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Introduction to Animal Husbandry

Introduction - Keeping Animals

Integrating animal husbandry into crop producing farms is one of the principles of organic farming. In temperate and arid zones, animal husbandry plays an important role in the recycling of nutrients, while it is less emphasised in the humid tropics. The caring, training, and nurturing of animals is considered an art in many farming communities. It is a strong tradition among pastoral communities such as the Massai in Kenya or the Fulani who live in most Sahelian countries. In these communities, animal husbandry is a mainstay in rural activities.

Animal husbandry in organic farming is different from extensive animal husbandry, which is often environmentally damaging (e.g. through overgrazing of common lands), and from intensive animal husbandry which keeps animals under ethically unacceptable conditions.

- **Farm animals can have many functions on a farm, but not all farms are suitable for keeping animals.**
- **Organic animal husbandry puts a central focus on the welfare and health of the animals.**
- **In order to obtain a sustainable farming system, it is crucial to select the right kind and number of farm animals.**
- **Sheds and beddings must be developed in a way to ensure the welfare and health of the animals.**

Integrating animals into the farm

Integrating animals into a farm can help to recycle nutrients. By-products such as straw, biomass from field margins or kitchen wastes, can be used as cheap and easily available fodder. At the same time, the dung should be returned to the fields in the most efficient way in order to increase the fertility of the soil. Animal products such as milk, eggs, and meat can both be used for home consumption in the family as well as for selling, thus generating additional income for the farmer.

Integrating animals in the farm

Animals integrated into the farm, showing the flow of fodder, dung and products

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Reasons to keep farm animals

Many farm animals have a multi-functional role. They can:

- **Yield products such as milk or eggs for sale or own consumption continuously**
- **Recycle by-products such as straw or kitchen waste**
- **Serve as draught animals for tillage or transport**
- **Produce meat, hides, feathers, horns etc**
- **Serve as an investment or a bank**

A cow is not just a cow! Farm animals can have many functions for a farmer

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- **Produce dung which is of great importance for soil fertility**
- **Help in pest control (e.g. dugs) and weed management (e.g. grazing on barren fields)**
- **Have cultural or religious significance (prestige, ceremonies etc.)**
- **Produce young stock for breeding or sale**

The significance of each role will vary from animal to animal and from farm to farm. It will also depend on the individual objectives of the farmer.

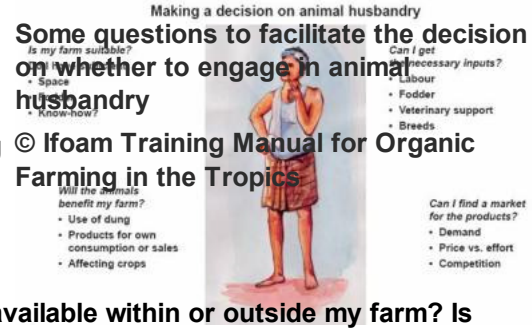
Making a decision on animal husbandry

There are several reasons for taking up animal husbandry as a part of your farming activities or even as the main one. There are also a number of critical aspects to be taken into consideration. In order to make a decision on whether and how to get involved in animal husbandry, you should ask yourself a number of questions:

Is my farm suitable? Do I have sufficient space for

shedding and grazing, sufficient fodder or by-products to feed, sufficient know-how on keeping, feeding, and treating the specific kind of animals?

Will the animals benefit my farm? Can I use the dung in a suitable way? Will I get products for my own consumption or sales? Will the animals somehow affect my crops?



Some questions to facilitate the decision on whether to engage in animal husbandry

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Can I get the necessary inputs? Is sufficient labour available within or outside my farm? Is enough fodder and water of good quality available throughout the year? Will remedies and veterinary support be available, if needed? Can I get suitable breeds of animals?

Will I find a market for the products? Does anyone want to buy my milk, eggs, meat etc.? Is the price worth the effort? Am I able to compete with other farmers?

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Requirements of Farm Animals

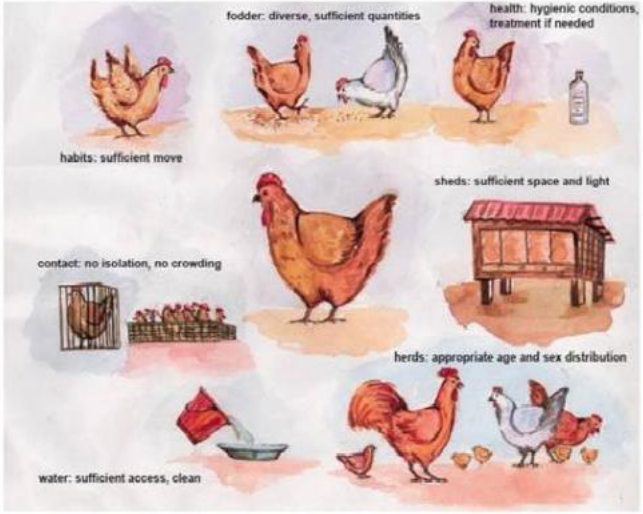
What animals need

Organic farmers try to achieve healthy farm animals which can produce satisfyingly over a long period of time. To achieve this goal, various needs of farm animals have to be considered:

- **Fodder in adequate quality and quantity: organic and without pesticide-residues; for non-ruminants: diversity in fodder is usually required**
- **Sufficient access to clean drinking water**
- **Clean sheds of sufficient size and with adequate light and fresh air**
- **Sufficient freedom to move around and perform their natural behaviour**
- **Healthy conditions and veterinary follow up, if needed**

- **Sufficient contact with other animals, but no stress due to overcrowding**
- **For herd animals: an appropriate age and sex distribution within the herd**

What farm animals need: for example chicken



Chicken have various needs which should be fulfilled simultaneously

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How many animals to keep?

In order to identify the appropriate number for a specific kind of animal on a farm, the following points should be considered:

- **Availability of fodder on the farm, especially in periods of scarcity (e.g. dry season)**
- **Carrying capacity of pastures**
- **Size of existing or planned sheds**
- **Maximum amount of manure the fields can bear**
- **Availability of labour for looking after the animals**

In tropical countries, farm animals are frequently found to be underfed. When defining the number of farm animals, keep in mind that the economical benefit will be higher when fewer animals are kept, but fed well. Not only the amount, but also the quality of the available food must be taken into consideration.

