VILLAGE BASED GOAT MEAT PRODUCTION IN ASIA

A TRAINING MANUAL FOR EXTENSION WORKERS

Rome 1988

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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A TRAINING MANUAL FOR EXTENSION WORKERS

prepared for FAO by:

A. QUARTERMAIN and N. K. BHATTACHARYYA

FAO ROME 1988
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Chapter 1.

**INTRODUCTION**

This manual sets out the proposed curriculum for a training programme on strategies for the development of village based goat farming in India. The training is directed at extension workers who are expected to be involved with village farmers or goat owners in attempts to improve the productivity and profitability of goat keeping within the village social and economic setting. The manual outlines a proposed syllabus and gives detailed notes to go with each component of the syllabus. Attention has been given to the needs of two types of extension worker -

1. Agriculture, animal husbandry or veterinary graduate officers who have a base of technical knowledge and skills.

2. General, village based extension workers such as social workers or those employed by voluntary agencies who will be involved with goat production but may have only a limited technical knowledge of animal husbandry.

The curriculum is structured such that a wider range of syllabus components is available for graduate workers and a more restricted range for those less technically qualified. However, all of the syllabus notes have been written using a minimum of technical jargon and should be accessible to all trainees with perhaps some guidance from the trainers. In addition, a simplified summary of the key elements is given at the start of each relevant chapter. This summary sets out the practical information needed by all extension workers in order for them to do an effective job.

The initial or pilot training programme is to be centred on the Central Institute for Research on Goats (CIRG) in the Uttar Pradesh State of
India. The consequent extension programme will be in villages in the region served by the Institute. Hence the examples and data given in the manual refer to the semi-arid plains region of Uttar Pradesh. Indeed, the extension messages which make up the core of the manual have been specifically developed using CIRG experience and are directly applicable to the needs of goat farmers in surrounding villages. However, most of the information, instruction and extension message content has a wider application and it should be possible, with minor modifications in some areas or replacement of certain sections, to adapt the manual for use elsewhere in India or indeed other countries with similar goat production development needs.

Village goat production in the north-west semi-arid region of India tends to be a small-scale activity predominantly the domain of villagers with little or no land of their own and who are disadvantaged by reason of sex, literacy, wealth, class or caste. Goat herds are often managed by women and children. There is scope for improvement of production levels without substantial alterations to the economic structure of farming but the scope is limited and interventions must be practical, acceptable and of proven benefit. The training programme is designed to enable the extension officers to come to terms with what is feasible in the village context in which they must work and to develop effective extension strategies aimed at reaching realistic development or productivity targets.

Development involves a steady, sustained increase in the quality of life of the village people. The longer term, developmental objective or goal of the extension project activities must be such a sustained increase. Quality of life will mean different things to different people and indices should be sought which are appropriate to the local environment, economy and social setting. Examples of possible indices of change are given in Chapter 7.
A strategy for development in a particular case should set out clearly the objective, what should be done and why these activities have been chosen. It should specify who should carry out the activities and in what sequence. It may spell out also how the activities can be carried out with the available resources and what techniques are to be used. It must also address the problem of who will pay and what external assistance may be necessary at various stages.

A particular extension programme may be considered a strategy for development. In the case of the programme which is the subject of this training manual, the extension process will be brought to bear on a limited number of villages with the purpose or immediate objective of achieving an increase in goat production. This increased goat production should be at least a contributor to achieving the goal of village improvement.

The inputs to the extension project are the extension officers themselves who will be trained in the programme outlined in this manual. They will carry with them whatever skills and motivation they have. The outputs will be an array of activities or actions by farmers and goat keepers which should lead to increased production as measurable using a variety of indices (Chapter 7).

The bulk of the manual (Chapter 5) contains an elaboration of 7 basic extension messages which will be conveyed to the farmers through the activities of the extension officers or extension process. Hopefully the goat keepers or potential goat keepers will be motivated to take up the suggestions or technology contained in these messages and benefit therefrom. The messages have been carefully chosen bearing in mind known local needs, constraints and which aspects of goat production are
amenable to improvement with proven technology which is within the capabilities of village farmers to adopt and apply.

Other sections discuss the collection of data necessary to further develop the extension programme, the means of getting the messages across to farmers, aspects of marketing and access to services and supplies, and techniques for monitoring and evaluating the progress of the extension programme. An evaluation of the actual training programme is included in the syllabus but is not discussed in the manual.

Goat production can be improved by increasing the quantity or improving the utilisation of the feed resource base enabling more animals to be kept or introducing technology to increase production by the existing animals such as interventions to decrease mortality and improve reproductive efficiency. Both of these aspects are included in the overall extension message.

Cross-referencing between chapters has been done as far as possible. Inevitably there is repetition of material and ideas but this should serve to reinforce the messages in the training programme.

Goat meat production has been chosen as the target of the extension programme. This is because, in the context of these villages, meat production holds the most potential for increasing cash earning capacity or commercialisation. This increased cash availability should enable farmers to increase their social and economic options. A high proportion of the villagers do not eat meat so that the animals are available to sell. This does not mean that milk production is unimportant. Milk is an important subsistence food of particular value in child development. The practices recommended in this programme will result in increased milk production as
well as meat production, although not specifically aimed at the former product.

It has been assumed that the reproductive potential of the local goats is not being fully exploited with, in particular, too high a kid mortality. The growth to sale or maturity of two kids per kidding instead of one can be readily seen by farmers as an advantage whereas increasing liveweights are not so readily realisable as benefits. Goat sale prices and returns are determined by number of goats sold and their condition rather than weight. The extension messages on reproduction, health, kid rearing and goat feeding have been developed to reflect the priority of reducing mortality from general ill health, misadventure and poor nutrition rather than from specific diseases.

Strategic use of available feeds is suggested rather than the use of purchased or otherwise valuable feeds and concentrates. The object is to make most effective use of vegetation resources while acknowledging that farmers have a wealth of knowledge about the available vegetation and the needs of goats. For example, knowledge about where to go for browsing and a sustainable lopping regime for fodder trees may be the keys to successful animal husbandry which no extension officer can supplant. Additions to the feed resource, particularly the growing of individually owned fodder trees on the farmers' own homestead land, can be successful given the availability of seedlings and the means to protect the growing plants. The technology for growing fodder vegetation and the rehabilitation of rangelands is available but there is a problem in developing community action to develop this resource and use it in a fair and sustainable way.
Of all previous interventions, only health care provided free was sustainable because the benefits of animals not dying were obvious and there was no cost. People have not in the past been interested in purchasing additional feed, developing communal land or breeding using animals introduced from outside. The present set of extension messages have been developed with a clear thinking about the constraints and avoidance of past failures.
Goats are raised preferentially by the poorer farmers of the semi-arid and hilly areas of India. The initial investment is limited to the purchase of 3 - 5 goats (including a breeding buck), the provision of night shelter either as a separate hut or as space in the family buildings, earthen vessels for feeding and watering, and possibly some minor purchase of feed in the form of post-harvest agricultural by-products. Preventive health care is supposedly available free from the Government Veterinary Hospitals. Care of the animals during grazing and browsing is usually left to children and elderly women. The male goats run with the female herd at all times.

Goats are sold when money is required and middle-men may benefit at the expense of the farmers.

The productivity of the animals is generally below their potential. Grazing and browsing by goats is restricted to land unsuitable for cropping, to state or communal owned forest, to roadsides and other waste land between fields and around villages. Goats may be fed crop residues but this is usually restricted to grazing of the stubbles after the straws and stovers have been removed. Hence the animals are often not fed to appetite.

It is assumed that for local village goats, age at first kidding may be greater than 15 months, kidding intervals may be longer than 8 months and the incidence of multiple births may result in 130 kids born for every 100 females kidding.

Mortality rates are perhaps over 20 percent for kids up to the age of 3 months and 10 percent for all goats annually.

Kids may grow to liveweights of 17 - 18 kg by one year of age if well cared for under established systems of rearing, browsing and grazing.
9.

Opportunities for improvement in goat production are subject to some or all of the following constraints -

- Poor access to grazing land and browse
- Unavailability of crop residues due to alternative uses
- Inadequate marketing systems
- Use of children and the elderly as herders
- Lack of appreciation of the potentials of the animals
- Low social status of goat owners
- Low literacy of farmers (perhaps only 30 percent)
- Lack of motivation and confidence among farmers
- Little co-operation among farmers
- Limited services - veterinary, agricultural, social
- Low risk taking ability and problems with credit servicing
- Poor soils, semi-arid climate and shortage of water for irrigation
- Technologies suggested for improvement programmes not proven or not economic.
SUMMARY OF PRODUCTION TARGETS suggested for the extension programme:

Growth - as measured by weight at 1 year
- 10% immediate improvement
- 15% improvement in 5 years
- 30% improvement, long-term target

Reproduction -
- 2 kiddings in 14 months
- 7 - 8 months kidding interval or 60 - 90 days interval between parturition and successful mating
- Reduction in age at first kidding from assumed 15 months to 13 months
- First mating at 6 - 8 months of age for female kids
- Kidding rate (number of kids born per 100 females kidding) from 130 improving to 150

Mortality -
- From birth to 3 months of age reducing from 20% to 10%
- Overall mortality in the herd reducing from 10% to 5%
Chapter 2.

THE CURRICULUM

The syllabus for the training programme follows Chapters 3 to 7 inclusive of this manual. Chapter 5 on the Extension Message contains 7 separate lessons or extension messages which constitute the core of the extension package. There are therefore 13 major topics as set-out in Table 1, including an introduction and a summary. The system proposed for training is a block system with each of the topics constituting a block and allocated training time dependent upon importance and the time needed to impart the necessary skills. Each block will be completed before moving on to the next.

For graduate level extension trainees, the full course covers all 13 topics and requires a total of 26 days of training. For community, non-graduate extension workers, the shorter course which omits some of the detailed information and some of the practical skills requires a total of 16 days of training (Table 1).

The outline syllabus is as follows:

**Training Programme Outline Syllabus**

**Introduction:**
Orientation to the course, the Institute and local agriculture; development and strategies for development; the extension programme in development; constraints, objectives and targets.

**Methods of Technology Transfer:**
How to get the message across to farmers; planning the extension programme; implementation of the programme; methods to use.

**Practical:** Practice of methods.
Survey Techniques:
Collection of the necessary background data; the information needed and why; simple survey methods.
Practical: Weighing of goats; dentition and ageing.

The Extension Message:

Lesson 1 - The value of goats:
Educate farmers as to the true biological and economic values of their goats. Virtues of the goat and its products; productivity; economic values.

Lesson 2 - Breeding:
Expand the utilisation of selected male goats for breeding and the use of the Barbari type to increase marketing opportunities. Selection procedures; recording.
Practical: Castration; identification by tattooing.

Lesson 3 - Fodder resource:
Teach farmers the means to improve feed and fodder resource management and availability. Choice of plant species; silvicultural techniques; incorporation of fodder trees into farming systems; utilisation methods.
Practical: Fodder species identification; use of fertilisers and mulch; bunds, trenches, pits and grass strips; protection of growing plants; termite control; lay-outs, spacings and combinations of species.
Lesson 4 - Reproduction:
Stress the supreme importance of achieving a high level of reproductive efficiency. What to do to achieve the targets.

Lesson 5 - Health Care:
Implement the recommended package of measures necessary to maintain as good a health situation as possible. Causes of ill-health or mortality; how to know when there is a health problem; prophylactic measures; day to day treatment; major disease outbreaks.
Practical: Vaccination; drenching and dipping; construction of raised floors; trimming of hooves.

Lesson 6 - Kid rearing:
Demonstrate to farmers the principles of good kid rearing practices. Causes of losses; milk sharing with humans; suggested kid rearing practices.
Practical: Construction of kid boxes; preparations for kidding; udder bags.

Lesson 7 - Feeding:
Demonstrate the possibilities of enhanced production through strategic supplementation of grazing and browsing with concentrates and other feeds, especially for kids between 3 and 9 months of age. Strategic supplementation; dry matter intake; requirements for energy and protein; matching feed supplies to requirements.
Practical: Calculations of nutrient availability and requirements.
Marketing, Services and Supplies:

Marketing, including home consumption; taking advantage of available services; availability and affordability of necessary supplies.

Practical: Home slaughtering and care of skins.

Monitoring and Evaluation Techniques:

The efficiency of the extension programme; measurement of implementation by farmers; evaluation through increases in goat production; recording; evaluation through changes in village and farmer welfare.

Summary:

Summary of objectives, targets, constraints and possibilities; evaluation of the training programme.

In addition it may be possible to include one or two field trips to institutes such as the Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh and the Central Arid Zone Research Institute, Jodhpur, Rajasthan.

Some of the practical skills that need to be developed are for the extension officer's own benefit and some are for passing on to farmers. Other than skills in extension techniques, those skills needed by farmers are those included in the short course. The skills needed by farmers include drenching and dipping, foot care, raised floor construction, kid box construction and general kid rearing skills, a variety of silvicultural skills, and home slaughtering.

It is not intended that the graduate extension officers should spend a lot of time doing routine recording, vaccinations, castrations, ration
formulation or general animal care operations. However, they should be able to do or demonstrate these skills if required or if farmer practice can be improved. Delivery of some kinds of visible health care requiring some skill may be useful in winning farmer confidence and acceptance of the extension messages.

TABLE 1

OUTLINE CURRICULUM

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Chapter 3.

METHODS OF TECHNOLOGY TRANSFER

HOW TO GET THE MESSAGE ACROSS TO FARMERS

1. Identify the audience
2. Clarify the extension message
3. Plan the extension programme

Farmers must be motivated to adopt new ideas.
Farmers are concerned with minimising risks.
If possible, identify and use the Opinion Leaders.

1. The extension messages must be simple.
2. The benefits must be obvious.
3. The innovations must be technically possible
   financially feasible
   socially acceptable

Speak the farmers' language - you are working for them.
The farmers must understand why they will benefit if they change their practices or make innovations.

Keep the whole village fully informed about the programme.
Consult with the village leaders and other community workers.
Ensure village participation in the planning process.
Do not be too ambitious - plan a programme that you know will work.

Remember that farmers may know more or be more skilled in certain things than you. Use this knowledge and skill.
17.

- Show an interest in farmers' existing practices.
- Do not attempt to teach farmers things they already know.
- Do not contradict farmers unless absolutely necessary.
- Do not belittle farmers.

Use a mix of extension methods involving seeing, hearing and doing.
Review progress with the whole village from time to time.
Do keep good records to monitor progress.
Do not let yourself become the exclusive helper of a few influential farmers.

Farmers are the best extension agents -
"if my neighbour can do it so can I".
Methods of Technology Transfer

How to Get the Message Across

There are three main tasks facing an extension officer involved in a goat meat production improvement programme:

1. Who are the farmers you wish to reach?
   Task 1 - Identify the audience

2. What is the message you want to get across?
   Task 2 - Clarify the extension message.

3. How are you going to get the message across?
   Task 3 - Plan the extension programme.

The suggested extension message is spelled out in detail in lessons 1 - 7 of Chapter 5 of this manual and need not be discussed at this stage. However, certain principles concerning the nature of the message must be constantly in mind:

1. Keep it simple.
2. Benefits should be obvious.
3. The innovations must be appropriate:
   Financially feasible
   Socially acceptable
   Technically possible

The objective of the extension programme is to have farmers motivated to adopt the technological innovations. Motivation is vital to enable farmers to
overcome the natural reluctance to accept innovations for fear of the risks - both financial and social - involved or thought to be involved. Financial risks may not necessarily result from using money to buy inputs with possible debt implications but may result even when the innovations do not require any cash outlay. The fear of reduced output if things go wrong with the result of less flexibility, loss of food security or postponement of some target purchase, can deter farmers. Social risks are concerned with possible "loss of face", reduced standing in the village hierarchy or even abuse if others have followed the leader down a wrong path.

Hence we cannot afford to have things go wrong. This comes back to the nature of the extension message and the necessity for putting across simple, proven, appropriate ideas.

Who are the farmers we wish to reach?

In many situations, all farmers are goat farmers and all employ the same kinds of management. In such cases the extension process is simplified. Communities are sometimes divided by sociologists into -

Innovators - the small number of people who readily try new ideas.
Opinion leaders - those with influence who largely determine the changes that occur in village life.
Followers - most people are followers who adopt the ideas and methods of the opinion leaders. These may be divided into an early and a late majority depending on speed of adoption.
Laggards - those who are exceptionally slow to adopt new ideas - often the least advantaged and most at risk if ideas fail.
In general the simplest and most fruitful course is to identify and work with the opinion leaders.

However, in the Indian (Uttar Pradesh) village situation the reality may be more complicated in that not all farmers are goat keepers. Innovators and opinion leaders are not from the poorer, less educated, disadvantaged groups in the village society and hence may not keep goats.

Therefore, in order to reach the farmers with goats it may be necessary to cross traditional leadership patterns. The village poor are directly or indirectly dependent upon many other people and they cannot afford to disrupt these networks or antagonise others. Enmity may be created if traditional leaders are by-passed and the social balance of a village can be upset. The majority will not adopt new technology without the advice or even approval of the opinion leaders. The innovators, who might be expected to respond to the extension process, are often social isolates but with access to capital and outside assistance. Such people may well be made interested in goats but at an intensive, purchased-input level rather than at the traditional small-scale, low-input level.

The solution to these problems is not easy and cannot be written down as a formula. Each situation must be studied by the extension officer before starting the programme. A good knowledge of the village leadership pattern and the characters of the leaders themselves will help you to choose an appropriate starting point. Full discussion with everyone concerned so that all influential people, even those without goats, are fully conversant with what you intend to do, and hopefully approve of it, is always the first step.
It would be helpful if the villages chosen for the initial extension campaign are villages in which at least some of the opinion leaders are also traditional goat keepers.

The goat farmers are often women and children. They may not necessarily be the owners but they are the ones making day-to-day decisions about goat husbandry. They ideally should therefore be closely involved in the extension programme, if not its main target audience. This also may not be easy. However the methods chosen should take this into account which may reduce the value of group meetings and increase the value of home visits, involving the whole family, and result demonstrations.

Imparting of skills or skill demonstrations must be to those who are actually going to use the skills.

