,078	63,440
Total	142,475	153,269	127,186	422,931

1 Reflects actual dollars for grant and number of years of actual financial/material support. HPI is directly involved with each project for an additional two years beyond the financial support years. Indirect support (Management & General; Fund Raising) is not included. The funding years indicated represent HPI's fiscal year July 1 through June 30.

PROJECT PROFILE

This project will assist 470 original families from six communities by providing 9,400 breeding rabbits (16 does and four bucks per family), training and technical services. Within three years, the families will have improved income, nutrition and rabbit-raising skills. Eighty percent of the project participants will be women, and all participants, both men and women, will take part in gender training. One participant from each community will be selected to be the Heifer rabbit-raising community leader, to ensure proper management. Another 1,410 families will benefit from "passing on the gift."

PROJECT HOLDER

Founded in 1985, the Dayi County Rabbit Association (DCRA) is a grassroots NPO and NGO of farmers and animal technicians. It is a source of information, training and extension services for rabbit farmers in the county. DCRA plays an important role in rabbit breed introduction, product processing and marketing in Dayi.

Ren Xuping is the director of DCRA. He was one of the four recipients of Heifer China's Dayi Project in 1985. With Heifer China's support and his own hard efforts and intelligence, he has excelled in the rabbit industry and is now well-known as the "China Rabbit King." He won Heifer's Golden Talent Award in 1999, and he has been helping his fellow villagers, who were as poor as he was 20 years ago. Influenced by Heifer's Passing on the Gift, he continued to pass on gifts for 37 generations (19,402 breeding rabbits and over 30,000 copies of technical materials) to 3,788 poor families.

This project will provide funding for DCRA's project-related office expenses and the hiring of project staff. Heifer China will assist DCRA to implement this project. Heifer China is the representative office of Heifer International in China. Established two decades ago, it is fully operational with 28 full-time staff and over 100 volunteers nationwide.

LOCAL CONDITIONS AND OPPORTUNITIES FOR ASSISTANCE

Dayi County is 52 kilometers west of Chengdu City. It covers 1,548 square kilometers with a population of 500,000, of which 420,000 are rural people. There are 58,000 mu (9,338 acres) of grassland and 613,800 mu (98,822 acres) of farming land, which produces 590 million kg of grass and 200 million kg of crop stalks.

Chuxin is an area where the three hilly townships of Chujiang, Xinchang and Xieyuan meet. On the hills, the villagers have very limited arable land, since the government launched the "Grain-to-green" policy to return crop land to forest and grassland on slope land. Villagers have been living on government subsidies, 150 kg of rice and 20 yuan (US $2.5) per mu (0.16 acre) of land each year. The subsidy is not enough to feed an entire family, so most of the male villagers must work in private, local coal mines for extra income, which is used for expenses such as healthcare and children's education. Forty percent of the households had an average annual income of less than US $250 in 2005. By 2010, the government will stop the subsidies. The local coal mines are subject to closure by 2008, due to unsafe conditions and deadly accidents. Therefore, the villagers need to find other means of livelihood.

Most women are unemployed, and they worry about the future of their families. After housework, they spend most of their time doing nothing. They depend on their husbands, who have no stable income either. They have low social status. Rabbit raising is a suitable income generation activity and is supported by the villagers. The local sub-tropical humid climate and abundant rainfall is favorable for the growth of forage grass, which provides an ideal food source for rabbits. Farmers in Dayi County have a tradition of rabbit rearing. Dayi is the largest rabbit meat production base in Sichuan Province. Xuping Food Co., Ltd., an affiliate of the DCRA, specializes in purchasing, processing and marketing rabbit meat within the province and nationwide.

One animal health worker will be selected in each community from recipients who are comparatively experienced in rabbit raising and enthusiastic in providing technical services to other farmers. They will be trained on scientific rabbit raising skills so as to solve basic technical problems for the community and insure the achievement of sustainable community development, even after the project is complete.

The Dayi County government has been offering incentives to rabbit raisers. The quarantine and vaccination fee is either waived or reduced. The government also provides rabbit raisers with some grass seeds and free technical services for grass planting. Heifer China Xieyuan Meat Rabbit Raising Project was implemented in two villages of Dayi County in 2005 and has brought a significantly positive impact to the project participants, both economically and spiritually. Poor farmers in other areas also wish to apply for a project that will improve their livelihood. By the end of June 2006, most recipient families of the Xieyuan meat Rabbit Raising Project earned more than $375 per family from raising rabbits.