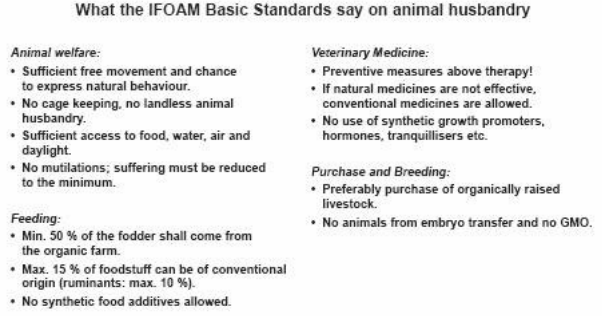
What the IFOAM Basic Standards say on animal husbandry

Organic animal husbandry means not only feeding organic food and avoiding synthetic food additives, but also putting a focus on satisfying the various needs of the farm animals. Good

health and welfare of the animals are among the main objectives. Suffering due to mutilations, permanent tethering or isolation of herd animals must be avoided as much as possible. For various reasons, landless animal husbandry (i.e. fodder purchased from outside the farm, no grazing land) is not permitted in organic farming.

There is a range of standards regulating the management, shedding, feeding, veterinary treatment, breeding, purchase, transport, and slaughter of farm animals in detail. Some of the most important standard requirements are listed below.

Ifoam Standards for Animal Husbandry



Some important requirements of the IFOAM Basic Standards referring to animal husbandry

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Housing

The type of shed should be specific to the type of animals to be sheltered. Poultry, for instance, should be housed in sheds that do not get too hot. Contact of the animals with their faeces should be avoided as much as possible.

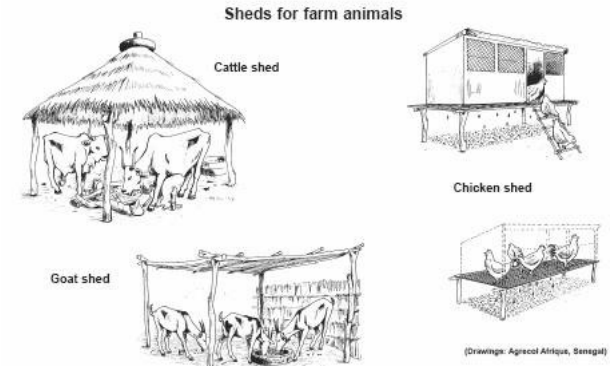
Planning sheds

With the exception of nomadic lifestyles, most farm animals are temporarily kept in sheds. The combination of animal husbandry and farm activities requires control of their movements so as to avoid damage to crops. For the welfare and health of the animals, sheds must be cool and aerated, and protect from rain. They should be constructed in a way ensuring:

- **Sufficient space to lie down, stand up, move and express natural behaviour (e.g. licking, scratching etc.)**
- **Sufficient light (as a rule, one should be able to read a newspaper in the shed)**
- **Protection from sunlight, rain, and extreme temperatures**
- **Sufficient aeration, but no draught**
- **Appropriate beddings (see section below)**
- **Elements to exercise natural behaviour (e.g. for poultry: perching rails, sand baths and secluded laying nests)**
- **Sheltered pits or heaps to collect and store manure**

For economic reasons, sheds can be built with simple, locally available materials. Many countries have a rich tradition of shed constructions, and have developed the most efficient and appropriate shed systems for the conditions of the region. If techniques of this heritage are combined with the above principles, a locally adapted and at the same time animal friendly system may be obtained.

Sheds for farm animals



Traditional simple sheds in Senegal: cattle shed, goat shed, chicken shed

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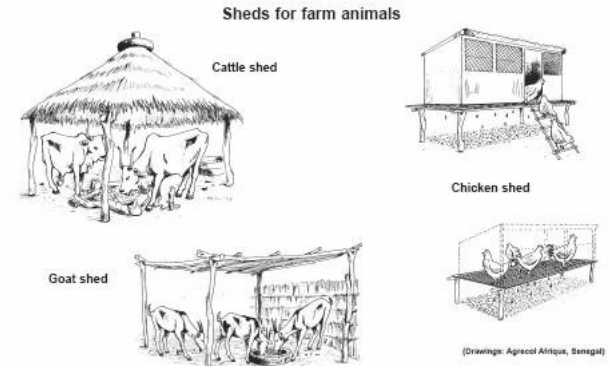
Beddings

Beddings are materials used in sheds for keeping the floor soft, dry, and clean, which is important for animal health. They absorb the excrements of the animals and need to be replaced from time to time. Beddings can be of straw, leaves, twigs, husks or other locally available material. They can be replaced daily or kept for several months while adding fresh material on top.

Sheds for farm animals



Traditional simple sheds in Senegal: cattle shed, goat shed, chicken shed

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Feeding animals

The availability of fodder is one of the limiting factors in animal husbandry. Organic husbandry should be mainly based on the fodder produced on the farm itself. As is the case with humans, there is a direct link between the food and the health of the animals.

- **A diverse and balanced mixture of food is a pre-condition for good animal health.**
- **Grazing and shed feeding both have their advantages as well as disadvantages.**
- **Fodder cultivation can be integrated into the farm without too much competition with crop production.**
- **Overgrazing is a major threat to soil fertility.**

A balanced diet

Food requirements of animals If farm animals are to be productive (milk, eggs, meat etc.), it is important that they get suitable food in sufficient quantities. If the fodder production of one's farm is limited (which usually is the case), it might be economically valid to keep less animals but supply them with sufficient food. The appropriate quantity and the mix of feed items will of course depend on the type of animal, but also on its main use (e.g. chicken for meat or egg production, cattle for milk, meat or draft etc.). In milk production for example, cows producing milk should be given fresh grass and possibly other feed items of sufficient protein content. On the same diet, draught animals would rapidly become exhausted.

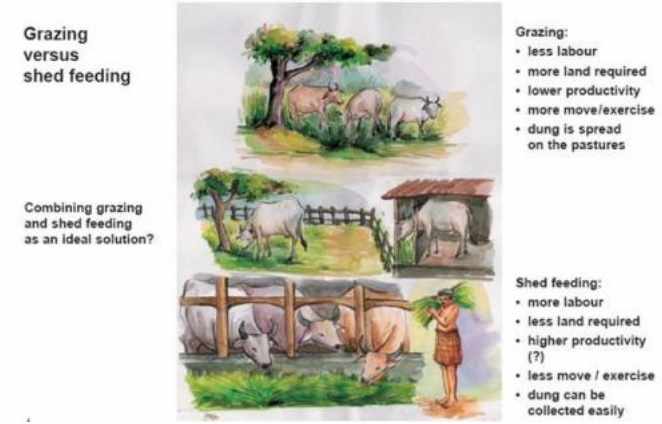
A balanced diet will keep an animal healthy and productive. Whether or not a farm animal receives the appropriate amount and kind of fodder usually can be seen by the shine of its hair or feathers. For ruminants, a majority of the fodder should consist of roughage (grass, leaves). If concentrates or supplements are used (e.g. agricultural by-products and wastes), they should not contain growth promoters and other synthetic substances. Instead of buying expensive concentrates, there are a variety of leguminous plants rich in protein which can be grown in the farm as cover crop, hedges or trees. If mineral content in the available fodder is not sufficient to satisfy the animal's requirements, mineral salt bricks or similar feed supplements can be used as long as they do not contain synthetic additives.