Opinion leaders may be convinced that goats are economically worthwhile but may still be reluctant to keep them due to social constraints.

**Planning the extension programme:**

In planning the programme you must assume:

- existence of the social barriers already discussed.
- poverty and therefore low risk bearing capacity and low ability to employ inputs that cost money.
- low literacy and therefore low effectiveness of written material and greater effectiveness of verbal and practical skill or result demonstration methods.
- labour availability and therefore scope for labour intense innovations.
Always remember:

You must speak the farmers' language - use words they can understand and give thought as to how you can reduce the social distance between you and the farmers while maintaining your prestige due to knowledge and skill.

You are working for the farmer - not for the Government, the Institute or yourself.

Note that no extension programme is any good unless farmers adopt the new technology. It is relatively easy to take the messages in Chapter 5 and convey them to the farmers. It is not so easy to achieve understanding as to why the messages are good and what benefits will come to those who adopt.

Let us assume that we have the necessary background information (Chapter 4) about the village and the goat keepers - that we know our target audience.

Let us also assume that we have our clear, simple, appropriate set of extension messages and skills which we wish to impart and which we are convinced will benefit the farmers in clear and obvious ways.

Note that the benefits must be obvious. It may not help adoption of new technology if we achieve say a 1 or 2 Kg increase in the liveweight of a goat at one year of age, for even if the farmers can see this they are unlikely to benefit in the market. The achievement of an extra kid surviving to market is obviously beneficial.

How then do we get the message across?
Step 1: The farmers, and preferably the whole village should be fully informed as to what is going to happen. The programme should be discussed with all concerned until everyone is happy with it. The extension officer must take into account the traditional village structure - the village committee (Panchal) with its president (Pradhan). The Block Development Officer should also be involved together with other village-based community welfare and extension officers, e.g. health, veterinary, forestry. Note well the vital importance of community lands to goat production and that such lands are controlled by the Panchal.

Step 2: A plan of work should be prepared following the consultations with the villagers and other officials. Of course an outline plan would have been prepared before these discussions but the final plan should eventuate as a result of village participation. The plan of work should set-out the intended activities, their sequence and timing. The implementation of some activities will be dependent upon the outcome of preceding activities so that a certain flexibility of timing is required, together with an adequate monitoring and evaluation procedure (Chapter 7). Monitoring will allow the extension officer to assess the efficiency of the various types of extension activities in getting the message across and the farmers motivated to act. Periodic evaluation will enable assessments of the effectiveness of the extension activity in achieving increased goat meat production.

Step 3: The actual implementation of the extension programme requires dedication and motivation on the part of the extension officer. It requires the timely provision of various aids - audiovisual, literature - as well as adherence to the schedule of planned events and activities.
Note for planning – do not be too ambitious. It is better to have a small, well executed programme than a large, comprehensive programme that does not work.

Remember always – the farmers may know more about some things than you do – farmers know about goat behaviour, about the local vegetation and diet selection by goats, about seasonality of production, about the production characteristics of their own animals – use this information in a two-way flow of ideas. This will help them build their confidence. Farmers may also be more skilled at certain practical tasks than you are – if there is a particularly skilful farmer, use this skill for demonstration and assistance to other farmers, e.g. building of kid boxes. Do show an interest in the farmers existing practices.

**Do not**
- Try to teach farmers things they already know about – you could make a fool of yourself.
- Contradict farmers unless you are absolutely sure they are wrong.
- Belittle farmers or make them appear foolish in front of their peers.

What sorts of methods should we use?

Farmers learn by seeing, hearing and doing. A mixture of activities is usually best. In general, the more different activities the more likely is the message to sink in.

**Meetings**

General village meetings are useful and necessary at the start of the programme to get everyone involved (see Step 1 above). General meetings may also be useful from time to time to review progress. However, in general, work with small groups or families is more effective.
Group Activities

Activities can be conducted with small groups of say 10 and certainly no more than 20 people. It is probably best to have a cross-section of the community in each group rather than having the people in a group say all of the same caste. However, women or children may work better in groups of their own kind where they are not dominated by men. Much exchange of ideas can take place in these groups as well as the development of skills (see skill demonstrations below).

Individual or Family Contact

Naturally from the point of view of the individual farmer, the best extension method is one-to-one contact. However this is not a very efficient use of the time and energy of the extension officer. Family home visits are best used to prepare for result demonstrations (see below) which can then be used for group activities.

Do not let yourself become the exclusive helper of influential individual farmers.

Literature and Audio-Visuals

The distribution of literature may not be too effective because of illiteracy. The availability of suitable material is very limited but there may be individual farmers who could benefit from further information in a written form. The use of specially written wall newspapers may be effective in the village situation to help people understand the programme and keep them informed of progress. Specific extension messages could be highlighted in a series of possibly weekly paste-ups.
The use of specially prepared video tape programmes may well be a feature of this particular extension campaign. The video could be used on a communal basis to introduce the extension messages and show results from adopting the technology (result demonstration) before they can be shown live in the actual village.

The radio can be a potent medium in the village situation for getting simple messages across to a wide selection of people. Use the radio particularly for motivation and for educating people as to the true value of their goats.

**Skill Demonstrations**

A skill demonstration is a "how to do it" demonstration of a new procedure or a better way to do an existing procedure. The demonstrations are best done in small groups with each farmer given a chance to try the skill.

**Result Demonstrations**

Result demonstrations show the results of the application of new technology. They must be carefully organised using perhaps 10 selected farmers who will then become the agents for further dissemination of the new practices. Such demonstrations take time to prepare but are probably the best way of bringing about changes provided:

* The results are obviously beneficial and possible with the farmers normal resources.
* The other farmers can identify with those demonstrating the results.

Some questions to answer:-
Does the result demonstration have a clear, specific purpose?

Is the potential audience clearly defined?

Does it meet the farmers interests and needs?

Have the farmers been involved in designing the demonstration?

Were the farmers selected by the community?

Are the farmers managing the demonstrations themselves?

Are the new practices readily apparent?

Can the changes be clearly seen?

Are records being kept?

Can the new practices be readily adopted by all farmers?

Remember – farmers are the best extension agents.

Encourage the attitude – if my neighbour can do it so can I.
Chapter 4.

SURVEY TECHNIQUES

COLLECTION OF THE NECESSARY BACKGROUND DATA

For an effective extension programme it is necessary to collect and assess background data concerning the goat owners and their way of life. However we need to carefully consider the reasons for collecting the data. We do not want to spend a lot of time and resources collecting data for its own sake.

Extension programme planners need to know:

- the current social and economic status of the village and of the goat owners within the village.
- the people who actually look after the goats. These may not be the owners. For some aspects of the extension programme the target group may be the owners and for other aspects the target group may be those who care for the animals day by day.
- the problems and needs of these target groups.
- the farmer skills that need to be developed. This will determine not only part of the content of the extension programme but also the extension officer skills that need to be addressed in future training programmes.
- the political and institutional structure of the village. It is important to know where power and influence lie and what institutions (village committees, co-operatives, clubs or societies, schools) can be used in the extension programme.
- the availability of services (veterinary; marketing; agricultural) and supplies (agricultural and veterinary inputs, credit, fodder tree seedlings).
It is also necessary to decide what records need to be kept in order to monitor what is happening in the course of the extension programme and to evaluate the effectiveness and impact of the programme (Chapter 7). The survey data collected at the beginning of the programme will determine what indicators of change can be used in subsequent evaluation.

Survey data are also needed to assist the extension officer to feed back to the research station or institute information on the types of farmer problems and needs that should be addressed in the research programme. The linkage between farmer and research worker is usually less than adequate and it must be a key role of the extension officers to facilitate the flow of information in both directions. It became quite clear while deciding on the extension messages to be included in this training programme that most of the available research results could not be directly translated into practical recommendations for farmers. It is a duty of the extension officers to demand that the research services tackle and solve farmer specific problems as identified by the extension officers and carry the research through to the stage of formulating practical recommendations. Unfortunately, extension workers are usually not very skilled in defining farmer problems in a way which can be directly taken up by research. The research institutions need to assist the extension officers to develop these skills. Research often addresses only the problems of large or wealthy farmers, uses resources on the research station which are unavailable to small farmers, fails to take account of the integrated nature of village agriculture, or fails to undertake realistic economic analyses of the costs and benefits of implementing the research results. The survey should indicate who the goat farmers are in any village and what problems they have which require solution by research.
30.

There are no clear scientific guidelines as to how many farmers or villages should be sampled in a survey in order to get the information required. Of course the information must be accurate, but since it is largely descriptive a clear picture of the situation might emerge quite quickly or it may never be very clear.

The CIRG has completed some benchmark surveys as part of the Operational Research Project started in 1978 and also in the Lab-to-Land Programme started in 1979-80. The types of data collected enabled surveys of complete villages. Clusters of 3-5 villages, selected to be representative of a region, have been surveyed. A questionnaire suitable for a survey of all goat farmers in a village has been developed and a translation of this Hindi-language questionnaire, with slight modifications and some additions, is given at the end of this chapter. Some survey questions are applicable to the individual family and some to the village as a whole. This distinction is made clear in the questionnaire.

The surveyed farmers can also be used in subsequent surveys to monitor extension message uptake (Chapter 7) and the surveyed villages used in the periodic evaluations of the impact of the extension programme on village life.

More detailed data on goat production is necessary for subsequent evaluation of the effectiveness of the technological changes being made by farmers in bringing about increases in production. It is suggested in Chapter 7 that each extension officer should probably not try to record in detail more than about 20 herds or about 100 goats. However for the initial general survey a larger number of owners' herds can be included since only crude data can be obtained until the sample goats are identified by tattoo or name and records kept of reproductive events.
It is suggested that this background survey work be done by officers of an institution (such as CIRG) in co-operation with the extension officers assigned to the village in question. In addition to the survey questionnaire information, some background production data can be obtained by recording the sex, age, weight and owner of every goat in the village. This can be done quite simply over a number of days by recording each owner's herd in turn.

The only equipment needed for this goat population survey is a simple suspended clock-face scale or set of bathroom scales. The techniques for weighing the goats are illustrated in Figure 1. Age determination is done by examination of the teeth. It may only be possible to record adult ages according to the presence of the first, second, third or fourth pair of permanent incisors (see Box).

In small herds the owner may know the birth date (at least as to month) of each kid. The owner should also be able to recall whether or not the kid was born as a single or a twin and, if the latter, what has happened to the twin-mate. Information on the last kidding, number born and what happened to the kids, should be available for each adult female goat in the herd. While this information may be crude and not necessarily completely accurate, it will enable some initial benchmarks to be set against which to judge subsequent events as revealed by the evaluation recording.
FIGURE 1: Weighing goats
DENTITION AND AGEING OF GOATS

Inspection of the teeth has for long been used as a means to estimate the age of an animal. The pattern of eruption and wear of the teeth can give an indication of approximate age.

The mature goat has 32 teeth with 8 incisors in the lower front jaw and 3 each of premolars and molars in either side of the upper and lower jaw. Molar development is an accurate indicator of age but is very difficult to use in the live animal. There are difficulties also in obtaining accurate estimates of age from the incisors alone but examination of these teeth remains the only practical method.

Although with experience on a particular breed of goat it may be possible to judge the age of an animal under one year by the growth of the deciduous incisors or milk teeth, it is normally only possible to estimate age of adults from the presence and wear of the first, second, third or fourth pair of permanent incisors. These incisors replace the milk teeth in sequence starting from the central pair and working outwards to the fourth pair (Figure 2, i - vi).

Estimates of the ages for eruption of the permanent incisors and of indications of wear in these teeth for the Barbari goat are as follows:

Eruption of permanent incisors:

<table>
<thead>
<tr>
<th>Pair</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>First pair</td>
<td>15.0 (13.5 - 21.5) months</td>
</tr>
<tr>
<td>Second pair</td>
<td>20.0 (19.0 - 25.0) months</td>
</tr>
<tr>
<td>Third pair</td>
<td>24.5 (22.0 - 31.5) months</td>
</tr>
<tr>
<td>Fourth pair</td>
<td>28.5 (26.0 - 31.5) months</td>
</tr>
</tbody>
</table>

Wear of the incisors

<table>
<thead>
<tr>
<th>Wear Description</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Just started</td>
<td>30.0 - 34.0 months</td>
</tr>
<tr>
<td>Table of tooth levelled</td>
<td>42.0 - 48.0 months</td>
</tr>
<tr>
<td>Reduced in size</td>
<td>56.0 - 72.0 months</td>
</tr>
<tr>
<td>Reduced to stubs, broken or absent</td>
<td>over 84.0 months</td>
</tr>
</tbody>
</table>

Further details can be found in the CIRG Extension Leaflet number 17 - Dentition and Ageing in Goat and Sheep - 1986.

For practical recording purposes in the initial survey it is only necessary and practicable to classify the goats into 6 age classes:

1. Milk teeth only
2. Two permanent incisors
3. Four permanent incisors
4. Six permanent incisors
5. Full set of permanent incisors
6. Worn or broken incisors (aged)

This will be illustrated and practised in the practical training sessions.
FIGURE 2.1: Kid at birth with milk teeth just cutting

FIGURE 2.2: Kid at 1 year of age with full complement of milk teeth

FIGURE 2.3: Young goat at 15 months of age showing 2 permanent teeth

FIGURE 2.4: Goat at 20 months of age with second pair of permanent teeth

FIGURE 2.5: Goat at 24.5 months of age with third pair of permanent teeth

FIGURE 2.6: Goat at 30 months of age with full mouth of permanent teeth
SURVEY OF GOAT FARMERS

1. DATE:

2. NAME OF VILLAGE: TEHSIL: DISTRICT:

3. NAME OF PANCHAYAT:

4. NAME OF HEAD OF THE FAMILY:

5. FATHER'S NAME:

6. HOUSE - KACCHA/PUKKA/OTHER

7. PROFESSION OF HEAD OF THE FAMILY: RELIGION: CASTE:
   IS THE WORK IN THE VILLAGE OR ELSEWHERE?

8. EDUCATION LEVEL OF HEAD OF THE FAMILY: YEAR PASS

9. DETAILS OF FAMILY MEMBERS:

<table>
<thead>
<tr>
<th>NAME OF FAMILY MEMBER</th>
<th>RELATION TO HEAD OF THE FAMILY</th>
<th>AGE</th>
<th>EDUCATION/ LITERACY</th>
<th>PROFESSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>2.</td>
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<td>3.</td>
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<tr>
<td>4.</td>
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<tr>
<td>5.</td>
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<td>6.</td>
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<td>7.</td>
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<td>8.</td>
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<td>9.</td>
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</tr>
<tr>
<td>10.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: For children, state if still at school.
10. ANNUAL INCOME OF THE FAMILY:
   a) FROM AGRICULTURE (Including Animal Husbandry):
   b) FROM SERVICE OR OTHER SOURCES:

11. ARE YOU OR MEMBERS OF YOUR FAMILY ASSOCIATED WITH ANY ORGANISATION/INSTITUTION?
    PANCHAYAT/CO-OPERATIVE/WOMEN'S GROUP/OTHERS/NONE

12. HOW MUCH LAND DO YOU HAVE? _______ ha
    a) IRRIGATED _______ ha
    b) UNIRRIGATED _______ ha
    c) UNCULTIVABLE WASTE _______ ha

13. WHAT ARE THE MEANS OF IRRIGATION?
    CANAL/WELL, OWN OR HIRED/POND/OTHER

14. WHICH OF THE FOLLOWING AGRICULTURAL IMPLEMENTS DO YOU OWN?
    COUNTRY PLOUGH/TRACTOR/THRESHER/CHAFF CUTTER/BULLOCK CART/OTHERS?