OBJECTIVE AND ACTIVITIES

Increase the recipient families' income

- Conduct baseline survey
- Sign *passing on* contracts with participating families.
- Purchase 9,400 breeding rabbits
- Distribute rabbits to 470 families

OBJECTIVE AND ACTIVITIES

Improve recipient families' rabbit raising skills

- Train families on sustainable livestock development and other agriculture methodologies.
- Construct standard rabbit cages
- Provide fundamental training on rabbit cage building, feeding, disease control, grass planting, etc.
- Provide agricultural supplies to participating families.
- Conduct farmer exchanges among participating communities

OBJECTIVE AND ACTIVITIES

Achieve community harmony and cohesion

- Heifer Cornerstones training
- Pass-on gift ceremony
- Elect community management group
- Training for the Community management group
- Leadership training
- Gender training
- HIV/AIDS awareness training
- Environment protection training
- Regular community activities
- PSRP

OBJECTIVE AND ACTIVITIES

Improve the environment

- Build bio-gas tank
- Compost the rabbit manure
- Plant forage on the grass land
- Train the farmers of the environment knowledge and teach them how to identify and eliminate the poisonous grass

PASSING ON THE GIFT

Every recipient will sign a contract with the DCRA before receiving the breeding rabbits. They will pass on the same number of breeding rabbits and knowledge they receive to other needy families from the second year of the project implementation. At the en of the project, 1,410 families will have received pass on gifts. The DCRA will organize and monitor the passing on process. DCRA will integrate all resources available in order to guarantee that pass-on families will have the same support as the original families within the project implementation period. Heifer China staff will also check the passing-on process.

KEY WORDS: **Animal Health/Vet Care**
Biogas
Gender Equity
Income Generation
Self-Reliance

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INTERNET SITES

Domestic Animal Diversity Information System
dad.fao.org

Food and Agriculture Organization of the United Nations
www.fao.org
www.fao.org/ag/againfo/home/en/index.htm
Viale delle Terme di Caracalla, 00153 Rome, Italy

Guide to Backyard Rabbit Production
www.fao.org/ag/AGAinfo/themes/documents/ibys/
Office of Knowledge Exchange, Research and Extension, Fao, Viale delle Terme di Caracalla 00153 Rome, Italy

Heifer International
www.heifer.org/programinfo
1 World Avenue, Little Rock, AR/USA 72202

Livestock Research for Rural Development
www.lrrd.org
Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuaria, Cali, Colombia

Microlivestock
www.nap.edu/catalog.php?record_id=1831
The National Academies Press, 500 Fifth Street NW, Lockbox 285, Washington, DC 20055

On-Line Rabbit Course in Spain (in Spanish)
www.cfp.upv.es www.dcam.upv.es/egran/curso cunicultura on-line.pdf
www.dcam.upv.es/egran/poster_cuni.pdf

Smallstock in Development
www.smallstock.info/index.htm
DFID Livestock Production Programme, Natural Resources International Ltd, Aylesford, Kent, United Kingdom

Southern University Agricultural Research and Extension Center: Rabbit Housing Manual
www.suagcenter.com
P.O. Box 10010, Ashford O. Williams Hall, B.A. Little Drive, Baton Rouge, LA 70813

The Rabbit: Husbandry, Health and Production
www.fao.org/docrep/t1690E/t1690E00.HTM
Office of Knowledge Exchange, Research and Extension, Fao, Viale delle Terme di Caracalla 00153 Rome, Italy

Tropical Forages: An Interactive Selection Tool
www.tropicalforages.info
CIAT, 7343 NW Terrace, Medley, FL 33166

Tropical Rabbit Production Book (in French)
www.cuniculture.info/Docs/Elevage/Tropic-01.htm
Cuniculture, 87A Chemin de Lassere, 31450 Corronsac, France

World Rabbit Science Association
world-rabbit-science.com
INRA, Research Unit TANDEM, Research Center of Toulouse, BP 52627, 31326 CASTANET-TOLOSAN Cedex, France

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