Fodder cultivation

Grazing or shedding?

In many regions of the tropics, favourable periods with abundant fodder alternate with less favourable periods when there is almost nothing to feed to the animals. But keeping animals means providing fodder throughout the year. Fodder can be produced on the farm as grazing land or as grass or tree crops used for cutting. While grazing requires less labour than shed feeding, more land is needed and appropriate measures to keep the animals away from other crops must be undertaken. Grazing may lead to a lower productivity (milk, meat) but usually is the more favourable option concerning health and welfare of the animals. Shed keeping, however, has the advantage that the dung can be easily collected, stored, or composted and applied to the crops. Whether grazing or shed feeding is the more suitable option will mainly depend on the agro-climatic conditions, the cropping system, and the availability of land. A combination of shed feeding and grazing in a fenced area may be an ideal combination of high productivity and animal friendly husbandry. In extensive grass lands of semi-arid areas, however, grazing may be the only suitable option.

Grazing versus shed feeding



The pros and cons of grazing and shed feeding, and the combination of both systems as a promising option
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Integrating fodder cultivation in the farm

In most smallholder farms, fodder cultivation will compete for space with the cultivation of crops. Whether fodder cultivation (and thus animal husbandry) is economically more beneficial compared with crop production must be assessed case by case. However, there are some options for integrating fodder crops in farms without sacrificing much land. Below are some examples:

- **Grass or leguminous cover crops in tree plantations**
- **Hedges of suitable shrubs**
- **Shade or support trees**
- **Grass on bunds against soil erosion**
- **Grass fallows or green manures in the crop rotation**
- **Crops with by-products such as paddy straw or pea leaves**

Pasture management

The management of pastures is crucial for a good herd management. It is also important to practice appropriate management throughout the year. There are many different types of grasses, and every climatic region has grasses which are specifically adapted to the conditions. In some cases it may be worth considering to till the grazing site and sow grass varieties that are more appropriate to the animal's needs.

Overgrazing is probably the most significant threat to grass land. Once the protective grass cover is destroyed, the top soil is prone to erosion. Degraded pastures or land with little plant cover is difficult to re-cultivate. Therefore, it is important that the use and intensity of grazing on a particular piece of land is appropriate to its production capacity. Sufficient time must be

given to a pasture to recover after intensive grazing. Fencing off of areas and rotation of the grazing animals on several pieces of land is a suitable option. This will also reduce infection from parasites encountered while the animals graze.

The intensity and timing of grazing as well as the cutting of the grass will influence the varieties of plants growing in the pasture. If certain weeds are a problem, the organic farmer will have to change his management practises as weedicides can not be used.

Rehabilitation of pastures
Rehabilitate pasture land with improved grass varieties and legumes for higher yield, higher nutrive value and palatability. Grasses can be transplanted or grown from seed. Legume seeds are sown between grass lines. Multipurpose trees can also be planted to provide fodder, fuel and timber.

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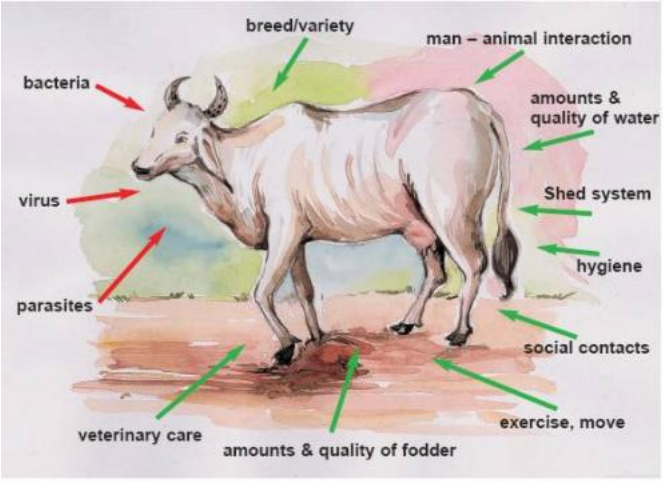
Keeping animals healthy

Factors influencing animal health
Disease causing germs and parasites are present almost everywhere. Like humans, animals have an immune system which is usually able to cope with these germs. And as with humans, the efficiency of the immune system will be disturbed if animals are not properly fed, can not practise their natural behaviour, or are under social stress.

Health is a balance between disease pressure (the presence of germs and parasites) and the resistance (immune system and self healing forces) of the animal. The farmer can influence both sides of this balance: reduce the quantity of germs by maintaining good hygiene, and strengthen the animal's ability to cope with germs.

Organic animal husbandry puts its focus on improving the living conditions of animals and on strengthening their immune systems. Of course: if an animal gets sick it must be treated. But the farmer should also think about why the immune system of the animal was not able to fight the disease or the parasite attack. And the farmer should think of ways to improve the animals living conditions and hygiene in order to strengthen it.

Factors influencing animal health



Bacteria, viruses and parasites attacking the farm animal which fights back with its immune system. The farmer can influence both sides of this balance

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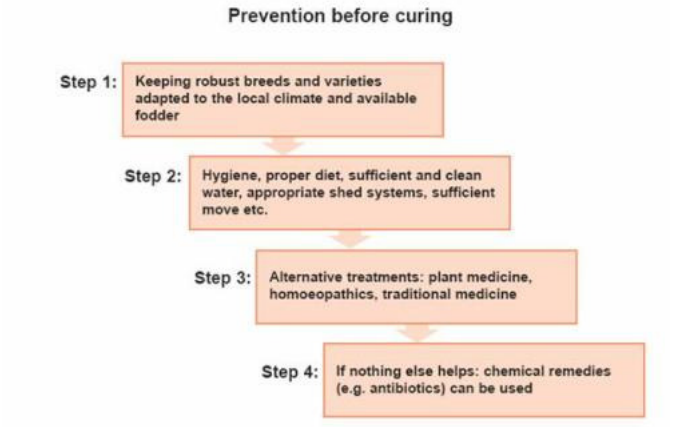
Prevention before curing

Similar as in crop health, organic animal husbandry puts the main emphasis on preventive

measures in order to keep animals healthy, rather than on curative methods. This starts from keeping robust breeds rather than high performing but verysusceptible ones. Next, the conditions in which the animals are kept should be optimal ones: sufficient space, light and air, dry and clean bedding, frequent exercise (e.g. grazing) and proper hygiene etc. The quality and quantity of fodder is of crucial importance for the health of the animal. Instead of feeding commercial concentrates which make animals grow faster and produce more, a natural diet appropriate to the requirements of the animal should be achieved.