15. DO YOU OWN A RADIO? TV? BICYCLE?

16. DO YOU SUBSCRIBE TO ANY NEWSPAPER OR MAGAZINE? WHICH?

17. HOW MANY ANIMALS DO YOU HAVE?
    COWS _______  SHEEP _______
    BULLOCKS _______  HORSES/MARES _______
    BUFFALO _______  DONKEYS _______
    GOATS _______  PIGS _______
    BUCKS _______  POULTRY _______
    OTHERS _______

18. SINCE WHEN HAVE YOU REARED GOATS? ______ YEARS

19. HOW MANY GOATS HAVE YOU REARED TO DATE? ______ NUMBER

20. WHAT GOAT BREEDS DO YOU HAVE?
    LOCAL(DESI)/BARBARI/JAMNAPARI/OTHERS
21. AT WHAT AGE DID YOUR SHE-GOATS FIRST KID? (Give for each She-Goat) ____________

22. WHEN YOUR GOAT IS IN HEAT, DO YOU GET IT SERVICED BY AN IMPROVED BUCK OR LEAVE IT IN THE HERD WHERE MALES AND FEMALES ARE KEPT TOGETHER?
IMPROVED BUCK/LEAVE IN HERD/OTHER RELEVANT DETAILS

23. WHO TAKES YOUR GOATS OUT FOR GRAZING?
HIRED HERDER/FAMILY MEMBER (NAME)

24. HOW MUCH DO YOU PAY TO THE HERDER?
R____ PER MONTH. OTHER DETAILS______________________

25. HOW LONG DO YOUR GOATS GRAZE DAILY? _________ HOURS

26. HOW MANY FODDER TREES DO YOU HAVE?
 TREE (NAME) NUMBER AGE

27. DO YOU GIVE SOME SUPPLEMENTARY FOOD AT HOME? (CONCENTRATE/FODDER/KITCHEN WASTES)
YES/NO

28. IF YES, HOW MUCH AND TO WHICH ANIMALS?
SUPPLEMENT__________ QUANTITY_______

29. DO YOU GIVE TREE LEAVES TO GOATS AFTER LOPPING?
YES/NO

30. IF YES, NAME THE TREE LEAVES? __________________________

31. HOW OFTEN DO YOU OFFER WATER TO GOATS? _____ NUMBER OF TIMES DAILY
BEFORE GRAZING/DURING GRAZING/AFTER GRAZING.

32. WHERE DO YOU KEEP YOUR GOATS AT NIGHT?
AT HOME/IN THE FIELD/IN THE SHED

33. DO YOU REMOVE SOIL FROM THE GOAT SHED/NIGHT HOUSING AND PUT IT IN THE FIELD?
YES/NO

34. IF YES, HOW OFTEN IN A YEAR? ______ NUMBER OF TIMES?
35. DO YOUR GOATS EVER SUFFER FROM DISEASES?
   YES/NO

36. WHAT DID YOU DO LAST TIME A GOAT WAS SICK?

37. HOW DID YOU KNOW THAT YOUR GOAT WAS SICK?

38. DO YOU TREAT YOUR GOATS AT HOME?
   YES/NO

39. IF YES, HOW?

40. FROM WHERE HAVE YOU PURCHASED GOATS? ________________

41. WHAT WAS THE AGE OF YOUR GOAT(S) AT THE TIME OF ITS PURCHASE?
   AGE_____ SEX_____ BREED_____

42. WAS IT PREGNANT, LACTATING OR DRY AT THE TIME OF PURCHASE?
   PREGNANT/KIDDED/DRY/OTHER DETAILS

43. HOW MUCH DID YOU PAY FOR THE GOAT? Rs. __________

44. HAVE YOU EVER SOLD YOUR GOATS/BUCKS?
   YES/NO

45. IF YES - IN THE LAST THREE YEARS -

<table>
<thead>
<tr>
<th>Age at which sold</th>
<th>Number</th>
<th>Amount Received (R)</th>
<th>To Whom (Trader/Goat Farmer/Butcher/Others)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncastrated male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Castrated male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

46. WHEN AND HOW MANY DID YOU LAST SELL?
   NUMBER MONTHS/YEARS

47. ON WHAT BASIS DO YOU SELL GOATS?
   WEIGHT BASIS/AGE/OThERS
   GIVE FULL DETAILS:
48. WHY DO YOU SELL GOATS?
   FOR INCOME/DUE TO DISEASE/NOBODY TO LOOK AFTER/OTHER

49. DO YOU MILK YOUR GOATS?
   YES/NO, USE FOR KID FEEDING

50. IF YES, DO YOU SELL IT OR USE IT FOR THE FAMILY?
   SELL/USE FOR FAMILY/both

51. AVERAGE MILK PRODUCTION FROM GOATS?
   A. 
   B. 
   C. 

52. AFTER KIDDING, DO YOU FEED COLOSTRUM TO KIDS?
   YES/NO

53. IF YES, FOR HOW LONG ______

54. DO YOU HAVE A BUCK FOR BREEDING?
   YES/NO

55. IF YES, DO YOU CHARGE FOR THE SERVICE FROM OTHER GOAT
    FARMERS?
   Rs. ______/ANY OTHER IN LIEU OF CASH ______

56. WHO PERFORMS THE FOLLOWING JOBS FOR GOATS IN YOUR
    FAMILY?
   a. FEEDING
   b. WATERING
   c. CLEANING OF GOATS
   d. CLEANING OF SHEDS
   e. MILKING
   f. TAKING FOR TREATMENT
   g. CARE OF SICK GOATS
   h. CARE DURING KIDDING
   i. OTHERS
38.

INFORMATION ON VILLAGE FACILITIES

57. DOES THE VILLAGE HAVE THE FOLLOWING?

HOSPITAL/SCHOOL/ROADS/SHOPS/COMMUNITY TELEVISION SET/
POST OFFICE

58. COMMUNAL GRAZING - AREA

- TYPE

- STATUS

59. VETERINARY SERVICE - DISTANCE?

60. GOVERNMENT TREE NURSERY - DISTANCE?
Chapter 5.

THE EXTENSION MESSAGE

Chapter 5 - Lesson 1.

THE VALUE OF GOATS

SUMMARY

Educate farmers as to the true biological and economic values of their goats.

The objective of the extension programme for traditional village goat keepers is an awareness of what is possible in goat production for them. This means maximising returns from existing resources.

We want to raise the farmers' self-esteem and motivate them to take advantage of existing opportunities and increase the benefits from keeping goats.

The virtues of the goat for village production:
- hardiness
- small body size
- browsing ability
- reproductive ability
- range of products - meat, milk, manure, skins

Productivity targets can be set for each type of goat in each type of village environment. Farmers should be made aware of the productivity achievable under their conditions and with their resources.

The economic returns from keeping goats can be very high compared with those from other business enterprises. Returns on capital of up to 50 percent and recovery of 70 percent of the retail price are possible.
Returns can be enhanced by targeting specific feasts or festivals, by selling breeding stock and possibly by co-operative marketing.

The value of the manure alone may give a 5 percent return on the capital value of the goat each year. Farmers should be encouraged to recover and use this resource effectively.

Goat skins also are a valuable resource from which returns can be enhanced by better slaughter techniques and care of the fresh skin.

Farmers may obtain better access to forest grazings by promoting the use of goats in weed control and fire prevention.
Chapter 5 - Lesson 1.

THE VALUE OF GOATS

Educate farmers as to the true biological and economic values of goats.

Traditional village farmers may not be obtaining the full potential benefits from their goat-keeping activities:
- because they are unaware of all the benefits from utilising or marketing quality products from their goats at the most optimum times;
- because they are unaware of the biological potential of their animals to produce increasing quantities of quality products in ways which are attainable without social or economic disruption.

Even when farmers are aware of better marketing opportunities or of the fact that some individual goats and herds are more productive than others, and it is most likely that they are aware of these things, they may well not know how to advantage themselves from this awareness. Application of the extension messages suggested in this manual should enable the farmers to exploit the biological potential of their animals, and better organisation of marketing and access to services should help them to take advantage of existing opportunities.

Total village production could be increased by encouraging more people into goats or into expanding their herds. Landowners, opinion leaders and others with status in the village might be easy to convince as to the values and virtues of goats and their products. However this may not necessarily mean that these people will take-up goat production or give a lead in technical innovation. There are social constraints against this.
People currently without goats but wishing to take up goat farming can be assisted by the extension officers. A minimum number of 5 goats (including one male unless the female goats can be run with another herd containing a suitable male) is suggested as a viable unit to assure cash returns. Adult goats may be purchased in the autumn, after the monsoon season.

Simply increasing goat numbers however could put too great a strain on existing vegetation resources and existing, traditional, landless or low status goat owners could be disadvantaged. Remember that the primary objective of the extension programme is an increase in the availability of goat products and increased income for traditional goat keepers. It is these people who must be educated and encouraged to get more out of their existing resources.

These farmers practice extensive systems of production in which the goats go daily to graze and browse in state or communal owned forest, on non-cultivable land and roadsides, often herded by children. They are affected by a variety of social and economic constraints such as:

- low income, literacy and status
- inability to utilise credit, even if available
- low land availability - often uncertain access to grazing lands and crop residues
- low risk bearing capacity

Such people are economically weak. Since they often must sell animals or products when sudden needs arise, rather than at optimum times, they are often short-changed. The development of co-operative activity, especially in marketing, would go a long way towards strengthening their economic position.
If these farmers were educated to become fully aware of the true values and virtues of their goats, this would help to:

- raise self-esteem
- make them more assertive
- enable advantage to be taken of the available services
- make them more successful in marketing
- motivate them to increase herd productivity

The first step then in winning farmer confidence and motivating them to embark upon the actions suggested in the extension programme is educational. This can be followed up by training and other steps necessary to maintain confidence, such as ensuring the reliability of supply of any suggested inputs and services. Reliance on external inputs however has been minimised in this programme since failures in delivery of inputs are likely and the emphasis in the programme is on self-reliance.

Awareness of the true value of their goat herds should cause farmers to demand attention from agencies, such as the State Department of Animal Husbandry and Veterinary Services, which tend to service the owners of cattle and buffalo rather than being alert to the needs of the owners of small ruminants.

What are the virtues of the goat and its products?

1. **Hardiness**

   Much has been written and debated concerning the hardiness of the goat as a species and its alleged superior fitness over other species of domestic animal. It is not intended to enter into this debate. There is no doubt however concerning the ability of the local goat types to thrive and produce in local village production systems which often put
severe stresses on the animals. Much of the failure of animals to produce to potential can be identified with specific stresses and at least part of the extension effort is to teach farmers how to overcome or eliminate stressful situations. These stresses are mainly nutritional (general or seasonal), disease related or due to failures in basic husbandry, care and attention. The general hardiness of the goat can be attributed in large part to its small size (relative to cattle and buffalo), its willingness to eat and ability to digest efficiently a wide range of food items gained from both grazing and browsing, and its reproductive capacity which enables it to respond to improvements in environment.

2. **Small body size**

Apart from its relationship to hardiness, small body size is a virtue for social and economic reasons.

Small animals are convenient for sale and consumption, particularly in situations of poor meat storage facilities. Smaller quantities of milk may also be convenient in situations where needs are limited and storage difficult. Where herd sizes are limited due to feed availability, the sale of a single animal to meet target needs for cash is less disruptive in a goat herd than it would be in a necessarily smaller cattle or buffalo herd. Small animals have a lower purchase price than larger resulting in less risk and less loss on accidental death. In general terms, the purchase price of a cattle beast is more than 10 times that of a high quality breeding goat, enabling the acquisition of a breeding herd of goats for the same outlay as required for a single cow or buffalo. Where feed resources are limited, a convenient breeding group of goats, consisting of a number of females (10–50) and one male, can be run as a unit.
3. **Browsing ability**

The willingness and ability of the goat to feed on a range of plant species and parts is well known and need not be elaborated. However, it should be noted that goats in any locality have definite preferences and will normally be found favouring a very limited range of food components at any time. These preferences will be well known by successful local farmers who will herd their animals to take advantage of them. Access to certain browse species may be critical for maintenance of production at certain times of year or may determine the productivity differences among herds.

4. **Reproductive ability**

The goat as a species has inherently a high reproductive rate compared, at least, to its larger competitors, cattle and buffalo. While the benefits of this reproductive ability may not always be realised due to mortality and various reproductive failures caused by disease, poor nutrition, poor husbandry or general environmental stress, the potential is there to respond to improvements. Goat populations can recover relatively quickly from numerical depletion caused by the necessity to sell or by natural disaster, disease outbreak or human failure.

5. **Range of products**

Emphasis in the extension programme is on meat production with a secondary benefit in terms of enhanced milk production. However the goat also produces two other very valuable products - manure and skins - which could in many situations be harvested and utilised more advantageously than at present.
Much has been written about the virtues of goat milk as a human food, and CIRG has produced a leaflet on the subject (Extension leaflet No. 20, 1986). There is no doubt as to the importance of goat milk as a nutritionally high-value food source for poorer Indian villagers and the special role of this food in human child development. The particular advantages of goat milk over cow milk, apart from availability, lie in its better digestibility and lower allergenic properties. The enhanced digestibility is largely due to smaller fat globules.

Productivity

There is of course a wide range of different goat types and breeds with different production characteristics. Production targets have been set in this manual which are relevant to the Barbari and Desi goats of Indian (Uttar Pradesh) villages.

Available evidence suggests that these goats can:
- grow to a liveweight of 18 kg at 1 year of age (ultimate target 23 kg).
- produce a first kid at 13 months of age.
- produce an average of 1.5 kids per kidding at intervals of no more than 8 months.
- produce over 100 kg of milk in 150 days of lactation with a peak daily yield up to 2 kg.

Economic Values

The monetary values placed upon goats and their products will of course vary from place to place and time to time. Goats can produce very high economic returns under traditional village systems because of the low cost or opportunity cost of the actual inputs used.
An attempt has been made by CIRG to quantify the economics of village goat production in the local district with realistic costings of inputs (Bulletin No. 9 - Economics and Prospect of Goat Rearing under Farm and Field Conditions in Semi-Arid Tracts of India, 1986). These calculations indicate returns of up to 50 percent on invested capital per year over a range of conditions.

The buying of animals and selling of products through a Goat Producers' Co-operative at the village or district level should result in assured prices and prevent exploitation by middle-men. To establish such an organisation it is necessary to initiate dialogue among farmers at the village or panchayat level. At a later stage, like-minded farmers should be helped at block or district level meetings to form a variety of co-operative organisations with assistance from Government. Annual contracts with public or private food processing factories should prevent distressed sales of products at low prices. The selling of meat or meat products through co-operative stores in the cities and urban areas should ensure quality control for the benefit of consumers and greater returns to farmers.

**Meat Value**

The meat value of goats can be determined whether the animals are used for home consumption or sold commercially. In the CIRG area, an 18 kg liveweight young goat might sell for R12 per kg liveweight or R216 per animal. The butcher might sell this same animal on a carcass basis for R36 per kg carcass or R285 per animal. In addition the butcher might obtain perhaps R15 for the skin and R8 for the head giving a total of R308 per animal. This indicates a good return for the farmer, 70 percent of the retail price.
The basic price of around R200 per animal can be enhanced up to a reported figure of 10 times the basic price when large, fattened animals are targeted towards specific festivals and feasts. Other alleged ways of ensuring good prices are to castrate all male goats destined for the meat market and to produce animals of the Barbari breed type rather than other less uniform types (Lesson 2).

Since farmers are often forced to sell because of immediate specific requirements for cash they can be disadvantaged in selling prices. The development of co-operative marketing aimed at stability of prices and of supply could be one way to ensure the best possible long-term price structure for farmers (Chapter 6).

It should be noted that goat meat has a marketing advantage over beef and pork because it is acceptable to all religious communities and is the highest priced meat in India.

Sale of Breeding Stock
Well grown, healthy Barbari goats, particularly females, are in demand for breeding purposes and currently sell for R250-450. This gives quite a reasonable premium over the meat market price and is an incentive for farmers to improve husbandry and consider village-wide action in selective breeding (Lesson 2).

Value of Milk
Available surplus milk, over and above that needed for good kid rearing, is normally used for local family needs. It is necessary to stress the priority needs of kids (Lesson 6). Milk not needed by the family can be sold locally and currently fetches around R2 per litre. Additional value can be added to the surplus milk by selling it in the form of casein (paneer) or the preparation of cottage cheese.
Value of Manure

Goat manure and manure impregnated bedding have value both for soil fertility restoration in gardening and for the production of bio-gas for household energy supply. The value of the manure for fertiliser, based on its nitrogen content, has been estimated by CIRG as R20 per goat per year, which is about 5 percent of the capital value of the animal. Farmers must be encouraged to recover and use the manure selectively to enhance food-crop production. The use of goat manure in promoting the growth of young fodder trees is also to be recommended (Lesson 3). Goat manure may be composted in shaded pits for use after 6 months.

Value of Skins

The value of goat skins to the butcher has been mentioned above and is currently some R12-15 per skin. Skins recovered from home slaughtering are a resource which is often under-valued. The values of goat skins can be greatly enhanced by good slaughter techniques and the beneficial effects of care and attention to the skin after slaughter (Chapter 6). The possible adverse effects of external parasite infestation on subsequent skin value should also be noted for discussion with farmers. Goat skins make high quality, soft and durable leather for garments and fashion goods if the raw skins are also of high quality.

Other Possible Values

In some regions and countries, goats are valuable for weed control, especially in tree crops, and can be used for fire prevention in forestry by the clearing of under-growth and fire breaks. This type of argument can be used by villagers to obtain better access to forest grazings.

It is also alleged in India that a light grazing by goats stimulates branching in gram crops and improves subsequent grain yields.
Goats play an important role in the total dry-land agricultural system in India. The land used for dry-land cropping is often of low fertility with poor organic matter content, low moisture retention properties and excessive alkalinity. The concentrated grazing by large numbers of goats overnight prior to tillage is used to improve soil condition. Sufficient fertility build-up may be obtained from such a practice to suffice for three successive subsequent crops.

The grazing of goats in dry fish ponds benefits fish growth in the subsequent rainy season. Goat manure can also be used directly as a source of nutrition for pond fish.

Goat slaughter wastes and washings are also valuable as fertiliser or for fish ponds and poultry feeding. Goat horns and hooves are utilised in cottage industries and the intestines are sought after as high quality casings for meat products.
BREEDING

SUMMARY

Expand the utilisation of selected male goats for breeding and the use of the Barbari type to increase marketing opportunities.

Recognise the value of the present types of goats for the traditional farming systems of the region. They have been selected over a very long period to be fit and to produce in this environment.

However - it is possible to assist the village farmers in a clear and profitable way by improving goat selection procedures.

Farmers must be taught to appreciate the longer term benefits of a more effective selection process than that currently used in the village.

Encourage the use of Barbari type animals for breeding since their offspring fetch a premium price in the market place. Use this to promote the wider use of male goats selected on productivity potential.

Improve selection for productivity by putting most emphasis on mothers' kidding records. Stress the primary importance of reproductive performance in overall herd profitability and the contribution of selective breeding to improving this performance.

Encourage the use of only selected male goats in the whole village.

Do not waste a lot of time helping farmers to keep breeding or production records of dubious value. Concentrate on essentials.
Expand the utilisation of selected male goats for breeding and the use of the Barbari type to increase marketing opportunities.

Selection and cross-breeding can be very effective in bringing about improved animal productivity through the widespread use for breeding of animals which are known to be genetically superior to those currently existing in the general population.

Genetic improvement is only effective in a village goat population when the offspring of selected parents replace the goats of the existing population. If animals which are known to be superior because of their basic nature, rather than because they have been better fed or cared for than their herd-mates, are chosen for breeding to become parents and their less favoured herd-mates are sold or castrated, then we can expect the offspring of these parents to be more productive than would have been the case if no selection had taken place. However, unless the superiority of the selected parents in the population from which they are chosen is very large for the really important aspects of production, then changes in the short term will be very slow.

In order to know that the selected animals are truly superior there must be clear objectives and good recording of production. By clear objectives we mean the results of decisions about what kinds of goats we want in the future and on which aspects of production (growth, milk yield, twinning rate) we should concentrate in the breeding programme.
To make rapid progress in a short time the selected animals must be far superior to their herd mates. This is only possible if very small numbers of animals are selected from very large populations and used widely in the general village herd. This is difficult in the existing village situation with a large number of very small herds unless there can be good organisation and complete farmer co-operation. Genetic improvement programmes are only obviously effective in the short term (say 10 years) if they are co-ordinated on a very large scale with clear objectives, good recording and co-operative action.

Let us be realistic about what is possible for goat improvement in the typical village situation in the near future.

Let us talk only about selection of which animals to keep for breeding and not about cross-breeding.

We must first recognise the value of the present types of goats for the traditional farming systems of the region. Breeds such as the Barbari, Jamnapari and Jhakrana have been developed by selection over a long period of time to be fit and to produce in local environments. Even the local or Desi types, which may not be clearly identified as belonging to one or other of the established breeds, are the result of local selection for performance. Cross-breeding suggests the deliberate mating together of animals from clearly different breeds (such as the mating of Jamnapari males to Barbari females). This should only be contemplated if, in a planned way with proper control, we wish to either change the breed of goat in the district or develop a new kind of goat. The former can be done by the use of males of the new breed for several generations (grading-up) and the latter by selection from a mixed population formed by cross-breeding. None of this should be contemplated unless a new kind
of goat is needed for new kinds of production systems. For example, it may be necessary to find or develop a more productive goat than the present animals if intensive fattening systems using valuable feeds are developed in future.

Is it possible to assist the existing village farmer in a clear and profitable way by improving goat selection procedures? Yes - but first we must look at current practices.

An advantage in current practices is that male goats are castrated, usually at about 1 month of age. The reasons for this are discussed below (see Box). About 1 in every 20 males is kept entire for breeding purposes. These breeding males are selected mainly on visual appeal but there could be some selection on the mother's performance as well as the individual size and health of the kid, depending on the owner. Most female kids that survive to breeding age enter the breeding herd and remain there until death or until culled for non-performance (not kidding) or old age.

Farmers may not see much benefit from changing these procedures - and in the short run they may be right.

However, the extension programme should not ignore breeding since a slow education process will enable farmers to understand the long term benefits of selection and they will be ready in the future to participate in possible co-operative group breeding schemes or co-operative schemes based around a central institutional nucleus herd.

What can be done in the shorter term?
1. There is an advantage to farmers in producing animals which can be clearly identified as belonging to the local Barbari breed. This is because such animals fetch a premium price in the market place - both for meat and for breeding purposes.

For example, a 6 month old female kid of good Barbari appearance can be sold for breeding for perhaps R250 compared to a butcher's price of perhaps R100.

Farmers may be prepared to buy Barbari breeding males from institutions such as CIRG. CIRG currently has 30-40 males available each year for distribution and sale at R250 for a 1 year old male. However there is no guarantee that these males are better genetically than the farmers' existing animals.

This favouring of the Barbari may well be pandering to local prejudice since we have no evidence that animals that look Barbari are any better in production than other local, non-Barbari (Desi) goats. However if the farmer can gain, then the extension should reflect this until such time as circumstances change. The proposal can be justified by using it to promote genetic improvement in general.

The best way to exploit the financial advantage for the farmer of using Barbari animals in the extension programme is to use it as a means of achieving better selection for production in farmers' herds.

2. The selection procedures in most farmers' herds could be improved. The main change suggested is to put greater emphasis on the mother's kidding record. Preference should be given to sons of females that have kidded twins at regular intervals of no more than 8
months - say 3 sets of twins in 2 years. The primary importance of reproduction performance in overall herd profitability should be discussed with farmers (Lesson 4). They are probably aware of this anyway but may not be aware of the importance of selection in maintaining high reproduction rate - particularly male selection.

People often do not see the connection between the selection of the breeding buck and the subsequent reproductive performance of his female offspring. It may be necessary therefore to explain that male animals can inherit and pass on to their offspring the biological ability to produce twins at regular intervals even though they themselves, as males, cannot express this ability.

As herd productivity improves there will be more and more surplus female kids available, over and above those needed to replace natural losses. This will enable selection of female replacements on the bases of superior growth rate and the reproductive performance of the dam. Older female goats may also be culled out of the herd if not reproducing to the same level as the rest of the herd. Serious culling however can only be done if there is a surplus of suitable young females, and older females should not be sold until their replacements are secured.

3. There is a problem with the presence of numbers of unselected male goats in the village belonging to farmers not yet following good selection practices. Such goats will compete with the farmers' selected males while the females and males are together on communal browsing and grazing or when coming and going.
Can co-operation or group pressure be used to ensure that only agreed selected entire males are present in the whole village? The extension officer should explore this possibility with the Panchai and in village meetings. Great care should be taken however not to alienate individual farmers by having, say, the Panchai telling them to get rid of certain animals.

This must be part of the breeding education programme.

**Recording:** The keeping of production records by farmers is not stressed at this stage. However, there will be need for the extension officer to keep records of individual animals for evaluation purposes (Chapter 7) and individual farmers, particularly the educated farmers, may wish to start keeping records if they are convinced that they may be of value in selection or goat management.

However, do not fall into the trap of spending a lot of time keeping records of dubious value for a few individual farmers.

Farmers do know their individual animals and can recognise them in a group. However, in order for evaluation recording to be done, the animals will have to be individually identified in some way that the extension officer can use. Such identification also aids the extension officer to discuss progress and problems with individual farmers.

The suggested means of identification is by tattoo, either inside the ear or under the tail (Figure 3, i - ii). There are traditional, professional tattooists in most villages whose technology for tattooing humans can easily be adapted for tattooing goats. Farmers are familiar with this technology and there is no need for purchased equipment.
FIGURE 3.1: Ear tattooing

FIGURE 3.2: Tail tattoo
Alternatively, a farmer with a few goats should be encouraged to name his animals so that the extension officer can make notes about individual animals if necessary. A note that Gauri (goat) of Babulal (owner) kidded on April the first may be of value in an ongoing extension dialogue between the officer and farmer Babulal.
FIGURE 4.1: Subcutaneous injection

FIGURE 4.2: Intramuscular injection
Castration of male goats is done by villagers mainly because castrated males fetch a premium price from butchers. Price is determined largely by condition or fatness and castrated animals do fatten and appear fat in a way that entire males do not.

While it has been proven elsewhere that, at least with sheep and cattle, entire males grow faster than castrates, the limited work done with goats in India suggests that this may not be the case with these animals for growth up to normal slaughter size. This may be due to the increasing fat deposition in the castrates or to the increased activity by entire males after puberty. Whatever the truth of the matter, there is no doubt that there is financial advantage to the village farmer in castrating males before puberty.

This practice has the secondary advantage of allowing selection to take place, albeit at a young age.

Farmers know how to castrate, usually favouring removal of each testicle through an incision on the side of the scrotum. Extension officer trainees not familiar with the technique will be taught it in the training course so that they will be on an equal footing with farmers when discussing these matters. Also no doubt there are farmers whose methods could be improved with a little guidance.

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**Do** Encourage the use for breeding of Barbari-type animals.

**Do** Encourage selection of male kids for breeding on the basis of their mother's kidding performance.

**Do** Encourage co-operative action to ensure only selected males are used in the village.

**Do** Start an education programme to get farmers thinking about future benefits from present use of selected males and females.
Teach farmers the means to improve feed and fodder resource management and availability.

The main nutritional limitation in goat rearing is the quantity of available feed.

Special fodder crops can be grown but the scope is limited by the shortage of suitable land and irrigation.

Waste lands used for grazing and browsing can be enriched by suitable plantings of trees and shrubs with edible leaves and pods.

The constraints are:
- poor, eroded soils
- low available water
- communal ownership and utilisation of the land

Discuss the possibilities for communal action in land rehabilitation with community leaders, organisations and in village meetings.

Encourage farmers to plant individually owned fodder trees and shrubs on their own land.

Appraise farmer needs to decide on suitable species.

Use result demonstration techniques to get the message across.

Do not spend time growing trees or running tree nurseries to the detriment of other important extension work.
Discuss with the community the possibilities of establishing a community nursery.

Extension officers should be familiar with the simple silvicultural techniques needed to grow healthy trees.

They should also be prepared to assist villages or individual farmers to plan suitable integrated systems of farming with appropriate mixes of crops, fodder trees and grass pasture.

- Explore the possibility of implementing managed grazing and browsing systems in each village situation.
- Assist farmers to develop suitable systems for grazing, browsing and lopping of trees which will ensure sustainable yields of good quality feed to meet the needs of the goat herd.
Chapter 5 - Lesson 3.

**FODDER RESOURCE**

Teach farmers the means to improve feed and fodder resource management and availability.

There can be no doubt that the quantity of available feed is the main factor limiting the expansion of goat production in the majority of Indian village situations. Most crop residues are utilised for feeding of cattle and buffalo. In addition, most traditional goat owners are land-less or have very small holdings of land which are fully committed to growing human food crops or cash crops. Goats are kept by these families because of their ability to utilise the vegetation growing on waste land and in forest. Grazing and browsing by goats is restricted to land unsuitable for cropping, state or communal owned forest, roadsides and other waste land between fields and around villages. Goats may be grazed on crop stubbles but only after the straws and stovers have been removed.

In general the nutritional limitation is quantitative rather than qualitative since the wide range of grazing and browse food items generally provide a nutritionally balanced diet. However, the goats may not be able to satisfy their appetites or obtain sufficient dry matter intake to meet production requirements at all times of year (Lesson 7).

Because of the shortage of arable land, and in particular irrigated land, the scope for growing special fodder crops for goats is severely restricted. While crops such as oats, berseem (*Trifolium alexandrinum*), forage sorghum, cowpea, cluster bean and other forage legumes can be grown and the technology is available, such interventions are beyond the
scope of most village goat keepers. What is possible is the enrichment of waste lands with suitable plant species and the planting of selected fodder trees.

Work is being done at various centres to identify the various fodder crops and browse species suitable for goats and to determine the composition and nutritive value of the edible parts. The technology is well developed for the growing and harvesting of a wide range of suitable plant species and varieties. What is needed now is an effort towards implementation of known technology.

The objective of the enrichment of non-cultivable waste lands is an increase in the total available and edible biomass together with an improved seasonal distribution of availability. This should result in improved goat production without alteration to the existing goat husbandry systems other than perhaps the utilisation of new food items.

There is no doubt that the edible biomass can be increased in marginal agricultural zones by the use of tree crops. Such zones are marginal in the most part because of poor soils or shortage of water. The soils typically have low organic matter content, low available nutrients and poor water-holding capacity. For example, the soils of the area around CIRG are mainly eroded, sandy alluvia of extreme alkalinity and with little to no organic matter. The ground water is largely saline. These problem soils are costly to develop for agriculture but the natural vegetation can be enriched by the planting and nurturing of selected fodder trees, shrubs and, in some cases, grasses.

Inadequate available soil moisture for optimum plant growth is a major constraint. Rainfall is often low, markedly seasonal and unreliable. The
water retention properties of the soils are poor. Available irrigation water is either saline or so valuable that it can be used only for essential and high value crops.

The ravines are an important group of waste lands occupying nearly 9 million hectares, mainly along the rivers of north-central India (the Yamuna, Chambal, Mahi, Sabarmati and their tributaries). The illicit cutting of trees, accompanied by incessant over-grazing, is considered to be responsible for the soil erosion by wind and water which has resulted in ravine formation. It is essential to develop a system of soil, plant and animal husbandry which will allow grazing and utilisation of tree products while replenishing and conserving the top soil. Rehabilitation of these lands requires control of grazing and browsing by a judicious mix of livestock species together with massive re-afforestation using multi-purpose, quick-growing plants which serve local needs.

Any major ravine development programme must encompass soil and water conservation techniques. Most afforestation programmes to date have suffered from a lack of rapport between foresters and local villagers, particularly goat farmers. The negative attitude of foresters to goats has fostered the planting of species of trees chosen primarily for timber values. However it would be more productive to involve villagers in re-afforestation using multi-purpose trees and to allow subsequent browsing by goats. Controlled browsing would not prevent the establishment and spread of grasses necessary for soil conservation.

The soil and water constraints can be overcome using known techniques but at a cost. The greatest constraint to any large scale planting of communal waste land is likely to be the difficulty in achieving a sufficient level of co-operation among the traditional users and controllers of the
There are identified problems in the development of community action to improve the fodder resource and to use it in a fair and sustainable way. Certainly there may be a need for external assistance if rehabilitation plantings are to be contemplated on any large scale. Such programmes are outside of the scope of this extension project, but what can be done immediately is the encouragement of the growing of individually or family-owned fodder trees on the farmers' own homestead land. Important here is the availability and cost of the planting material and the protection of the growing plants.

Once the available fodder resource has been improved there will be a need to develop improved techniques for the management of the resource. This may require some on-station research integrated with what is happening in the field. However, much of the development can be done by the farmers and extension officers working together to discover and apply techniques for sustainable harvesting of the various plant species and ensure a uniform availability to feed to the goats.

Choice of Plant Species
The choice of fodder tree or shrub species to be planted is of course location specific. For many situations a range of suitable species has already been identified and some have been tried in field-scale plantings. Such is the work that is being done by CIRG. The testing of new species in the field must be coupled with an ongoing appraisal of the real needs of farmers. For example, it may well be that the primary need is for fuel wood with goat fodder only a secondary consideration. Both result demonstrations on the growing of fodder trees and the appraisal of farmer needs can be done by the extension officers.

Note however that extension officers should not be growing trees to the detriment of other equally important aspects of their work.
Farmers use trees or their products for fodder, firewood, making implements, building, fertiliser, medicine and food.

The ideal tree species for planting is therefore likely to be multi-purpose.

There are clear advantages from the point of view of soil amelioration in promoting leguminous species with the capability of hosting nitrogen-fixing organisms in root nodules.

Many native species tend to be slow growing relative to soil exotic introductions. It is likely that single tree plantings primarily for fodder will tend to be exotic but for large-scale rehabilitation plantings an effort should be made to use a balance of native and exotic species.

The acceptability of the plant parts to goats is of vital importance. Trees with edible pods, such as for example *Acacia nilotica*, *Acacia tortilis* and *Acacia albida*, might be expected to have some advantages over trees with edible leaves only.

That the edible fodder producing ability of trees, even those primarily used for firewood, is important to villagers is illustrated by the complaints concerning the widespread use of the non-edible *Prosopsis juniflora* by forestry interests in rehabilitation plantings. The soil conservation purposes of forestry can only succeed if the trees grown can meet the needs of the people on a sustainable yield basis as well as preventing erosion.

The ideal fodder tree should be -
fast growing
- easy to establish
- producing edible leaves and pods
- multi-purpose fuel and fodder
- capable of fixing nitrogen
- having good soil binding and holding properties
- tolerant of heavy lopping
- able to coppice well

A list of possibly suitable species of nutritious fodder yielding multi-purpose species for the semi-arid areas of North India is appended to this Lesson.

Silvicultural Techniques

It is not possible for the extension officers to be expert horticulturists or silviculturists. However, they should be familiar with the various techniques necessary to enable farmers to grow satisfactory fodder trees.

Most chosen species for any particular area should be available or made available as young plants for direct planting. These may be potted or bare rooted as appropriate. Should it be that either villagers or extension officers are required to grow young plants in nurseries for distribution or own use, then techniques for seed treatment or vegetative propagation may need to be known. However, once again it should be stressed that it is not the proposed function of the extension officers to be running plant nurseries. If there is a need for a community service nursery in any village or district, then appropriate means to establish, service and maintain such a facility should be explored. A village nursery could be run by a village co-operative or by an individual villager as a business.
Suitable training could be found for villagers wishing to undertake roles in nursery management.

Silvicultural techniques that should be familiar to extension officers include the following:

- Use of fertiliser, organic manures and lime; particularly the use of goat manure in planting holes.
- Use of mulch for water conservation, weed control and fertilisation. Goat bedding could be a very suitable mulching material.
- Planting on bunds, terraces or grass strips for soil and water conservation as well as fodder supply.
- Pitting and trenching for water conservation.
- Protection of young plants from animals, including the use of mesh sleeves and used drums with the ends removed.
- Termite control.

Most of these techniques will be discussed and taught in practical sessions.

**Incorporation of Fodder Trees into Farming Systems**

The scope for the incorporation of new goat fodder crops into existing agricultural systems is limited for goat owners by the availability of suitable land and irrigation.

It is however possible to incorporate fodder tree crops into existing systems using a variety of agro-forestry and silvo-pastoral techniques. Agro-forestry systems have tree crops combined with agricultural crops in various arrangements. The most common arrangement is alley farming in which the crops are grown in alleys between parallel rows of a tree crop.
Silvo-pastoral systems are suitable for widespread areas of rangeland which is unsuitable for agricultural cropping due to water or soil constraints. A variety of spacings and geometrical layouts are possible for the trees planted either into natural vegetative cover or into established pastures of local or introduced grasses.

To establish silvo-pastoral systems on denuded land -

. Plant trees or shrubs during the monsoon.
. Remove weeds or undesirable bushes during the dry season.
. Establish grasses and legumes between the trees during the next monsoon.

Possible layouts, spacings and combinations of species will be demonstrated in the practical sessions.

Some suggestions as to suitable tree, shrub and grass species for the semi-arid areas of North India are listed at the end of this Lesson.

Utilisation Methods

It is assumed that effective utilisation of the improved fodder resource implies a sustained, maximum long-term yield of good quality goat feed. (See Lesson 7 for a discussion on what is meant by quality feed). It is probable that the natural vegetation is adapted to traditional grazing and browsing with marked seasonality or ability to regenerate after defoliation. However, over-use is common with progressive degeneration resulting in the dominance of less-palatable species and an increase in the proportion of bare ground. This of course leads to problems of erosion and loss of control of soil water.
The improvement of grazing and browsing management is difficult when the land is communal or state-owned. The development of co-operative approaches to communal land management is an urgent necessity but is probably beyond the scope of this extension programme. Extension officers should however explore the possibilities with the village leadership and in village meetings. A possibility for improvement is managed closure. In such a system some 10-20 percent of the grazing/browsing area is closed at any one time for 1-3 seasons to allow seed-set, improved vegetative cover and changes in the plant community in favour of more palatable species. The closed areas could be grazed in a controlled manner once or twice during the season and opened to full utilisation after the period of rest to enable a further area to be closed. Opportunity could be taken during closure to plant fodder trees or shrubs in a programme of vegetation enrichment.

The traditional lopping of established fodder trees probably involves some assessment of what constitutes a sustainable lopping regime. The desirable intensity and frequency of lopping will need to be established for any new species encouraged by the extension programme.