Where all these preventive measures are taken, animals will rarely fall sick. Veterinary treatment thus should play only a secondary role in organic farming. If treatment is necessary, alternative medicine based on herbal and traditional remedies should be used. Only if these treatments fail or are not sufficient, synthetic medicines (e.g. antibiotics) may be used.

Prevention before curing



Only when all preventive measures fail animals should be treated with alternative remedies

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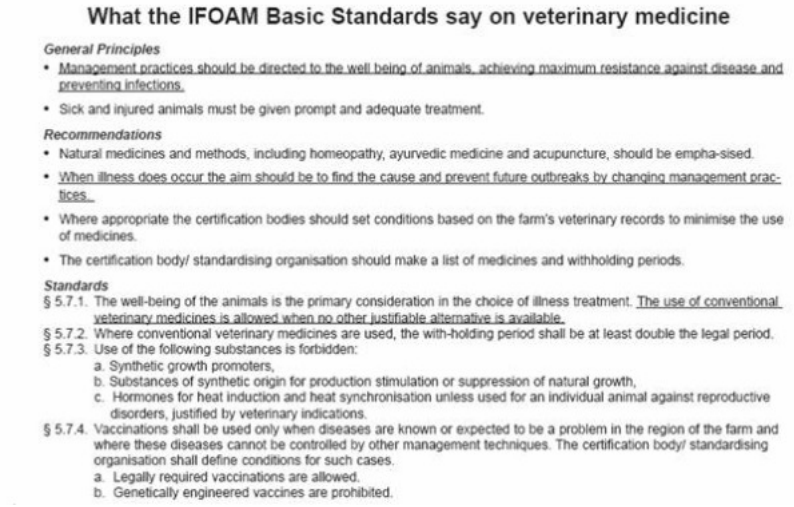
Veterinary treatment

The main principal for veterinary treatment in organic animal husbandry is:
get to know the causes of (or factors that favour) diseases in order to enhance the natural defence mechanisms of the animal (and to prevent its manifestations in the future, see above)

What the IFOAM Basic Standards say on veterinary medicine

Unlike in crop production, synthetic means are allowed to cure sick animals if alternative treatment is not sufficient. Here, reducing the suffering of the animal is given priority over the renunciation of chemicals. However, the standards clearly demand that priority is given to management practices which encourage the resistance of the animals thus preventing the outbreak of a disease.
Therefore, an outbreak of a disease shall be considered as an indicator that the conditions under which the animal is kept are not ideal. The farmer should try to identify the cause (or causes) of the disease and prevent future outbreaks by changing management practises.
If conventional veterinary medication is applied, withholding periods must be adhered to before the animal products can be sold as "organic". This shall ensure that organic animal products are free from residues of antibiotics etc. Synthetic growth promoters are not allowed in any case.

IFOAM Basic Standards on veterinary medicine



What the IFOAM Basic Standards say on veterinary medicine

General Principles

- Management practices should be directed to the well being of animals, achieving maximum resistance against disease and preventing infections.
- Sick and injured animals must be given prompt and adequate treatment.

Recommendations

- Natural medicines and methods, including homeopathy, ayurvedic medicine and acupuncture, should be empha-sised.
- When illness does occur the aim should be to find the cause and prevent future outbreaks by changing management prac-tices.
- Where appropriate the certification bodies should set conditions based on the farm's veterinary records to minimise the use of medicines.
- The certification body/ standardising organisation should make a list of medicines and withholding periods.

Standards

§ 5.7.1. The well-being of the animals is the primary consideration in the choice of illness treatment. The use of conventional veterinary medicines is allowed when no other justifiable alternative is available.

§ 5.7.2. Where conventional veterinary medicines are used, the with-holding period shall be at least double the legal period.

§ 5.7.3. Use of the following substances is forbidden:
a. Synthetic growth promoters,
b. Substances of synthetic origin for production stimulation or suppression of natural growth,
c. Hormones for heat induction and heat synchronisation unless used for an individual animal against reproductive disorders, justified by veterinary indications.

§ 5.7.4. Vaccinations shall be used only when diseases are known or expected to be a problem in the region of the farm and where these diseases cannot be controlled by other management techniques. The certification body/ standardising organisation shall define conditions for such cases.
a. Legally required vaccinations are allowed.
b. Genetically engineered vaccines are prohibited.

Statements of the IFOAM Basic Standards on Animal Health (Edition 2000). Sections of specific relevance in this context are underlined

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Controlling parasites with herbal remedies

Herbal medicines are widely used in many countries. Some traditional farming communities have a vast knowledge of local plants and their healing properties. Plants can definitely support the healing process, even if they do not eliminate the germ of the disease directly. Still, farmers should not forget to identify the cause of the disease and also to re-think their management practises. For parasite problems, changing the living conditions or the management of pastures will be more effective in the long run than any treatment.

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Breeding in Organic Animal Husbandry

Principles and methods

As preventive measures for maintaining good animal health are of high relevance in organic farming, the selection of breeds suitable to local conditions and to organic feeding is of crucial importance. This requires that suitable breeds are available. Traditional breeds of farm animals may be a good starting point for organic animal breeding. Animals can be improved by selection of individuals especially suitable for organic conditions. They can be crossbred with suitable new breeds, thus achieving an animal with the positive aspects of traditional breeds and the satisfying production of the new breeds.

For breeding, organic farming uses natural reproduction techniques. While artificial insemination is allowed, embryo transfer, genetic manipulation, and hormonal synchronisation are not permitted according to IFOAM standards.

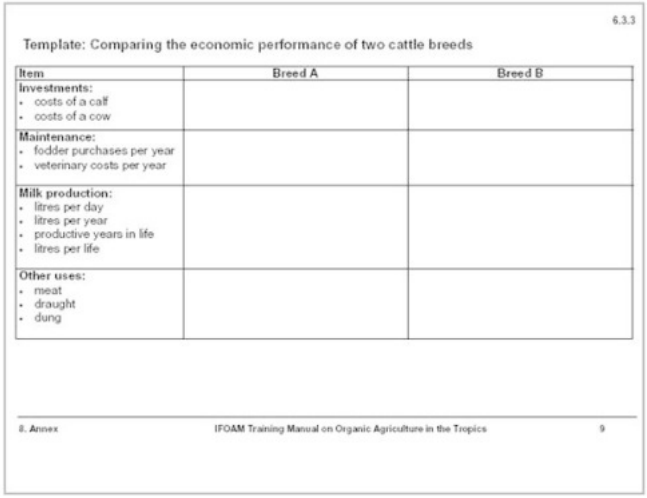
Breeding Goals

Over the last decades, traditional breeds have been replaced by high performing ones in many regions. Similar to high yielding plant varieties, these new breeds usually depend on a rich diet (concentrates) and optimal living conditions. As high performing breeds in general are more susceptible to diseases than traditional varieties, they need frequent veterinary interventions. Thus, these new breeds might not be the right choice for small farmers, as the costs of food concentrates and veterinary treatment are too high compared with what can be earned by selling the products.