It can be envisaged that eventually systems of feed budgeting would be developed enabling grazing, browsing and lopping systems to be related to the actual food needs of the individual or village herd. Means for assessing the quantity of the total available biomass and its nutritive value are needed for the monitoring and evaluation of steps taken to improve the fodder resource. Such assessments can be used to enable the availability of feed to be matched to the requirements of the goat herd as discussed in Lesson 7. Problems of over-utilisation, uneven utilisation or seasonal short-falls can then be identified for solution by the research institutions or by the village leadership and co-operative organisations.
List of suitable multi-purpose tree and shrub species

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<thead>
<tr>
<th>Acacia albida</th>
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<tr>
<td>Acacia catechu</td>
<td>Hardwickia binata</td>
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<td>Acacia senegal</td>
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<td>Acacia tortilis</td>
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<td>Albizia lebbek</td>
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<td>Azadirachta indica</td>
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<td>Balanites aegyptiaca</td>
<td>Tamarindus indica</td>
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<tr>
<td>Capparis seylanica</td>
<td>Zizyphus mauritiana</td>
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<tr>
<td>Clerodendron phlomidis</td>
<td>Zizyphus nummularia</td>
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Grasses

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<tr>
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<td>Cynodon dactylon</td>
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<tr>
<td>Dichanthium annulatum</td>
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<td>Themeda quadrivalvis</td>
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Stress the supreme importance of achieving a high level of reproductive efficiency.

Reproductive efficiency - the degree to which the female goat breeding herd demonstrates its biological capacity to produce kids.

Reducing mortality and increasing reproductive efficiency are the clearest roads to success in goat meat production.

Objectives - An awareness of the importance of reaching reproduction targets
- An ability to detect failures in reproduction and correct them

Targets - First kidding at 13-15 months of age
- Subsequent kidding every 7-8 months
- 150 kids born for every 100 kiddings

Do not overlook the importance of the male goat or take his fertility for granted.

To achieve the targets -

* Young animals should be growing well; mature animals well fed, fit and healthy.
* Females should be with active males at all times except during the kidding period and the first month of life.
Check for repeat matings 17-22 days following observed matings - if there are no obvious disease symptoms then try another buck.

If there is no obvious pregnancy or kidding by the time a female kid is 15 months of age, she is well grown and there is no reason to suspect the buck, it may be best simply to sell her for meat.

A mature female may lose too much condition during late pregnancy or early lactation, resulting in delayed resumption of oestrus cycles. Only good feeding and an active, fertile buck can ensure target kidding intervals.
Stress the supreme importance of achieving a high level of reproductive efficiency.

It is quite clear that the greatest immediate improvement in the productivity of village goat herds would come from an increase in the number of animals raised to slaughter or to reproductive maturity in a given time period. This increase in number of goats could come from a reduction in mortality together with an increase in reproductive efficiency. By reproductive efficiency we mean the degree to which the female breeding herd demonstrates its biological capacity to produce kids.

If the female goat herd includes the young females intended for breeding, then the components of reproductive efficiency can include:

- the age at puberty or age at first kidding
- the various intervals between successive kiddings
- the proportion of multiple births

Other aspects of reproduction are relatively fixed (such as length of pregnancy) or are included in the above components.

The objective of the extension programme is firstly, the achievement of an awareness among farmers of the supreme importance of early and regular kiddings, together with the maximum production of twins and their survival, in maximising the profitability of their herds. Secondly, this awareness should lead to an ability to detect failures in reproduction and take the necessary steps to correct the situation.
The present situation in village herds is not clearly known. Some data will be obtained from the preliminary surveys (Chapter 4) and more accurate data from the production recording necessary for evaluation of the extension programme (Chapter 7). Data currently available from research stations such as CIRG are not strictly relevant because of the management systems imposed in these herds. Indeed there is reason to believe that, at least for some components of reproduction, current village productivity may be better than that recorded on the stations. This is likely to be true for age at first kidding and kidding intervals because of the imposition of controls over mating and mating seasons in research herds. It is also possible that there is better access to browse and more skilled use of available browse in some village situations.

Nevertheless, it can be assumed for the moment that, for local village goats, age at first kidding may be greater than 15 months, kidding intervals may be longer than 8 months, and the incidence of multiple births may result in 130 kids born for every 100 females kidding.

Targets may be set as follows:

- First kidding at 13-15 months
- Subsequent kidding every 7-8 months
- 150 kids born for every 100 kiddings

There is a need to improve village production or ensure these target levels of production are maintained, together with an improvement in kid survival (Lesson 6).

It is assumed that in the village situation the female goats are with active bucks at all times except during kidding and, for female kids, during the
first month of life. This system probably ensures maximum reproductive opportunity.

It is also considered impossible to introduce high technology interventions such as hormone therapy, control of the oestrus cycle, artificial insemination, embryo transfers or control of the timing of parturition. Extension officers may however wish to become aware of future possibilities with respect to control or enhancement of reproduction and can be referred to the CIRG Bulletin No. 7 - Modern Reproductive Tools to Enhance Goat Production, 1985.

It is not intended here to discuss in detail the physiology of reproduction. Nevertheless, before discussing what should be done to ensure high reproduction rates there are certain general matters that should be considered. Officers requiring more detailed information can be referred to standard reference material.

The first point to stress is that males and females are equally responsible for successful reproduction. This should be obvious but the role of the male goat is often overlooked or taken for granted. To be effective, male goats must be active in seeking out and mating with receptive females. They must also be able to produce an adequate quantity of good quality semen. Sexual behaviour can be observed, but semen production can only be checked by trained people with appropriate equipment. The latter may become necessary in the future to avoid failures with bucks selected in any intensive breeding programme.

Sexual behaviour in mature but non-pregnant female goats follows a regularly repeating pattern - the oestrus cycle. This cycle or pattern in the Indian village goat is normally 20-21 days although a range of 17-22
days is common. The female is receptive to the male during heat or oestrus which occurs for 1-3 days (most animals 24-36 hours) in every cycle. During this oestrus period she will actively seek males and allow courtship and mating. Ovulation occurs about 30-36 hours after the start of this oestrus period. Pregnancy lasts for some 140-150 days following a successful mating.

Young female goats reach puberty and therefore begin to show the cyclical oestrus pattern at 6-8 months of age although this may be delayed by poor growth. An animal successfully mated at 8 months will kid for the first time at 13 months, the minimum age we have set as a target.

The observation of mating by a male goat does not necessarily mean that the female is in heat, forced mating can occur. However, if the female allows courtship and stands firm during mating it can be assumed that mating is occurring during the correct time to allow her to become pregnant.

What to do to achieve the targets

1. Ensure that young female kids are growing rapidly and are fit and healthy. Take note of the extension messages on kid rearing, health and the possibilities for strategic supplementary feeding of kids.

2. Ensure that female goats which have newly kidded and are in lactation have access to the best possible browse and grazing for the maximum time of daylight herding (at least 8 hours). Any additional feed which is available, such as kitchen scraps and better quality crop wastes (Lesson 7), and which is not needed for kidding females and growing kids should be given in next preference to animals in early lactation. It is known that the voluntary intake of feed may increase by as much as double during peak lactation and a goat may not have
enough browsing time to eat to appetite and secure all her requirements.

3. All young females, approaching puberty and intended for breeding, and all newly kidded females should be exposed to the best available bucks (Lesson 2), preferably for 24 hours a day. If co-operative arrangements are being used to share a buck amongst different owners, then the female goats of all the owners should be run together and with the buck at least during the daylight grazing and browsing hours. However, note that much intense mating takes place at night when the goats are confined together in the night housing.

4. Farmers should be made aware of the normal 3 week length of the oestrus cycle. If a female goat required to become pregnant is seen to be mated, then the farmer should watch her carefully from 17 days later for the following 5 days to see if she is mated again. In this way repeat breeding problems can be detected. If there are no obvious disease symptoms in the repeating female goat (Lesson 5) then infertility in the buck should be suspected.

Try another buck.

If the suspected buck is a particularly valuable animal, because of a planned selection programme or because he has been purchased at a high price for some reason, then the extension officer could ask an institution such as CIRG to test the goat for semen production and quality.

5. If a young female kid which is growing well and healthy is not mated by 10 months of age, is not obviously pregnant by 13 months or has not kidded by 15 months of age, then a problem may be suspected.
Again ensure that an active, fertile buck has access to the female kids at all times.

Pregnancy diagnosis in the goat is not easy but when the goats are well known and observed every day as happens in village herds, swelling of the belly may be detected perhaps as early as 3 months after a successful mating. A firming-up of the teats and udder may also be detected well before kidding. There is no visual sign of pregnancy early in the process. Information on recent technology for pregnancy testing may be found in the CIRG Bulletin No. 7 mentioned earlier.

If there is no obvious pregnancy by 15 months of age then veterinary advice may be sought. Otherwise it may be best simply to sell the goat for meat and reduce loss.

Likewise if a goat which has kidded is not mated again within 3 months of the kidding, or does not kid again by 8 months, then advice should be sought. The goat may have lost too much condition during the early lactation or late pregnancy to enable her both to produce milk and to start normal oestrus cycles again. Only good feeding will solve this problem, provided that again an active, fertile buck is present with the female goats at all times.

There may be a problem of a delay in the resumption of oestrus cycles by goats that kid just before or during the hottest season of the year due to stress. Little can be done about this except to ensure the best possible feeding and comfort of the goats. Any indications of seasonal effects on breeding should be taken into account by the extension officer when judging whether or not a farmer has a real problem of extended kidding intervals.
Remember always - good feeding of healthy female goats and active, fertile male goats will generally ensure efficient reproduction.
Implement the recommended package of measures necessary to maintain as good a health situation as possible.

Health care starts with good animal husbandry. The maintenance of good goat health can best be assisted by encouraging farmers to adopt the recommended practices for goat care and feeding. Adoption of the extension package should result in improved production through a reduction in ill-health and annual mortality should be reduced to no more than 10 percent in kids and 5 percent overall.

Extension officers and farmers should discuss together how to detect sickness from abnormal appearance or behaviour of the goats.

Most causes of ill-health are preventable. However, some problems can only be dealt with by the veterinary services.

Farmers can be in a strong position to demand veterinary services if they are fully aware of the value of their animals and know when a health problem is serious enough to require veterinary assistance.

Do not spend a lot of time doing routine vaccinations against specific diseases but do consider using health care as a means to win farmer confidence and co-operation.
Note that - there is likely to be a shortage of veterinarians. - there will be little money for drugs and chemicals.

Drenching and dipping for parasite control may be beneficial. Obtain local veterinary advice as to appropriate least-cost programmes.

Do not let the farmers be conned into spending money on unnecessary drugs.

Do encourage co-operative village action for dipping if such is necessary.

Encourage the use of resting platforms or raised floors in the night housing.

Assist farmers to learn how to trim overgrown hooves if necessary.

Encourage farmers to demand veterinary services for essential day-to-day treatment of sick animals in order to encourage governments to maintain and expand them.

Draw the attention of the veterinary services to disease symptoms, even in cases where expensive treatment might not be warranted, in order that serious disease outbreaks may be detected early.
Implement the recommended package of measures necessary to maintain as good a health situation as possible.

Health care of a farmer's goats starts with the farmer. Good goat health is dependent upon good animal husbandry, which means simply care and attention to the needs of the goats. Local goats, adapted to local conditions, which are well fed and well housed at night should rarely suffer from disease. Nevertheless, mortality rates are generally very high, perhaps up to 20 percent of kids up to the age of 3 months and 10 percent of all goats every year.

The objective is that kid mortality should be no more than 10 percent and total mortality no more than 5 percent annually.

The extension officer can help the farmer most to reduce mortality by assisting with the implementation of the good husbandry techniques suggested in this extension programme.

Poor animal health may cause a loss of production even if there is no mortality. This loss of production is difficult to measure but the improved husbandry expected as a result of the extension programme should result in better health which will contribute to the expected overall productivity increases.

What are the causes of ill-health or mortality?
- Disease - caused by other organisms or faulty nutrition
- Accidents - physical injuries or predators
- Poisoning or intoxication
- Old age
- Starvation

The causes of losses of young kids are discussed in Lesson 6.

Most of these causes of ill-health are preventable.

The main concern of this lesson is disease. Disease can be defined as any abnormal change in an animal's body or in some of its organs so that these organs are not functioning properly. The farmer, more than anyone else, will be aware of what a normal animal should look like and how it should behave. The extension officers should also be aware of these things and be ready to assist farmers in deciding whether or not a particular animal is diseased.

It is worthwhile getting farmers to discuss this as part of the extension programme.

The farmer and extension officer may not necessarily be able to diagnose a specific disease when faced with a sick animal but a thorough investigation should enable them to decide if the problem can be dealt with by them or whether they should call for veterinary help. The first step is to decide whether or not an animal is sick. A healthy animal should graze and browse in a regular manner and rest contentedly. Goats may not drink much water when feeding on lush vegetation but will drink at least once daily during the hot, dry times of the year. Fresh water should be provided daily in the night shelter. Healthy animals are alert and move
quickly and easily. Quiet, much handled animals may sometimes appear lethargic, but their eyes will be bright and their natural inquisitiveness easily aroused. The natural functions of breathing, ruminating, defaecating and urinating can be observed to be normal.

Things to look out for:
- Loss of weight or condition (fatness); excessive thinness.
- Wounds, external parasites, skin infections.
- Lameness.
- Scratching, biting, rubbing.
- Unusual discharges from the mouth, eyes, nose, vagina.
- Difficult breathing.
- Abnormal faeces, especially discolouration (white or yellow colour) and diarrhoea (runny faeces).
- Fever; high body temperature compared with other goats.
- Anaemia; pale colouration of the lining of the eyelid compared with other goats.
- Harsh feel or excessive shedding of the hair coat.

When the abnormality appears serious and the cause is not obvious, reference should be made to the veterinary services.

Disease prevention and treatment of animals are often considered to be the concern only of the veterinarian or State Veterinary service. Extension officers must remember the constraints that:
- there is likely to be a scarcity of veterinarians;
- there will be little money available for drugs and chemicals.

Hence it is important for the farmer to know when there is a serious problem that demands veterinary intervention. It is also important for the
farmer to be aware of how to obtain access to whatever veterinary services exist.

In India, the State Veterinary Services may be more concerned with cattle and buffalo than with goats. Rich and influential farmers with cattle and buffalo are more likely to be able to command the attention of veterinary officers. Goat farmers will be in a better position to demand veterinary services which are often free if they are fully aware of the value of their animals and know when outside intervention is necessary for disease control.

In some past extension programmes, veterinary health care interventions such as vaccinations have been provided free to village animals. These have naturally been acceptable to the farmers because the benefits of animals not dying are obvious and there was no cost. While it may be desirable for the extension officer to undertake certain routine vaccinations in order to win farmer co-operation and motivate them to adopt other aspects of the extension messages, the farmers must be taught that the value of their animals is such that it may pay even to buy veterinary assistance when truly warranted. The decision, however, must be made locally since it depends upon local costs and values. The extension officer must help farmers to weigh up the costs and benefits of veterinary assistance.

Correct methods for vaccination are included in the practical component of this training programme. Both sub-cutaneous and intra-muscular methods will be taught (Figure 4, i-ii). It is not intended that extension workers should spend a lot of time on routine vaccinations, but delivery of this kind of health care may be a means to win farmer confidence.
There are three types of activities related to specific disease prevention and control:

1. **Prophylactic measures against diseases**
   
   (a) **Infectious diseases**
   
   Some prevalent diseases can be controlled by annual vaccination. These include, for example:
   
   - *Haemorrhagic Septicaemia*
   - *Enterotoxaemia*
   - *Goat Pox*

   Other infectious diseases such as *Foot and Mouth Disease* and *Rinderpest* can also be controlled by vaccination if the situation warrants this kind of action.

   (b) **Diseases caused by Parasites**
   
   (i) Internal parasites of the stomach and intestines. These can be a major cause of goat sickness and death, depending upon the grazing management systems and the climate. They are not believed to be a major problem in the traditional grazing and browsing systems of the semi-arid zone of India.

   A suitable drenching programme can be worked out if necessary. For example it may prove beneficial to drench goats before and after the monsoon season. Drenching of very small numbers of goats can be done using a small bottle with a narrow but strong mouth.

   Institutions such as CIRG should be asked to routinely monitor local goat populations for internal parasites by faecal examination.
(ii) External parasites such as ticks, mites and lice. The presence of these animals becomes fairly obvious by the behaviour of the goats to combat itching and the parasites themselves or their effects on the skin and coat of the goat are fairly visible. Routine dipping in a suitable chemical solution, once or twice a year, may be necessary. The goat must be totally immersed in the solution and the skin thoroughly wetted. Take care however that the animal does not inhale any liquid. This can best be done in some kind of tank, metal or cement, which could be a communal village facility. With co-operation and co-ordination to have all village goats dipped at the same time, the cost for each goat owner should be minimal.

Obtain local veterinary advice as to an appropriate least-cost dipping programme and try to obtain total village co-operation.

(c) Measures to keep goat resting places clean and dry

The use of raised or slatted floors in the places where goats are housed for the night is an aid to health maintenance. Both during cold and hot weather the sleeping/resting place should be clean, dry and well ventilated. Goats seem to prefer raised areas and the use of slatted or mesh floors facilitates the collection of the goat faeces for use on gardens and for tree growing (Lesson 3).

CIRG has constructed steel mesh panels, 1m x 1.2m, which can be used as raised flooring or as the walls of temporary pens for holding goats. Such panels could be made cheaply in the village from wood or scrap metal with slats of wood or bamboo instead of steel mesh. The panels can have legs or be raised on blocks or forked sticks set into the floor of the house.
The soil and manure from the resting places should be removed regularly (monthly). Lime, if available, may be mixed with any new soil added to the floor.

(d) **Foot Care**

While foot-rot and other foot infections are not a major problem with goats, the hooves do tend to become overgrown in some situations leading to discomfort and the possibility of harbouring disease. Overgrown hooves should be pared back to normal when observed, using a sharp knife or secateurs.