In addition, for organic farmers the main animal product (e.g. milk) is not the only reason to keep animals. Breeding activities therefore should try to optimise the overall performance of the animal, taking into consideration the different goals of an organic farmer. For example a poultry breed suitable for organic smallholder farms might not be the one with the highest egg production, but one in which meat production is good, and kitchen wastes and whatever is

found on the farm yard can be used as feed. Suitable cattle breeds would produce sufficient milk and meat while feeding mainly on roughage and farm by-products (e.g. straw), be of high fertility and good resistance against diseases, if required, they can also be used for draught and transport.

Maximum performance or life production?
When comparing the production of different breeds of cows, usually, only the production per day or year is taken into consideration. However, high performing breeds usually have a shorter life span than traditional ones with lower production. The life milk production of a cow giving, for example, 8 litres per day, but over 10 years, therefore would be greater than the one of a highbreed cow yielding 16 litres per day, but dies after 4 years. As the investments to get a milk producing cow are quite high, i.e. the rearing and feeding of a calf or the purchase of an adult cow, continuous production over a long life span should be of high interest to the farmer. This should be reflected in the breeding goals, which so far mainly focus on the maximum short term production.



6.3.3

Template: Comparing the economic performance of two cattle breeds

Item	Breed A	Breed B
Investments: • costs of a calf • costs of a cow		
Maintenance: • fodder purchases per year • veterinary costs per year		
Milk production: • litres per day • litres per year • productive years in life • litres per life		
Other uses: • meat • draught • dung		

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Animal Welfare in Organic Agriculture

Animals are an important component of of the organic farm. They form part of a system in which all parts interact to their mutual benefit. But opposed to the crops, animals are not just parts of this system. They are creatures with feelings and deserve special considerations. This makes their management fundamentally different from that of crops. "When a farmer is learning to manage a farm with no chemical inputs, sometimes a field may become overgrown with weeds, for example. The farmer might not be able to do much about it, and may simply accept the loss as an inevitable part of learning how to farm organically. However, it is not acceptable to let animals suffer or die." (Vaarst et al., 2004)

Animal welfare is to note that animals have experiences and are sentient beings. This gives humans a moral obligation to treat animals well and to prevent that they suffer or die. To avoid suffering is both important in organic and conventional animal husbandry, but the organic principles go further than animal welfare. One of the basic principles in organic farming is to allow animals to behave naturally. But just allowing animals to express natural behaviour does not guarantee their welfare. In fact, natural behaviour can sometimes reduce welfare. For example, the escape behaviour of a hen in response to a predator (e.g. a fox) and the wallowing by bigs when hot, are both natural behaviour. However, it would not be in the best interest of these animals to expose them to these conditions just so they can show their natural behaviour. Thus the absence of a wallow where the temperature is controlled is not a problem, but it becomes a problem if the temperature rises.

Cattle:

Living in groups is a basic characteristic of cattle, a social species, and can only be fulfilled by keeping them loose housed. Tied cattle are very restricted in their behaviour, which has negative consequences on health. If cattle are kept on pasture, shelter should be available to protect them from sun during hot periods, and from rain and wind during cold. Trees can serve to give shade and protection in summer. During the winter in temperate and cold areas, free-range cattle need at least a dry lying area with protection against wind. In wet areas, this can

only be offered by a roofed area.
A cause of behavioural problems and inconveniences in cattle is bad handling. Research has developed some general rules how to reduce the animals' fear of humans and improve the ease of handling. All cattle can be taught to be easy to handle and not to be frightened or attack defensively. For example, it is important to teach bulls acceptable behaviour as calves. Individually reared bulls were found to threaten and attack humans more than those reared in groups. If you treat your cattle well, they will be easier to handle. Avoid shouting and hitting as it will lead to a higher level of fear from humans and more animals attacking humans.

Pigs:

Apart from adult boars and sows around farrowing, pigs are social animals and should be kept in groups. Their natural groupings are small and stable. In commercial productions pigs are usually kept in larger groups and repeatedly mixed with unfamiliar individuals. Problem arises from disrupting social bonds. Thus, mixing of pigs should be avoided whenever possible.
Pigs should be allowed to eat simultaneously. If their feed is restricted, each pig should have sufficient space at the through.
Floors should be bedded with straw or similar material. Bedded flooring not only improves comfort, but also allows the pigs to investigate and manipulate the material, reducing destructive behaviour against other pigs such as tail biting.
Special emphasis should be given to the housing of farrowing and lactating sows. To enable them to turn around, to perform nest-building behaviour, to separate their dunging area from their lying area and to prevent piglets from being crushed, sows must be allowed a minimum space of 7.5 m².

Poultry (Laying Hens):

Laying henns have a daily rhythm of food intake, therefore feed should be plentiful especially in the late daytime hours. A scratching area with adequate litter is important for the welfare of laying hens, it also helps to prevent feather pecking. Long straw seems to be the most suitable

material for foraging, scratching and pecking. Also, giving hay, silage and other materials (e.g. pecking stones), as well as scattering grain, allows foraging and keeps the hens busy. Laying hens should have access to an outdoor run that also provides foraging possibilites. In outdoor runs, hens can take in a lot of fresh plant matrial. The run should also be equipped with cover, such as trees and bushes to provide hiding places and shade. To prevent an excessive use oth the vegetation and accumulation of nutrients, a rotation system must be used (at least to runs of 4m² each), thereby also reducing the risk of parasitic infection. A separate large box with sand should be present in the hen house or the outside run to allow dust bathing. Perches are a preferred site for laying hens to preen, but also for rosting and sleeping, especially at night.

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Information Source Links

- **IFOAM Training Manual for Organic Agriculture in the Tropics**
- **Vaarst, M; Roderick, S.; Lund, V. et al. (2004): Animal Health and Welfare in Organic Agriculture, CAB International, Wallingford, UK.**

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status: under construction

Introduction

The Arid and Semi Arid Lands (ASAL) of Kenya make up 84% of Kenya's total land surface; supports about 8 million Kenyans, as well as 50% of the livestock and 65% of the wildlife population. Kenya ASALs produce the bulk of the red meat consumed in Kenya under nomadic pastoralism and ranching production systems supporting about 6 million beef cattle. The beef industry represents an important proportion of the economy accounting for about 70% of total beef meat consumed in the country. Apart from meat beef cattle have several benefits, which include; milk, hides and skins, draught power for land preparation and transport and manure too.

Smallholder dairy farmers in East and Southern Africa produce over 80% of the milk consumed in this region. Estimates from 2005 rate annual milk production in Kenya at 3.2 billion litres, worth over 50 billion Ksh annually. This sector of agriculture, forming an economical basis of millions of livelihoods, has huge potential for improvement through management practices, better feeding and breeding practices, disease management and improved care of the young.