(e) **Poisonous Plants**

In situations where there are recognisable plants which are known to be toxic to goats, these weeds should be removed from the grazing and browsing areas if possible. Otherwise, the herders should be instructed to look out for and avoid concentrations of such plants. Communal village action may be necessary to achieve the elimination of toxic weeds.

2. **Day to Day Treatment for Specific Diseases**

The veterinary services may be called on to treat animals for specific diseases as and when they occur. These may include:

- **Mastitis**
- **Colibacillosis** (*E. coli*) in kids
- **Pneumonia**
- **Coccidiosis**
- **Mycoplasmosis**
- **Chlamydiosis**
- **Contagious Ecthyma**
Cases of serious dystocia, abortion and major wounds or broken limbs should also be referred to the veterinary services. Simple first aid by the farmer can prevent wounds from becoming infected and causing serious health problems.

There are plans to establish mobile poly-clinics in at least some parts of India. Such clinics would operate out of institutions such as CIRG, concentrating on regular day-to-day treatment of goats in villages. This should greatly improve the access of village goat farmers to veterinary services. The extension officers should encourage farmers to make full use of such services in order to encourage government to maintain and expand them.

3. **Control of Major Disease Outbreaks**

The state veterinary services should obviously be concerned with the control of major outbreaks of infectious diseases. They are more likely to be able to deal effectively with the situation if farmers report disease symptoms in their goats, even if the value of the animals does not warrant expensive treatment. Diseases in this category could include -

- Contagious Caprine Pleuropneumonia (CCPP)
- Mycoplasmosis
- Bluetongue
- Caprine Arthritis and Encephalitis (CAE)

In addition, the veterinary services should be carrying out routine testing for diseases such as Brucellosis and Johne's Disease.
91.

Details on the clinical symptoms of the various diseases prevalent in North India and mentioned in this chapter, together with information on preventive care for goats as given in the CIRG Bulletin No. 5 - Preventive Health Care of Goat Diseases - are appended.
COMMON DISEASES OF GOATS

RINDERPEST: There is mild thermal reaction and diarrhoea. Ulcerative lesions appear on the inner side of the lower lip and gums.

Preventive care: Tissue culture Rinderpest vaccine should be used in any endemic area.

FOOT AND MOUTH DISEASE: The disease is mild in adult goats. Vesicles on the tongue, lips, cheeks, gums, dental pad and on the skin between claws, occasional blisters on teats and udder. Lameness is seen in adult goats. Deaths may occur in young kids.

Preventive care: Isolation of the sick goats and vaccination of the remaining herd is required. Care of infected goats includes mouth washing with alum or potassium permanganate and application of boroglycerine on the ulcers is beneficial.

GOAT POX: Slight fever. Congested areas and vesicles appear on ears, nose and udder. When vesicles dry, crusts are formed. Kids show high temperature and death occurs before development of skin lesions.

Preventive care: Isolation of sick goats, washing of lesions daily with diluted hydrogen peroxide and application of antibiotic cream are required. Milkers' hands must be scrubbed with non-irritant antiseptic solution daily.

CONTAGIOUS ECTHYMA: Pustular and scabby lesions develop on the muzzle and lips. Broncho-pneumonia and gastro-enteritis are observed in kids.

Preventive care: Infected kids should be isolated. The lesions should be treated with antiseptic drugs. Antibiotics should be given to prevent secondary bacterial complications.
JOHNE'S DISEASE: Loss of body weight, weakness and emaciation. Frequent diarrhoea in some goats. The clinical disease occurs after 1-2 years of age.

Preventive care: Consult the goat health specialist for testing of your goats. Culling of the positive animals is recommended.

BRUCELLOSIS: Abortion in late pregnancy is the feature of the disease. Retention of placenta and metritis are common. In bucks infertility, orchitis and swollen joints are seen.

Preventive care: Have your goats tested for brucellosis. Culling of positive animals is recommended.

HAEMORRHAGIC SEPTICAEMIA: High fever, difficult respiration and coughing. Sudden death may occur.

Preventive care: Vaccination with H.S. adjuvant vaccine is recommended before the onset of rains every year.

ANTHRAX: Sudden high temperature (up to 42°C), loss of appetite, sudden death. In less peracute form, goats may live for a day and develop bloody diarrhoea.

Preventive care: Isolation of the affected animals. Massive doses of penicillin may save the goat. Annual vaccination of goats in endemic areas is necessary.

COLIBACILLIOSIS: Kids under one month of age are commonly affected. Important symptoms are fever, diarrhoea or dysentery, loss of appetite, dryness of hair and skin coat. In later stages the temperature becomes subnormal.

Preventive care: Depending upon sensitivity of E. coli, all new born kids are to be given a specific antibiotic for 4 - 6 days.
ENTEROTOXAEMIA: Severe pain in the abdominal region, abrupt excitement and kids jump in the air to fall down; sudden death.

Preventive care: Kids at 3 months of age should be vaccinated with two doses. Annual vaccination is required thereafter.

CHLAMYDIOsis: Pneumonia and sometimes diarrhoea are present in goats. Pregnant goats often abort in early stages of gestation. Kids develop arthritis.

Preventive care: Treatment with penicillin is effective.

MYCOPLASMOSIS: There is a high rise of temperature with respiratory trouble. In some cases arthritis and mastitis are seen.

Preventive care: Treatment with Tylosin or Erythromycin is effective at an early stage.

MASTITIS: Fever in acute mastitis. Enlarged, hot, painful udder. Milk watery, often with flakes of blood. The affected quarter may become atrophic or agalactic.

Preventive care: After washing with KMnO₄ solution, remove the milk carefully from the affected quarter. Introduce antibiotic intramammary infusion, leave for 24 hours and repeat for 3 days. Regular testing of milk samples is recommended.

COCCIDIOSIS: Diarrhoea, anaemia, weakness and death are seen in kids.

Preventive care: Drenching with Sulphamezathine 0.2 gm/kg body weight and Ampresol 20% solution 100 mg/kg body weight 4-5 days are effective.

VERMINOUS PNEUMONIA: Respiratory trouble with persistent or severe coughing. There is usually a discharge from eyes and nostrils.

Preventive care: Vaccination is effective.
PARASITIC GASTRO-ENTERITIS: Diarrhoea, severe anaemia (white eyes), emaciation and watery swelling under the jaw (Bottle Jaw) are the common symptoms.

Preventive care: Faecal examination is necessary. Nilverm 15 mg/kg body weight, Panacur 5 mg/kg body weight and Thiabendazole 50 mg/kg body weight are effective.

LIVER FLUKE: Diarrhoea, emaciation and oedema of the throat are commonly observed.

Preventive care: Faecal examination is essential. Zanil 10-15 mg/kg body weight and Distodin 20 mg/kg body weight are effective.

TAPE WORM: Diarrhoea and constipation; segments of tape worm may be seen in the faeces.

Preventive care: Panacur 10 mg/kg body weight is very effective. Kamala 2-3 mg/animal is also effective.

ECTOPARASITIC INFESTATIONS: Cause irritation, transmit many diseases, cause anaemia and poor health.

Preventive care: Regular dipping with 0.5% Seven or 0.2% Cythion at monthly intervals or whenever needed.

MANGE: Flakey, scurfy dandruff on the skin, severe itching; hairlessness develops and the skin becomes thick, hard and corrugated.

Preventive care: Skin scraping examination is essential. Clip hair and wash with warm water and soap. Apply 0.5% malathion, 0.5% Seven or 0.06% Lindane as a spray. Swab or dip thrice at 7 day intervals.
RING WORM (FUNGUS): Inflammation of hair follicles, loss of hair. Lesions are circular on the face, shoulder, neck, around eyes; irritation and rubbing; thick crusts or scales may appear.

Preventive care: After clipping the hair and scrubbing with water and soap, apply salicylic or benzoic acid ointment 2-5% or tincture of iodine once daily until lesions heal.

TYMPANY/BLOAT: Loss of appetite, dullness, depression, distended abdomen on the left side, froth from the mouth. Animals become restless and soon die.

Preventive care: Drenching with 28 gm sodium bicarbonate in 280 ml of hot water. A cup of mineral oil may also relieve the condition. In acute cases, removal of gas with a thick needle is needed.

HYDROCYANIC ACID POISONING FROM SORGHUM OR CASSAVA: Blood is bright red in colour; nervous symptoms and sudden death of the goat.

Preventive care: Sodium thiosulphate 2 gm in 15 ml of water subcutaneously and sodium nitrite 1 gm are to be given.

NITRATE/NITRITE POISONING FROM FODDER MAIZE/MILLET: Respiratory difficulty, staggering gait, frequent falling; blood becomes chocolate brown in colour; sudden death.

Preventive care: Treatment with high doses of Vitamin C and methylene is indicated.
Demonstrate to farmers the principles of good kid rearing practices.

The objective is a reduced mortality and increased kid growth rates. Most benefit will come from reducing mortality. Concentrate on the first month of life.

Constraints

- farmers cannot afford special housing, drugs, chemicals or supplementary feeds except in minor ways or in very essential cases.
- there is a scarcity of veterinary assistance.
- mother goats must go out for daily browsing and the kids also after the first 3 - 4 weeks.
- owners wish to take a share of the milk for their families.

Most deaths are from cold exposure, mis-mothering, inadequate food, digestive disorders and respiratory infections.

Suggested practices

* Kidding in a clean, dry, sheltered place.
* Minimal disturbance during the birth process.
* Use of kid boxes for the first few weeks while mothers are out browsing.
* Kids must be allowed all available colostrum and adequate suckling, especially during the first month. Owners may begin to share the milk after this time or if there is an obvious surplus.
* Kids must be allowed out to browse from 3 - 4 weeks of age.
Care and attention will prevent most disease problems. Farmers should keep a look-out for diarrhoea and respiratory problems and seek help if necessary.

Good health for the herd means good health for the kids.
Demonstrate to farmers the principles of good kid rearing practices.

The objectives of good kid rearing are reduced mortality and increased growth rates. It is quite clear that major benefits to farm families will come from raising an increased number of kids to sexual maturity or slaughter weight. Increased growth rates are not so clearly beneficial but should occur anyway as a result of actions designed primarily to reduce mortality.

The crucial time for reducing mortality is in the first month of life of the kid, but it is important to consider management up to 3 months or more — until the kid is fully weaned and independent. At present it is likely in most villages that 20 percent or more of kids die in the first 3 months from birth. The target is to reduce this to no more than 10 percent by care and attention to the suggested simple kid-rearing programme.

It is necessary to work within the constraints of the present situation. These include —

* Farmers cannot afford special housing on a big scale, for kids or for the whole herd.

* There is a scarcity of veterinary assistance.

* The mother goats must go out for browsing, leaving their kids. Under natural conditions the kids are hidden by their mothers while they browse and are visited from time to time. There is a limit to the amount of time female goats close to kidding or just kidded can be kept out of the main herd.
* Owners wish to take a share of the milk for human use and there are traditional methods used to achieve this sharing (see below).

* After the first few weeks, and no later than 1 month, the kids must go out for browsing with the herd.

* There will be little money available for drugs, chemicals or supplementary feeds.

Causes of losses

Deaths of kids in the first 3 days of life can be very high, especially if they are born outside and in the monsoon season.

Among the causes of early deaths can be included -

Dystocia - This occurs if the kid is too large to pass readily through the pelvic opening at birth. This can be a problem with small (first-kidding) mothers, especially if very well fed during late pregnancy. Less frequently there can be problems of malpresentation, inadequate uterine contractions or inadequate cervical relaxation. None of these problems are likely with village goats.

Physical Environment - The kid has a finite energy store in the body at birth and this is not added to until the first drink of colostrum. In warm conditions the new-born kid can live for up to 2-3 days without feeding but in cold, wet or windy conditions the kid will die from hypo-thermia (low body temperature) or loss of sucking drive within 1 day.
Mis-mothering and starvation - Kids will quickly die if the milk intake is inadequate. Very small kids, often one of twins or triplets, may never suck or may fail to establish a bond with their mother. Mothers in poor condition may not take any interest in their kids, especially after a prolonged kidding process. Simply the milk supply may not be enough for the kids' needs. There are likely to be more problems with first kidding females than with older goats.

Disease - Kids are particularly prone to digestive upsets and respiratory infections (Lesson 5). Diseases can be easily transmitted from kid to kid, especially with night housing of the herd. There is a wide range of potentially lethal, disease-causing organisms.

Predators - Losses from wild dogs and possibly jackals may occur with kids born outside or once the kids start to go with the herd for browsing. This should not be a problem with intensive herding and night housing, but the herders, particularly young children, may get careless.

The recommended package of kid-rearing practices is designed to minimise these problems.

Milk Sharing
In the best village situations, the kids get all the milk produced by their mothers for the first month. Thereafter, for the second and third months, the milk is shared between the kids and humans. Weaning takes place at about 3 months and all subsequent milk can be taken by humans.
Lactating goats can have their udders protected from unwanted sucking by enclosing the udder in a bag (Figure 5). This is a common practice in Indian villages. After the first month, the kid may be allowed to suckle one teat and the other teat may be milked. This can be done twice a day until weaning. Alternatively the kids may be allowed to suckle during the night but the day-time milk is kept for human use with a full milking each evening.

In many cases the kids receive less milk than might be obtainable under the above system. In particular, kids may be deprived of their full intake of colostrum because of the notion that colostrum is good for human children. While some compromise may be necessary in sharing normal milk between the needs of the kids and the undoubted needs of human children for milk to promote healthy growth, no compromise should be made with respect to the colostrum which must go to the kids.

Kids should be fed colostrum from their own mothers. However, should the mother die at birth, colostrum from another mother is better than no colostrum at all.

Information on the milk production of local Barbari goats suggests that the total milk available may be only 300-400g per day with perhaps up to 2 Kg per day from exceptional animals at peak lactation. The milk intake of a single kid could therefore be as little as 150-200g which is totally inadequate for normal growth. The total 300-400g should be considered the minimum daily milk intake for a single kid, at least for the first month of life.

Kids will start to nibble grass and young leaves from about 3 weeks of age and are effectively grazing and browsing by 6-7 weeks.
FIGURE 5: Doe's udder protected to prevent suckling

FIGURE 6: Kid box
Suggested Kid Rearing Practices

1. Preparation

It is important that the place where the pregnant goat will kid is clean with fresh bedding of straw or grass. She may be kept inside for a few days before kidding and fed with cut or gathered forage and any other suitable, available feeds. However, it is often difficult to tell when a goat is within a few days of kidding and under most circumstances she would be better off out browsing than retained inside. There are distinct advantages in separating her from the herd if she is likely to kid overnight, or keeping her in if she is likely to kid during the day. This will ensure an easy, undisturbed birth and good bonding between mother and offspring immediately after birth.

Farmers will usually know when their own goats are about to kid. Signs may include increased nervousness, pawing of the litter, slight mucous discharge from the vulva and a distinct swelling of the udder perhaps 24 hours in advance.

2. The birth

Goats should not be disturbed while kidding. The owner should be present at kidding but must not disturb the mother in any way. The birth process may take about 1 hour and the after-birth should be discharged from about half an hour to 4 hours after the kidding is finished. After-births are often eaten by the mother.

It is vital that good bonding between mother and offspring be achieved, since maternal care is perhaps the most important factor in survival of the kids. To achieve a good bond the mother must clean and groom her own kids and remain undisturbed for the first few hours. This bonding is necessary so that mothers can easily locate
and recognise their own kids and calm them. It may be necessary for the farmer to intervene, for example to remove the membrane from over the mouth and nostrils, if the kid does not bleat and breathe immediately or the mother fails to clean the kid.

Cutting of the navel cord and application of iodine is often recommended. This should not be necessary if clean bedding is used.

Do not recommend practices to farmers that have a cost and may disturb the animals unless you are absolutely convinced that the practices are necessary.

3. Kid Boxes

Where the grazing/browsing system for goats is such that the animals must travel long distances and to different places each day, there is a necessity to keep the kids at home for the first few weeks and up to one month. Under natural conditions the mother leaves the kids hidden for 2-8 hours while browsing and returns to the exact spot to reclaim them. This behaviour lasts from a few days to up to several weeks, or until the kids are able to keep up with the herd. It is better for the kids to be left in the village than hidden somewhere in the fields.

There is an advantage for protection of the kids from heat or cold, and for the prevention of spread of disease among kids, if each set of kids is kept in a separate box while the mother is out browsing. Such boxes are easily constructed of wood but do have a cost. Each box should be some 500-600mm long, 400-500mm wide and 300-400mm deep (Figures 6) If the bedding in the box is kept fresh and clean, disease will be minimised and any case of diarrhoea will be easily detected.
4. Feeding

The kids must be allowed to suckle all of the available colostrum produced by the mother during the first 3-4 days of life. This first milk is markedly different from the later, normal milk. It has a higher content of fat, protein and vitamin A. It is a laxative which is beneficial to the young kid. Most important of all is the immunoglobulin or antibody content which gives protection to the kids against infectious diseases with which the mother has had contact.

As mentioned earlier, few goats will have surplus milk over and above the needs of the kids in the first month. Kids rarely over-indulge in suckling when their requirements for milk are being met. The mothers can be milked by the owners if there is an obvious surplus.

From about 3 weeks of age the kids will begin to take an interest in green vegetation and should be allowed to browse from no later than 1 month of age.

5. Health Care

Adequate feeding and the use of kid boxes with clean bedding will minimise disease problems. Specific diseases and the action necessary to prevent or control them are discussed in Lesson 5. The farmer must keep a look-out for signs of diarrhoea and for respiratory problems - coughing or nasal discharge. If a problem is suspected then the State Veterinarian can be called.

For disease prevention -

Make sure kids get their colostrum.
Make sure bedding is clean and dry.
Keep kids isolated from other than litter mates and mother for the first weeks.
Avoid damp conditions and excessive heat or cold.
Avoid sudden changes of feeding.

Steps taken to prevent disease in the whole herd will obviously benefit kids. Such steps include the provision of dry, raised platforms or slatted floors for night resting, the provision of clean drinking water, adequate feeding and the control of internal and external parasites.
Demonstrate the possibilities of enhanced production through strategic supplementation of grazing and browsing with concentrates and other feeds, especially for kids between 3 and 9 months of age.