Well worked out economics of dairy production is essential for making profits from dairy production. The economics of animal keeping is very dependant on the basic corner stones:

Animal diseases

Health, welfare and basic good nutrition (For more information on Nutrition in Dairy animals - link to animal nutrition and feed rations)

Fodder Production and Conservation

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Products

Economics of Dairy production

Economics of Dairy production: Estimation of returns from different scenarios of smallholder systems

Dairy farming is an important source of income and employment in Kenya. The population of dairy cattle is estimated to be about 3 million in the country. The cattle are kept under extensive and intensive management systems. Extensive systems are confined to a few ranches and large scale farms. The intensive systems are the most predominant and comprise zero-grazing and semi-zero grazing systems. Arising from reports and data collected by different institutions, a rough estimate of returns obtainable from dairy enterprise can be calculated. The important inputs for dairy production include land, labour and capital.

Land

Land is the most important resource for feed production besides being used for infrastructure development. Estimates of land required to raise a livestock unit (cow and calf) under different scenarios vary with ecological zone, forage management practices, and feeding strategies. For instance, under intensive forage production in high rainfall (e.g. UH 2- 4; LH 2-4; UM 1-4, LM1-3 ? link to agro-ecological zones) areas, one acre can sustain a livestock unit. In areas with low rainfall, the acreage required to sustain a livestock unit increase drastically and may reach 10 acres under moderate management.

Labour

Dairy production is generally labour intensive regardless inclining towards machinery or human to perform tasks. Labour is generally estimated to take about 40-50% of the total cost.

Capital

The most important capital in dairy industry are the cows and construction of management infrastructure (shed, milking crushes, fencing, and husbandry apparatus/equipment). The cost of an in-calf heifer vary from Ksh 40, 000-120,000/- (USD 540- 1600) depending on genetic potential. Simple cow sheds for holding upto 4 cows are estimated to cost (50,000-100,000/-) depending on source of materials and labour. The cost can be substantially reduced by using own timber, building stones, rainwater and home labour during construction. Important recurrent costs include purchase of feeds, artificial insemination, health care and milk marketing (transport, preservation and value addition).

Estimated returns from dairy systems based cows with varied production potential under different managements (production inputs)

The following 5 examples of how to calculate economic returns from dairy cattle should only be taken as guidelines. It is very important that each dairy farmer calculates production figures based on available feedstuffs in the area, what can be grown on the farm ? and the cost of growing it, as well as the price of milk that can be obtained from the market. Under Animal Nutrition and feed rations (link please) it is described what dairy cown need in terms of nutrition. Each dairy farmer must decide the best possible production system at the most economical costs in order to get a decent income from dairy production.

Also health and welfare of the animals are very important aspects, as too many veterinary bills or loss of productive animals are very costly affairs. It is always prudent to reduce costs as much as possible bearing in mind that some costs like basic nutrition, health and animal welfare are the cornerstones of a profitable dairy production.

General assumptions:

- **A dairy cow consumes feed dry matter (DM) amounting to 3% of its body weight daily**
- **No mortality occurs**
- **The calf is raised successfully as replacement stock or sold after attainment of physiological maturity**
- **Artificial insemination (AI) is practiced under intensive and semi-intensive systems. Natural mating is practiced under extensive/pastoral systems**
- **There is unlimited milk market**
- **Milk is sold at farm gate without value addition or any form of processing**
- **A bale of hay weighs 14.4 kg (DM basis)**
- **Labour costs vary with systems and locality**
- **Labour is not hired under pastoral system**

Example 1: Dairy cow (Friesian or Ayrshire) weighing 400 kg kept in high potential highlands of Kenya (UH, LH, UM or LM climate) under intensive or zero grazing management based on outsourced (bought) feeds.

Daily diet example

Feedstuff	Amount dry matter (DM) basis (kg)	Amount Fresh (kg)
*Napier grass (kg)	5	25
**Lucerne hay (kg)	3	3.5
**Dairy meal (kg)	4	4.5

Maclick super	**0.12 (120 g)**	**0.12 (120 g)**
Total	**12.12**	**33.12**

Assumptions: * DM content = 20%, * *DM content = 90%

- **Note:**
- **1 . Forages with low DM content to be weighed fresh and wilted before feeding.**
- **2. Fresh water to be available free choice**
- **3. Wastages to be compensated for during feeding**

Production aspect	Quantity	Unit cost/price (KES)	Annual Value (KES)
A			
1. Fixed (capital) inputs			
Dairy cow[1]	1	80,000	15,000
Cow shed[1]	1	50,000	10,000
2. Recurrent inputs			
Forages	2920 kg	5.55/kg	16,222
Concentrates	1460 kg	21.4/kg	31,286
Health	1	15,000	15,000
AI	1.3	600/service	800
Calf	1	12,502	12,502
Labour		6,000/month	72,000
Total (A)			**172,810**
B			
3. Outputs	6020	30/litre	180,600
Milk *	1	30,000	30,000
Calf	1,752 kg	3	5,256
Manure			**215,856**
Total (B)			**43,046**
Gross margin (profit) = B – A			

1 Cow and cowshed are considered as having long-term value; annual costs are estimated to

cater for risks of unavoidable losses and depreciation

***Calculations based on average daily milk = 20 litres in 301 days lactation**

Example 2: Dairy cow (Friesian or Ayrshire) weighing 400 kg kept in high potential highlands of Kenya (UH, LH, UM or LM climate) under intensive or zero grazing management based on home grown forages.

Daily diet example

Feedstuff	Amount dry matter (DM) basis (kg)	Amount Fresh (kg)
**Napier or Columbus or Guinea grass or combination	3	15
**Kikuyu or Rhodes or Star grass or combination	2	8
*Sweet potato vines or Lucerne or desmodium	2	13.5
**Calliandra or Sesbania or Leucaena	1	5

***Dairy meal	4	4.5
Maclick super	0.12 (120 g)	0.12 (120 g)
Total	12.12	46

Production aspect	Quantity	Unit cost/price (KES)	Value (KES)
A:			
1. Fixed (capital) inputs			
Dairy cow[1]	1	80,000	15,000
Cow shed[1]	1	50,000	10,000
2. Recurrent inputs			
Forages			
Concentrates	2920 kg	2.77/kg	8,111
Health	1460 kg	21.4/kg	31,286
AI	1	15000	15,000
Calf	1.3	600/service	800
Labour	1	12502	10,879
Total (A)		6000/month	72,000
B:			**158,076**
3. Outputs			
Milk	6020	30/litre	180,600
Calf	1	30000	30,000
Manure	1752 kg	3	5,256
Total (B)			**215,856**
Gross margin (profit) = B – A			**52,780**

1Cow and cowshed are considered as having long-term value; annual costs are estimated to cater for risks of unavoidable losses and depreciation *Calculations based on average daily milk = 20 litres in 301 days lactation

From the above comparison it can be seen that home production of forages gives a higher return from similar systems, but that dairy production can still be profitable when fodders are bought in (depending on price).

Example 3: Dairy cow (Friesian or Ayrshire) weighing 400 kg under intensive management in a peri-urban area fed on purchased forages, agro-industrial by products and concentrates based

diets.

Daily diet example

Feedstuff	Amount dry matter (DM) basis (kg)	Amount Fresh (kg)
*Grass hay	4	4.5
Molasses	1	1
**Brewers waste	1	20
*Lucerne hay	1	1
*Sunflower cake or cotton seed cake	2	2
*Dairy meal	3	3.5
Madiek super	0.12 (120 g)	0.12 (120 g)
Total	**12.12**	**31.12**

Assumptions:

- *** DM content = 90%;**
- *** *DM content = 5%**
- **Note: 1. Forages with low DM content to be weighed fresh and wilted before feeding.**
- **2.Fresh water to be available free choice**
- **3. Wastages to be compensated for during feeding**

Production Aspects Example 3	Quantity	Unit cost/price (KES)	Annual Value (KES)
A - Costs:			
1: Fixed (capital) inputs			
Dairy cow	1	80,000	15,000
Cow shed	1	50,000	10,000
2: Recurrent Costs			
Forages	1823 kg	3,33/kg	10,129
Agro-Industrial by-products	1460 kg	8,00/kg	11,680
Concentrates	1093 kg	21.4/kg	23,404
Health	1	15,000	15,000
AI	1.5	600/service	800
Calf	1	11,031	11,031
Labour	1752 kg	10,000/month	120,000
Total A:			**217,724**
B- Income:			
3: Production of			
Milk	6020 L	30 per Liter	180,600
Calf	1	30,000	30,000
Manure	[illegible]	[illegible]	[illegible]
Total B			215,856
C- Gross Margin (profit)			
B-A			- 1,868

1 Cow and cowshed are considered as having long-term value; annual costs are estimated to cater for risks of unavoidable losses and depreciation *Calculations based on average daily milk = 20 litres in 301 days lactation

From example 3 we can learn that one must be very careful about feeding expenses. Buying in too much feed at too high prices will cancel out any profit and even make a loss. It is very important to always list all expenses and evaluate whether they are justified.

Example 4: Jersey cow weighing 300 kg under intensive system (zero grazing) in Western or Eastern Kenya (UM or LM climate) receiving at least 800 mm rainfall fed on home grown forages.

Daily diet example

Feedstuff	Amount dry matter (DM) basis (kg)	Amount Fresh (kg)
**Napier or Columbus or Guinea or Giant panicum or Guatemala grass or combination	2	10
**Kikuyu or Rhodes or Nandi setaria or Star grass or combination	2	8
*Sweet potato vines or Lucerne or desmodium	1	7
**Calliandra or Sesbania or Leucaena	1	4
***Dairy meal	3	3.5
Maclick super	0.12 (120 g)	0.12
Total	**9.12**	**32.62**

Assumptions:

- *** DM content = 15%;**
- *** *DM content = 20%;**
- ***** DM content = 90%**
- **Note: 1. Forages with low DM content to be weighed fresh and wilted before feeding.**
- **2.Fresh water to be available free choice**
- **3. Wastages to be compensated for during feeding**

Production aspect example 4	Quantity	Unit cost/price (KES)	Value (KES)
A - Costs			
1. Fixed (capital) inputs			
Dairy cow[1]	1	60,000	10,000
Cow shed[1]	1	50,000	10,000
2. Recurrent inputs			
Forages	2190kg	4.00/kg	12,167
Concentrates	1095 kg	21.4/kg	23,433
Health	1	10000	10,000
AI	1.3	1000/service	1,300
Calf	1	12502	10,065
Labour		6000/month	72,000
Total (A)			**148,965**
3. Outputs			
Milk	5418	30/litre	162,540
Calf	1	30000	30,000
Manure	1314 kg	3	3,942
Total (B)			**196,482**
Gross margin (profit) = B – A			**47,517**

1Cow and cowshed are considered as having long-term value; annual costs are estimated to cater for risks of unavoidable losses and depreciation

***Calculations based on average daily milk = 18 litres in 301 days lactation**

Jersey cows, being smaller animals, eat less than Friesian or Ayrshire cows, and has better quality milk. Some dairies will pay extra for the good quality milk (higher cream and protein content) but this is not yet common in Kenya

Example 5. Pastoral system keeping dual-purpose Sahiwal cow under IL conditions grazing

good quality pasture (Themeda, Bothriochloa, Cynodon, Cenchrus or a mixture of these)

Production aspect example 5	Quantity	Unit cost/price (KES)	Annual (KES)	Value
A - Costs				
1. Fixed (capital) inputs				
Dairy cow[1]	1	20,000		2,000
Cowshed (Manayatta Boma)[2]	1	2000		2,000
2. Recurrent inputs				
Forages	3066kg	2.00/kg		6,132
Health	1	2000		2,000
Calf	1	1626		1,626
Total (A)				**13,758**
B – Income:				
3. Outputs				
Milk	1040	20/litre		20,800
Calf	1	5000		5,000
Manure	1226 kg	1		1,226
Total (B)				**27,026**
Gross margin (profit) = B – A				**13,268**

1Cow and cowshed are considered as having long-term value; annual costs is estimated to cater for risks of unavoidable losses and depreciation

2 Manyatta Bomas are constructed under the pastoral system; annual cost is estimated

***Calculations based on average daily milk = 4 litres in 260 days lactat**

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Cattle Health and welfare

Cattle health and welfare are two very important aspects of dairy production. Most dairy farmers have felt the painful loss of a good cow but may not always be aware why the loss occurred. Many losses can be avoided by paying careful attention to preventive health care and seeing that the animals are comfortable and able to function the way nature intended. The following are the main preventive measures every serious dairy farmer should consider:

- **Proper feeding and prevention of starvation is the first aspect to be addressed**
- **Preventive health care such as regular tick control**
- **Prevention of management diseases**
- **Vaccination of animals according to veterinary recommendations for the area**
- **Good housing/ milking facilities, where proper hygiene can be managed**
- **Good supervision to ensure incidental diseases are dealt with in a timely and appropriate manner**

Tick control

In East Africa many serious diseases are transferred by ticks. This is less severe in 0-grazing units than in animals grazing pastures and interacting with a certain amount of wildlife. However tick

Dips

These are structures built on ranches or communally where animals are driven through a bath of acaricides. It is an easy procedure but quite costly, and there can often be cases of animals that swallow some amount of dip solution with varying results ? from death of the animal to some degree of poisoning.