Goats on normal grazing and browsing obtain a reasonably balanced diet. There may, however, be inadequate quantities of food from time to time. Recognise the skills of farmers in knowing where to take goats for browsing and the best lopping regime for fodder trees.

Supplementary feeds are those additional to normal grazing and browsing. Strategic supplementation is the targeting of specific classes of goat or specific times of year for the use of what supplementary feeds are available.

There are very few research findings to help us make decisions about the wisdom of strategic supplementation.

Be careful not to substitute a costly supplement for part of an equally beneficial normal diet.

Provided goats are eating to appetite, all energy requirements are likely to be met unless the feed is predominantly dry crop residues or mature, dry grasses. Again, if goats are eating good quality grasses and browse to appetite, then protein intakes should be adequate. However for milk production, adult female goats on poor to average grazing may benefit from supplementation of the diet with higher protein feeds such as pulse grains,
brans or oil-seed cakes. By good quality grazing and browse we mean young, green leaves, seed heads and pods.

It will usually be expensive to waste protein by feeding more than is necessary.

The main benefits from supplementation will come when animals are unable to satisfy their appetites from good quality grazing and browse. If the grazing is predominantly dry grass or cereal straws and stovers, it is almost impossible to supplement the diet to make it adequate for growth or lactation. However, if the grazing or browsing is average to good and the diet is only deficient in quantity, then supplementation with specially grown fodders, cereals, brans or pulse grains will be beneficial. This is likely to be particularly true for kids growing rapidly between the ages of 3 and 9 months. Each situation needs investigation with the desirability of result demonstrations and economic assessments of the costs and benefits.

Of course, any animals on poor quality grazing or browsing will benefit from supplementation, even if the diets are still inadequate for full growth or lactation. Again the costs and benefits would have to be assessed for each situation.
Demonstrate the possibilities of enhanced production through strategic supplementation of grazing and browsing with concentrates and other feeds, especially for kids between 3 and 9 months of age.

It is not the intention here to discuss in detail the nutritional requirements of goats. It is assumed that goats on normal grazing and browsing obtain a reasonably balanced diet with respect to the various nutritional components - proteins, energy, vitamins, minerals. There are, no doubt at least from time to time, deficiencies in total available intake so that goats are not eating to appetite and producing to genetic potential. Also there could well be seasonal shortfalls in specific nutrients or specific mineral deficiencies. These however have not been identified sufficiently well to be the components of a feed supplementation programme. More research work is needed to define, in particular, possible specific mineral deficiencies.

There is an ongoing debate in India concerning the future directions of the goat industry. The debate is largely between advocates of intensive stall or feed-lot feeding, by landless labourers and poor, urban families as well as large-scale business enterprises, and those who believe that goat production will remain largely a traditional, low-input activity reliant on browse and communal grazing for the foreseeable future. The advocates for the promotion of intensification base their arguments on an ongoing reduction in available browsing/grazing land due to afforestation and land distribution schemes, the opposition to goats among forestry interests, the availability of bigger, faster-growing or higher milk producing animals through controlled cross-breeding, and alleged economies of scale pointing
to bigger herds. For such production there is a need for the development of least-cost rations for various classes of goats based on cheaper and possibly non-conventional feeds. While this debate will no doubt continue and is important in terms of the allocation of research and development resources, it is quite clear that the small-scale, low-input traditional systems will continue to be of vital importance to survival and welfare in Indian villages and the current extension programme is focussed sharply on these systems.

Goats in these village-based extensive systems have always been fed supplementary feeds either on a regular or periodic basis. By supplementary feeds is meant feeds that are additional to grazing and browse, including crop residues and stubbles grazed in the field after harvest. A wide variety of crop residues, food wastes and cottage agro-industrial by-products are available. Unfortunately, since many goat keepers are small farmers or landless, most of the crop residues go to working or dairy cattle and buffalo. What we are concerned about in this lesson is the more efficient or effective use of what supplementary feeds are available, including the possibility of purchased concentrates or agro-industrial by-products, in strategic supplementation of goat diets.

By strategic supplementation is meant the targeting of specific classes of animals either generally or at specific times of year. Such animals would be favoured with preferential access to the available supplementary feeds because of proven benefits in terms of ease of management and increased production. An example has already been given in Lesson 6 on kid rearing when it was suggested that mother goats about to kid should be removed from the herd and kept close to home for a few days. Supplementary feeding at this time is a necessity brought about by other management considerations.
Most suggestions for the use of supplementary feeding have been made on the basis of assumptions about feed requirements or ideas borrowed from elsewhere, rather than on local or even Indian research findings. Even where research may show a gain in productivity to be made by supplementary feeding it is not necessarily worthwhile if there is increased labour or some purchased feed costs involved, or if the farmers get no return in the market for the increased production.

For example, it has been mentioned elsewhere that under present marketing conditions a farmer is unlikely to benefit in sale price of a slaughter animal from even several extra kilograms of liveweight at slaughter.

Before discussing supplementary feeding in more detail it is necessary to consider some general matters concerning goat nutrition. The dry matter intake of a goat depends upon appetite and feed availability. Goats have distinct food preferences and will seek out those plant species and parts which they favour. Good farmers and herders know of these preferences and can increase the intake of their animals by having them in the right place at the right time or by choosing the right trees for lopping. Much of the preferred browse will be seasonal in availability. However, in most traditional browsing situations there is a range of food items which follow each other sequentially throughout the year so that goats are able to maintain quality of intake if not necessarily quantity. Further information on preferred browse species can be found in Lesson 3. When feed is abundant, goats will be able to freely express their preferences, but as quantities decline, animals need to eat less favoured species or reduce intake. They tend in fact to do both in a kind of compromise.

Older and more fibrous plant material tends to have a lower rate of passage out of the rumen because of less rapid fermentation and larger
particle size following chewing than young green leaf material. With feeds of very low digestibility and slow rates of passage, the degree of fill of the rumenoreticulum may depress intake. This compounds the problem of the low nutritive value of such feeds, but fortunately they are not of great significance in traditional goat feeding since straws and stovers tend to be fed to cattle and buffalo.

Given the availability of suitable feed, intake can be considered a linear function of body weight but with higher intakes by growing animals, lactating animals and those in poor body condition than by otherwise equal animals in terms of liveweight.

It is important when considering supplementary feeding that the animals are in fact currently under-fed. Otherwise we get into the situation where the goats will simply substitute a possibly costly supplement for part of an equally beneficial normal diet.

While it has been reported that goats will consume 4-7 percent of their liveweight in dry matter (DM) per day, with Indian village goats the intakes are more likely to be in the range of 2.5 - 5.5 percent, dependent on feed quality and physiological state of the animal.

Energy: The unit of energy now used internationally is the joule. In practical animal feeding the unit will be the megajoule (MJ) or one million joules. The losses of energy which occur in the digestion and utilisation of the gross energy in feeds is shown diagrammatically in Figure 10. The metabolisable energy (ME) is an approximation to the energy actually absorbed by the animal and it is modern practice to evaluate feeds on the basis of their metabolisable energy content. Thus the nutritive value of a feed can be expressed as the ME in MJ per Kg of feed dry matter (MJ/Kg DM) (Table 2).
**FIGURE 7**: Chart of energy losses

- **GROSS ENERGY** (FOOD INTAKE)
  - Faeces
- **DIGESTIBLE ENERGY** D.E.
  - Urine
  - Methane
- **METABOLISABLE ENERGY** M.E.
- **TISSUE BREAKDOWN** (WEIGHT LOSS)
- **HEAT PRODUCTION**
- **PRODUCT ENERGY**
  - Protein and Fat Gain
  - Milk
  - Foetus Gain
### TABLE 2
GENERALISED ENERGY AND CRUDE PROTEIN CONTENTS OF FEEDS

<table>
<thead>
<tr>
<th>Feed Type</th>
<th>Energy ME (MJ/Kg DM)</th>
<th>Crude Protein (% of DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereal Grains</td>
<td>13</td>
<td>12-14</td>
</tr>
<tr>
<td>Pulse Grains</td>
<td>12-13</td>
<td>24-26</td>
</tr>
<tr>
<td>Bran</td>
<td>10-12</td>
<td>15-18</td>
</tr>
<tr>
<td>Oil Cakes</td>
<td>12-13</td>
<td>33-50</td>
</tr>
<tr>
<td>Straws</td>
<td>6-7</td>
<td>4-5</td>
</tr>
<tr>
<td>Green Grasses</td>
<td>8-12</td>
<td>6-25</td>
</tr>
<tr>
<td>Browse Leaves</td>
<td>10-12</td>
<td>10-20</td>
</tr>
</tbody>
</table>

Similarly the energy requirements of animals can be expressed in terms of the daily requirement of ME for maintenance of body tissues (liveweight maintenance) and for other productive functions such as growth, lactation, or growth of the foetus. The requirements can then be related to the amount of feed DM needed if the nutritive value (ME content or nutrient density or energy concentration) of the feed is known. However, the efficiency with which the ME is used for growth in particular, is dependent upon the ME concentration of the feed with approximately twice as much ME being needed for a given growth rate if the feed is poor dry grass (6 MJ/Kg DM) rather than grain (13 MJ/Kg DM).

In general terms, the daily energy (ME) requirements of goats can be summarised as follows:
## Requirement for Maintenance

<table>
<thead>
<tr>
<th>Liveweight of goat (Kg)</th>
<th>Requirement (MJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Light activity</td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3.0</td>
</tr>
<tr>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>30</td>
<td>6.8</td>
</tr>
<tr>
<td>Milk production</td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td></td>
</tr>
</tbody>
</table>

Only with goats feeding predominantly on straws, stovers or dry, mature grasses is energy intake likely to be a problem, provided actual DM intakes are to appetite. In this case, supplementation with any of the likely available cheap supplementary feeds, including green fodder grown perhaps under irrigation (Forage oats, cowpea, berseem (*Trifolium alexandrinum*), forage sorghum) or harvested from especially grown fodder trees, will be beneficial. A list of possible supplementary feeds with nutritional values is given in Table 3.
## TABLE 3
NUTRITIONAL VALUES OF POSSIBLE SUPPLEMENTARY FEEDS

<table>
<thead>
<tr>
<th>Grains</th>
<th>Metabolisable</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dry Matter</td>
<td>Energy</td>
<td>Crude Protein</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>MJ/Kg DM</td>
<td>Percent</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>89</td>
<td>13.3</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>89</td>
<td>13.0</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>Sorghum Sorghum bicolor</td>
<td>89</td>
<td>13.1</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>Pearl Millet Pennisetum typhoides</td>
<td>89</td>
<td>13.0</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>Pulses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chickpea Cicer arietinum</td>
<td>11.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black Gram Phaseolus mungo</td>
<td>93</td>
<td>12.9</td>
<td>26.2</td>
<td></td>
</tr>
<tr>
<td>Green Gram Phaseolus aureus</td>
<td>88</td>
<td>12.8</td>
<td>24.4</td>
<td></td>
</tr>
<tr>
<td>Cluster Bean Cyamopsis tetragonoloba</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cowpea Vigna unguiculata</td>
<td>89</td>
<td>12.8</td>
<td>26.3</td>
<td></td>
</tr>
<tr>
<td>Pigeon Pea Cajanus cajan</td>
<td>88</td>
<td></td>
<td>26.3</td>
<td></td>
</tr>
<tr>
<td>Moth Bean Phaseolus aconitifolius</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lentil Lens esculenta</td>
<td>89</td>
<td>10.0</td>
<td>18.0</td>
<td></td>
</tr>
<tr>
<td>Brans</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>89</td>
<td>10.0</td>
<td>18.0</td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>91</td>
<td>12.1</td>
<td>14.8</td>
<td></td>
</tr>
<tr>
<td>Pulse</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oilseed Cakes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groundnut Arachis hypogaea</td>
<td>92</td>
<td>13.1</td>
<td>49.8</td>
<td></td>
</tr>
<tr>
<td>Sesame Sesamum indicum</td>
<td>93</td>
<td>11.5</td>
<td>51.5</td>
<td></td>
</tr>
<tr>
<td>Field Mustard Brassica campestris</td>
<td>94</td>
<td>12.0</td>
<td>33.1</td>
<td></td>
</tr>
<tr>
<td>Straws/Stovers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td>85</td>
<td>7.2</td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>90</td>
<td>5.7</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>Pulses</td>
<td></td>
<td>6.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>88</td>
<td>7.4</td>
<td>4.1</td>
<td></td>
</tr>
</tbody>
</table>

**Protein**: For practical purposes we can evaluate the protein content of feeds for goats simply in terms of crude protein (CP) which is derived by multiplying by a factor of 6.25 the nitrogen content from chemical analysis.

Then if we consider the CP percentage of the dietary dry matter, a rough guide to goat requirements can be given as follows:
<table>
<thead>
<tr>
<th>Protein Percentage</th>
<th>Adequacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>6% CP</td>
<td>adequate for maintenance</td>
</tr>
<tr>
<td>10-14% CP</td>
<td>adequate for growth</td>
</tr>
<tr>
<td>15% CP</td>
<td>adequate for lactation</td>
</tr>
</tbody>
</table>

At lower levels of protein content, the activity of the micro-organisms in the rumen is depressed and the rate of digestion of the plant material (particularly cellulose) will be slowed. On the other hand, at very high protein levels the micro-organisms will use the excess protein as an energy source and this is a wasteful process.

Again only animals grazed solely on cereal straws or dry, mature grasses are likely to have inadequate protein for maintenance. Normal diets of a mixture of green grasses, browse leaves, pods, and kitchen wastes are expected to have adequate protein for growth provided intakes are adequate. There is no need to use high protein pulse grains or oil cakes to add to supplementary feed concentrates for growth if cheaper cereal grain and bran products are available, unless again the grazing/browse is only or predominantly dry grasses or cereal stubbles or stovers. For reasonable levels of milk production, however, goats are likely to be inadequately fed unless on good grazing and browse.

A mature female goat of 25 kg liveweight may consume 750g of DM per day (3 percent of LW). With a maintenance requirement of 6-7 MJ she will require a diet containing 8.0-9.3 MJ/Kg DM and 6 percent crude protein.

It is clear that even maintenance cannot be met by diets of cereal straws or stovers alone.

A diet containing 500g of DM from cereal straws and 250g from cereal grain will contain:
and provide 6.5 MJ to the goat. This is adequate for maintenance. The CP content will be:

\[
\frac{(500)(6.5) + (250)(13)}{(750)} = 8.7 \text{ MJ/Kg}
\]

Animals will not grow or lactate on such diets. Good green grass and browse diets will provide sufficient energy and protein for growth and moderate lactation but, in the latter case, only if intakes are increased to 4 percent or more of liveweight.

Supplements used with browsing for kid growth, fed at a rate of 2 percent of liveweight, might provide 40 percent of the animal's total dry matter intake.

A 10 Kg kid growing at 50g per day requires about 5 MJ ME per day. With an intake of 5 percent of liveweight, the intake is 500g and the feed must contain therefore 10 MJ ME per Kg DM and 14 percent crude protein. Since good grazing and browse are likely to have this composition, the supplement should also have this composition since it is additional feed rather than corrective of dietary deficiencies. Cereal brans are quite adequate supplements. If the supplements are predominantly cereal grains, it might be wise to increase the protein content by the addition of pulse grains to make a diet 85 percent cereal and 15 percent pulse. There should be no need to purchase expensive oil cakes if grains are available in the village at a cheaper price.
A lactating female Barbari goat of 25 Kg liveweight and giving a peak daily yield of one Kg of milk requires $6.5 + 5.2 = 11.7$ MJ ME and a diet containing 15 percent CP. If she achieves an intake of 5 percent of liveweight she will consume $1.25$ Kg of DM. This feed requires to have $9.36$ MJ ME/Kg DM and 15 percent CP to provide her requirements. All available feeds except again poor grasses, straws and stovers are likely to have adequate energy but could be inadequate in protein. Good quality browse and grazing (young leaves, seed heads, pods) would probably have adequate protein but cereal or poorer grazing based diets may need supplementation with feeds containing pulse grains, brans or oil-seed cakes.

Further calculations on diets and meeting animal requirements will be done in the practical sessions.

The three stages of the production cycle for which supplementary feeding is most often suggested are:

- for pregnant goats in the last 1-2 weeks before kidding;
- for lactating goats, especially in early lactation;
- for kids at various stages of growth to slaughter or sexual maturity.

We have found no evidence for benefits from supplementary feeding of pregnant goats under Indian village conditions, provided we are talking about local types of goat that are not obviously starved.

Some research has been done on supplementary feeding of lactating goats. There is no evidence in the work so far that feeding goats concentrates at the rate of one percent of body weight (250g for a 25 Kg goat) per day in addition to 8 hours of grazing/browsing and 100g of concentrates per day.
to all goats has any real beneficial effect on milk yields or liveweight changes. However, the 100g per day of concentrates could have hidden the benefits from further supplementation. More work needs to be done but, at this stage, supplementary feeding of lactating goats with concentrates cannot be recommended as a general rule, especially if the goats are receiving adequate field time on normal good quality grazing and browse.

Additional feed in the form of crop residues or by-products which are available free could be fed to lactating goats provided that appetite is not being satisfied by normal grazing/browsing and provided the feeds are not needed for cattle/buffalo or for supplementary feeding of kids.

Some work has been done to try to find out the likely benefits of giving supplementary feed to growing kids of different age groups. Benefits have been found, but before considering these we must draw attention to two matters:

- If kids are being fed to appetite on green vegetation obtained by browsing/grazing, then little gain might be expected from making available more of the same to these animals. Only if the available grazing is dry grass or crop residue stubbles, which are of low digestibility and low available protein, might supplementation with green fodder be beneficial. Otherwise we are talking about concentrates with a probable cost.

- Benefits in growth rates will only be realised if the marketing system can be made more sophisticated (Chapter 6) with goats traded on a liveweight or carcass weight basis.
Information available suggests that with Barbari kids from 3 to 6 months of age, up to a 50 percent increase in growth rate can be achieved by supplementing 8 hours of browsing/grazing with a concentrate mixture fed at the rate of 2 percent of body weight per day. This is a maximum concentrate intake of about 300g per day at 6 months. On the basis of costing used in the report of this work, the cost of concentrates and additional labour was such that the supplemented kids cost nearly 40 percent more per Kg of weight gain. This is clearly not worthwhile, but a viable situation could be found if labour were available free and the concentrates could be obtained locally at lower cost. If concentrates were obtainable at less than 45 percent of the assumed market price the supplementation would have become economic.

The point to be made here is that each extension officer must work out the economics of each case, using as a starting point the knowledge about the level of benefit to growth rates likely from concentrate supplementation. Even that will vary with the quality of the available browse and the energy concentration of the concentrate. Clearly, result demonstrations in village herds are necessary to use as a talking point (Chapter 3).

There is some evidence that the benefits of concentrate supplementation continue from 6 months to 9 months of age but there is little effect from that age onwards, perhaps due to a gradual increase in foraging ability with age. A liveweight of 20 kg at 12 months is achievable with present animals compared to the current 17-18 Kg achieved with good grazing/browsing alone. Thus the 15 percent increase in liveweight at slaughter, targeted to be reached in 5 years, is achievable biologically but the economic benefits need further investigation and demonstration with village herds.
MARKETING, SERVICES AND SUPPLIES

Of vital importance for the functioning of any farming system are suitable marketing arrangements, access to necessary services and availability of essential supplies. It is difficult to generalise about these things since they are all subject to local peculiarities. Local farming systems operate within the constraints imposed by available markets and access to inputs but this does not mean that the situation is satisfactory. Lack of marketing, services and supplies may be limiting expansion of production or may negate the beneficial effects of an extension programme to improve productivity.

Extension officers must be aware that for any extension programme to succeed there must be acceptable markets for any increased output and any required inputs must be both available and affordable. Improvements in marketing arrangements, better accessibility to services and the provision of supplies, perhaps free or subsidised, can be powerful aids to the motivation of farmers to take up extension messages and implement recommended practices. However, great care must be taken to ensure that any changes are sustainable for as long as necessary so that farmers are not faced with, for example, a sudden withdrawal of a service having committed themselves to some dependent change in farming practice.

Marketing in a traditional subsistence system is taken care of by home consumption and local community exchanges of goods and services. Once surpluses are generated on a regular basis through deliberate action to commercialise production, then regular markets must be found. There may well be existing traditional markets for surpluses which may or may not be satisfactory. Many Indian village goat producers have traditionally sold or bartered their products because they are vegetarian but still produce
goat meat because of social factors and the suitability of the local ecosystem for goat production. Because of their weak social and economic status, the necessity to sell to meet current needs, and the non-storability of goat meat, such villagers are vulnerable and can be taken advantage of by traders. This problem is not easy to solve.

In many villages there does not appear to be any policy for regular buying or selling of slaughter goats on the part of traders, butchers or producers. The banding together of village producers to sell animals on a co-operative basis, with or without some kind of formal organisation, would give them more power in dealing with buyers. The extension officer could perhaps act as a catalyst in bringing together producers and buyers to formulate an agreement to regularise and stabilise marketing and pricing of slaughter goats. The targeting of production to meet peak demands for feasts and festivals could be another way to advantage producers. It may be necessary for the extension officer to initiate a marketing survey to ascertain the true situation and the real interests of all concerned in slaughter goat and goat meat marketing.

An aspect of marketing that is often overlooked is the salvaging, care and preparation of goat skins from goats killed for home consumption. Careful, humane and hygienic slaughter and meat preparation are in any case desirable whether or not any product is marketed. The requirements for acceptable goat slaughter and skin care are discussed below (see Box).

Services include those village institutions such as health clinics and schools which contribute directly to village welfare. However the concern here is more with those services and institutions providing services which relate directly to goat production. These services include the veterinary services, extension services and other sources of information, financial services, co-operative organisations and marketing organisations.
This whole programme is concerned with improving the extension services and access to them. Remember that there may well be agricultural and forestry extension services employing people with expertise that can be drawn upon. In Chapter 3 on Extension Methods it was suggested that all village-based community welfare and extension officers should be involved in discussions on the goat extension programme. During these discussions, unexpected sources of knowledge and assistance could be revealed.

Goat farmers should be able to call upon the services of the State Department of Animal Husbandry and Veterinary Services or its equivalent. Farmers can ask for assistance from the government veterinarians once they are aware of what services are available and what assistance is actually required. These services are often free. Demands made by aware farmers will make the Department more alert as to their responsibilities to the owners of goats rather than just to the owners of cattle and buffalo.

Block Development Programmes in north India include land development, soil correction, water resource development, agroforestry, animal husbandry and marketing. All of the services provided under these various programmes are free and may be identified as helpful to goat farmers. Government owned nurseries which distribute fodder trees at a low cost may be accessible. There are also free soil testing services through mobile laboratories in each district and such testing may be helpful for the successful fertilisation of planted fodder trees using subsidised fertiliser available in some programmes.

Financial services are likely to be required mainly for credit. Credit has a limited application in the goat production systems being discussed here. The programme is concerned with low purchased-input production. This is not to suggest that traditional goat production cannot generate income to
pay for inputs but rather that the benefits from the use of what purchased inputs could be used are very hard to quantify. This makes purchased inputs, even veterinary drugs, very hard to justify.

In India, Rural Banks provide loans for farmers currently below the poverty line in a variety of rural development programmes. Goat farming can be initiated using such loans.

Indebtedness may well be a current problem of goat farmers and improved financial institutions may alleviate resulting social problems. Improvement in goat production can only assist farmers to a better cash flow situation and a stronger financial base.

Note that the availability of services does not necessarily mean easy access to them. It has already been suggested that certain types of farmers or certain sectors of the village population are favoured in access to services that should be available to all. Increasing awareness and self-assertiveness on the part of goat farmers should make them more demanding of services which are theirs by right. The implementation of this extension programme exclusively for goat farmers should also assist in the re-distribution of services and the extension officer should be an advocate for goat farmer rights.

Supplies of importance to goat farmers include vaccines, veterinary drugs, chemicals for dipping, seeds, seedlings and other fodder tree planting material, breeding stock and possibly supplementary feeds. These have been discussed in the relevant lessons of Chapter 5. It only remains to repeat that any extension message based on a required input will be totally wasted unless the input is available and affordable.
Ancillary sources of information include written extension material designed either for extension officers or literate farmers. Suitable material for traditional village agriculture is rare and its usefulness is limited by low literacy rates. CIRG has produced a series of extension leaflets in Hindi and English as well as bulletins in both languages for graduate extension officers. Some of these have been referred to in this manual and a complete list is appended to this Chapter.

Research Institutions and Universities organise free training for farmers in various aspects of animal husbandry. Farmers should be made aware of training opportunities and field days. The extension officers may well be able to facilitate the attendance of selected farmers at such courses and extension programmes.
Humane and hygienic techniques are required when goats are slaughtered for home or local village consumption. In addition, care for the skins before, during and after removal from the carcass will result in a premium marketable product.

Slaughtering and skinning should best be done on and over a concrete pad. Once again there is a case here for communal action. A village slaughter pad protected from the rain and sun, with a pulley over it to enable the dead animal to be raised off the floor for bleeding and skinning, would be a valuable asset.

Animals ready for slaughter should be well rested, clean and dry. Goats which are dehydrated and exhausted before slaughter cannot yield high quality carcasses. They are most humanely slaughtered by shooting. (Figure 8). The firearm is held to the head at the point of the arrow and fired towards the mouth in the direction of the arrow. Alternatively the goat may be laid on its side, the throat cut and the neck broken by pulling the head well back as the cut is made. With both methods the throat will be cut to allow bleeding and the blood may be collected in a container.

The goat should be skinned immediately after death. Once the skin has been freed from around the lower legs using a sharp knife, the animal may be hung from the hind legs using a gambrel, rope and pulley as illustrated in Figure 9. The suspended animal can then be skinned, eviscerated and cleaned without contamination from the floor. Most of the skinning can be done by downward pull and the use of the hand to separate skin from muscle. Minimal use of the knife minimises the risk of cutting and damaging the skin.

Once the goat has been skinned and the internal organs removed, the carcass can be washed and hung in a cool place away from dogs and birds.

Contamination of the carcass with dust is common in Indian villages and should be avoided. Sun and heat promote the growth of bacteria and decomposition of the meat. Clean wooden blocks (for example of the Tamarind tree) should be used for the cutting of the carcass. Clean water should always be used for washing meat and the implements used for meat cutting and handling.

The production of good quality skins begins with the living animal. The skin is a living tissue so that anything affecting the health of the animal will affect the skin. Cuts, scratches, dog bites and external parasites will all result in visible damage once the skin is processed. Thorough bleeding of the slaughtered animal and good skinning are vital. The removed skin will normally be rectangular with the mid-line of the back down the mid-line of the skin and a leg in each corner.
FIGURE 8: Diagram showing where to shoot a goat

FIGURE 9: Hanging of goat carcass following slaughter
The removed skin should be washed, any excess fat or muscle tissue removed, and hung to dry in the shade. The objective is avoidance of any bacterial or fungal growth in the skin by depriving such organisms of moisture. Substantial loss of value may occur while the skins are drying and awaiting a buyer. Sun or hot winds will result in over-drying and cracking.

The skins are best dried by hanging them flesh side up, head to tail lengthways over a wooden rail or pipe in a well ventilated place in the shade.
The queen of goats - Jamnapari
Protect your animals from lice and ticks
Haemorrhagic septicaemia in animals
A nutritious green fodder for animals - Jowar (Sorghum)
Green fodder full of nutritious elements - Gwar (Cluster bean)
Tympany in goats
Proper management for prevention of kid mortality
Nutritious fodder for sheep and goats - Subabool (Leucaena)
Artificial insemination in goats
Necessary suggestions for producing green fodder during summer
Nutrition management in goats for higher production
The sole sustenance of the landless - goat
Procedures for prevention of infectious diseases in animals
The main diseases of goats and their prevention
Feeding management of goats for meat production from birth to 6 months

Pneumonia in goats and its prevention and cure.

Afforestation and goat husbandry in ravines
Dentition and ageing in goat and sheep
The grazing behaviour of goats vis-a-vis land degradation
CIRG at a glance
Virtues of goat's milk
Bulletins in Hindi

No. 1 Some suggestions for consideration while making animal houses in hot climates. 1985

No. 2 The main breeds of goat in India. 1985.

No. 3 Methods of preventing diseases in goats. 1985.

No. 4 Importance of modern reproductive techniques in goat development. 1986.

Bulletins in English

No. 1 Important breeds of Indian goats. 1985.

No. 2 Contribution to goat development in India - AICRP (Goats) 1985.

No. 3 Jamnapari goat. 1985.

No. 4 Feeding of goats. 1985.

No. 5 Preventive health care of goat diseases. 1985.

No. 6 Barbari goat. 1985.

No. 7 Modern reproductive tools to enhance goat production. 1985.

No. 8 Economics and prospect of goat rearing under farm and field conditions in semi-arid tracts of India. 1986.


Chapter 7.

MONITORING AND EVALUATION TECHNIQUES

For an extension programme to be effective and achieve some longer term impact on the life of the village, there must be an ongoing assessment of the changes which are happening and an identification of the problems which are occurring in the programme. This requires a collection of information concerning how well the programme is being implemented, a measurement of the changes, and judgements about the success of the programme overall. A thorough and unemotional evaluation of the programme should enable improvements to be made which will enhance future performance.

We need to consider first an ongoing monitoring of the efficiency of the extension programme itself. This involves assessment of how well the extension officers are performing the various tasks and activities as set out in the extension plan. It is also necessary to assess how well the extension messages have been transferred to farmers as judged by farmer motivation and actual implementation of the ideas and technology suggested to them.

Two types of things can be quantified to assist in monitoring:

1. The numbers of the different kinds of extension activities actually carried out and the level of farmer participation in each.

2. The numbers of farmers (or proportion of farmers) actually implementing the new ideas and technology.
Extension activities to be quantified:

- Group meetings
  - general village meetings
  - small group meetings
- Family visits
  - primary visits
  - follow-up visits
- Literature distribution
  - pamphlets (number)
  - wall newspapers
    (number and frequency)
- Video-tape showings
- Radio programmes
- Skill demonstrations
- Result demonstrations
  - number of participants
  - number of observers of each participant

Some of these activities overlap - for example, small group meetings may include video showings or skill demonstrations.

The data collected should include the numbers of farmers and type of farmer (sex, age group, socio-economic status) participating in each activity. The extension programme or plan for each officer should set targets for the frequency and level of participation for each activity. These targets can be set and the programme monitored by the controlling officers who should be able to judge after some time if the targets are realistic and whether or not there are problems in performance or participation.

It must always be borne in mind however that a large number of activities or high level of participation do not in themselves constitute an efficient extension programme.
Measurement of implementation by farmers:

The number or proportion of farmers in each village actually implementing designated new ideas or technologies can be recorded. A suggested list of such farmer actions has been compiled from the extension messages of Chapter 5 and is given at the end of this Chapter.

It is necessary to record the types of farmers and location with respect to village of the farmers taking up the messages. In this way problems can be identified and the extension modified if necessary. The problems could include low or no uptake of certain items of the messages by farmers in a particular village or by certain types of farmers. The reasons for this low uptake would then need identification.

Information necessary to classify farmers might include:

- Sex
- Age group
- Size of goat herd
- Education level
- Land holding
- Religion or caste

Can you compile a composite index of socio-economic status for a farmer in your community?

Each extension officer should be able to provide the necessary data for interpretation by the controlling officers of the extension programme.

The sampling techniques used in the surveys to collect the necessary background data on the project area and farmers (Chapter 4) can be used also in compiling the data on extension message implementation.
The second consideration is for an evaluation of the effectiveness of the technological changes being made in bringing about increases in goat production. To do this it is necessary to record production in at least a sample of the herds in each extension officer's project area. Research, and especially the farmer participation type field research necessary for result demonstrations, can indicate the likely level of response to innovations. The actual changes as indicated by field survey will be the result of both:

1. The proportion of the indicated responses actually achieved by farmers who implement the changed practices.

2. The proportion of farmers who take up the technology and make the changes.

The surveys by the extension officers as to which farmers are adopting the new ideas will enable the recording programme of goat productivity to include the herds of both adopting and non-adopting farmers in proportion to their representation in the farmer population. Of course sampling and interpretation will be complicated by the likelihood that many farmers will adopt only parts of the total extension package. Therefore some judgement will be required in the interpretation of the data obtained.

Fortunately it is probably not necessary to be too concerned about sampling since the successes or failures should be obvious.

Goat production records on a sample of herds are to be kept therefore to:

- provide background information
- enable result demonstrations
- monitor the effectiveness of the programme
- provide "talking points" for farmer and extension officer discussion.
Each extension officer should probably not try to record more than about 20 herds or about 100 goats. Animals in recorded herds should be identified by tattoo or in small herds by name (Lesson 2). Techniques for weighing of animals and for the ageing of animals whose birth-month has not been recorded have been discussed in Chapter 4.

Records to be kept:

Kid weights - for all kids in sample herds identified by month of birth -
Weights at 3, 6, 9 and 12 months. If the sample of kids is large enough the actual birth dates need not be known. Each herd need only be recorded once per month. Record the sex status (female, entire male, castrate male) of each kid.

Female performance - for all reproductive females in sample herds -
Date (or at least month) of each kidding. Number of kids born at each kidding. Number of kids alive at monthly intervals. Any other relevant observations on the birth or subsequent mothering.

The female kids identified for kid weight recording can subsequently be recorded for kidding performance, giving data on age at first kidding and sequential performance.

Management - aspects of management relevant to making judgements about the extent of implementation of the extension package in each herd must also be recorded - use the list given for monitoring of technology uptake.
Do not spend too much time collecting records to the detriment of the extension programme.

The third consideration is for an evaluation of the impact of improved goat production on village life and farmer welfare. This evaluation can only be done some time after the implementation of the programme when the achievement or not of a sustainable improvement in the quality of village life can be seen. It is suggested that 3 evaluation surveys could be made at 5, 10 and 15 years after implementation.

These surveys should collect the same information on individual farm families and on villages that is collected in the initial background data survey (Chapter 4). Indicators for measuring social and economic change at both family and village levels have been included in or can be derived from the answers of the suggested survey questionnaire. Indicators of change which are less likely to be biased than estimates of family income and which are easy to measure include:

Type (standard) of housing
Participation in community organisations
Attendance at meetings
Ownership of - radios
- bicycles
- farm implements
- animals (increased herd size)
- community television
Newspaper subscriptions
Sales of animals and prices achieved
Turnover in village shops
School attendance
Proportion of people working outside the village

Demand for veterinary services.

Some aspects of village level evaluation can be done by specialists from CIRG or another institution. Included could be an evaluation of any increased biomass productivity from communal grazing lands, changes in plant species distribution and frequency, and the success of fodder tree plantings. Methodology is available for estimating the status and trend of natural plant communities.

An important aspect in evaluation is an assessment of the maintenance of enthusiasm and performance by the extension officers. If the programme is going well and changes are occurring then enthusiasm should remain high.

The evaluations should also indicate where changes can be made to the extension messages and when additions can be made to take advantage of increasing awareness, affluence or literacy.

The social consequences of raising goat productivity are not always predictable. Increasing of cash income will not necessarily raise the living standards of the family. It is not always possible to sustain production or productivity increases since goats may be the first items sold if the family has financial difficulties, a poor harvest or unforeseen needs. The indicators used for evaluation can give us an overall picture but there may be individual failures within an overall success situation.
LIST OF FARMER ACTIONS WHICH CAN BE QUANTIFIED

Use of Barbari type male goats for breeding.
Use of male goats selected according to mother's kidding record.
Use of clean, dry bedding for kidding.
Primacy given to kid needs for colostrum and milk during the first month of life.
Construction and use of kid boxes.
Available supplementary feeds targeted to kidding females (those not going out for grazing/browsing), kids between 3 and 9 months of age, and lactating goats in that order of preference.
Construction and use of raised floors in night housing.
Keeping hooves from becoming overgrown and deformed.
Dipping and drenching if necessary.
Reporting of the occurrence of disease symptoms.
Planting and care of fodder trees and shrubs.
Adoption of recommendations for producing good quality goat skins.