Dips must be carefully maintained to ensure the concentration of acaricides is appropriate at all times. Too low concentration can lead to ineffective tick control and tick resistance to the acaricide used. There is also the problem of environmental pollution when dips need to be cleaned out. Where to throw all the old toxic waste?

Spray-races

Spray races are modernized dips, where cattle walk through a set of nozzles spraying acaricides to cover the whole animal. The spraying is done mechanically by pumps, with very little need for human labour. It is less hazardous than dips, and as the left over spray is recollected, strained and reused there is less waste of acaricides. The concentration of acaricides is also much easier to regulate than for dips. As animals walk into the spray race preparing to meet the spray and closing their mouths and too much inbreathing, the spray races have less problems of poisoning of animals than dips.

Back pack sprayer

As most small scale farmers do not have access to dips or spray races, the best option becomes spraying by back pack sprayer. This is labour consuming and it is easy to miss areas on the animals (often under the tail or behind leg joints), where ticks can then hide and multiply. It is also important to avoid spraying directly into the animal?s noses and open eyes. Animals can go blind from getting acaricides into their eyes, and can get poisoned by too much acaricide sprayed on their noses.

Pour-on

Pour-on acaricides are slowly becoming more popular. These are formulated in a way that a certain amount is simply poured along the back of the animal, from where it distributes itself evenly over the hide of the animal. Pour-on?s are very effective but also quite expensive.

Acaricides:

There are several different types of acaricides available on the market and it is advisable to keep interchanging them to avoid ticks becoming resistant. Several botanicals have also been found to be effective in place of acaricides (link to TOF article (Ayako on botanicals)). For organic farmers it always important to have as little poison on the farm as possible, and to choose the least harmful types of acaricides. However even organic farmers have to spray their animals, as regulations demand that the animals are kept healthy and comfortable.

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Diseases

Types of Diseases

Diseases in cattle are categorized into two:

1. Notifiable diseases

Name	Type of vaccination	Remarks
Lumpy Skin Disease (LSD)	Once a year	-
Contagious Bovine Pleuro pneumonia (CBPP)	Once a year	-

Rinderpest	**Every 6 months**	**-**
Foot and Mouth Disease (FMD)	**Every 6 months**	**-**
Rift Valley Fever	**Yearly**	**Also affects human beings**
Anthrax and Blackquarter	**Every 9 months**	**Also affects human beings**
Brucellosis	**Once in a lifetime(to calves only)**	**Also affects human beings**
Malignant catarrhal fever	**No vaccination**	**Avoid contact with wildebeest**
East Coast Fever (ECF)	**No vaccination**	**Treatable**
Trypanasomiasis	**No vaccination**	**Protective medicine available**

Note: All notifiable diseases require imposition of quarantine.

2. Non-notifiable diseases (all the rest of the diseases)

- **Management diseases - such as mastitis, milk fever, diarrhea,**
- **Tick and insect borne diseases - such as anaplasmosis, babesiosis, East Coast Fever, Rift Valley Fever etc**
- **Eye problems**
- **Fertility problems**
- **Skin diseases**
- **Zoonotic diseases (transferable to humans)**
- **Water borne diseases**
- **Parasites**

- **Air borne diseases**

The above listing is sometimes overlapping ? a zoonotic disease like rift Valley Fever is also an insect (mosquito) borne disease, and mastitis ? a management disease ? can also be caused by wounds left by tick bites.

Vaccination:

It is important to keep up the vaccination schedules listed above in the table on notifiable diseases. This will avoid a lot of grief when outbreaks suddenly occur. It is much cheaper to keep up vaccination schedules than to suddenly have to treat a lot of sick animals. Always prevention is better than cure, as there is no loss of production in prevented diseases.

The following lists a few management diseases and their prevention and management

Milk Fever

Common in high yielding lactating cows just after calving. Milk fever can kill an otherwise healthy cow in less than 24 hours if not successfully managed. Causes: Nutritional disease/disorder associated deficiency of Calcium. Friesian and jersey cows are highly susceptible.

Symptoms: Cow staggers on moving; cow feels hot to the touch (fever); Cow will lie down on its side with legs thrust out and head turned back.

Prevention

- **If the cow is left with its calf for the first 3 days after calving and not milked by people during this time, many cases of milk fever can be avoided. Besides, the first week's milk is not suited for mixing with other milk for sale.**
- **A handful of agricultural lime mixed with the first feed given after birth will prevent most cases of milk fever.**

Treatment

If discovered early enough, a handful of lime in a bottle of water and fed to the cow may be sufficient for the cow to recover. For late discovered cases of milk fever (when the cow is no longer able to drink) only the use of calcium formulations administered right into the bloodstream by a veterinarian can save the animal (consult veterinarian)

.

Parasites

Ecto-parasites are mainly ticks, fleas, and flies.
Prevention and control:

- **Regular dipping or spraying with effective acaricides and insecticides.**

Endo-parasites include roundworms, flatworms, liver flukes, etc.
Prevention and control

- **Administer anthelmintics at recommended rates every 3 months (vet advice is necessary here).**

Tick borne diseases

Cause: These are diseases transmitted by ticks. They include ECF, Heart-water, anaplasmosis and babesiosis (red water).

Prevention:

- **Regular dipping or spraying with approved and effective acaricides.**
- **Vaccinate against ECF. For treatment consult a veterinarian**

Mastitis

Mastitis is one of the most common challenges to milk production in East Africa, and is not even always recognised as a disease. In some communities symptoms of mastitis are attributed to 'bad eyes' or witch craft. Mastitis is the infection of the teat milk canal spreading into the udder, and making the milk unfit for consumption. The main causes are bacteria, but cases of fungal mastitis are also known. The entry of the bacteria into the teats can come via the milk canal from dirty hands, or through small scratches caused by rough milking, tick bites, encounters with thorns etc. It is therefore very important to always clean the teats and the hands milking them very well before milking, and if any scratches are seen to disinfect the teats immediately after milking.
Causes: Poor milking hygiene/technique (stripping); Incomplete milking; Muddy environment.

Prevention

- **Clean milking environment**
- **Use of strip cup - this will show early infections as small nodules of coagulated milk will show in positive cases**
- **Teat dipping after milking in antiseptic**
- **Milk infected quarters/cows last**
- **Proper milking - do not over pull the teats**
- **Proper drying of milking cows (dry cow therapy)**
- **Vaccinate cows right after giving birth against mastitis (much cheaper than treatment). One vaccination will protect the cow for a full lactation period against most mastitis causing bacteria, and yields will not be lost due to mastitis.**

Treatment

- **Use of recommended intramammary antibiotics**
- **If persistent consult veterinarian**

Common causes of infertility

- **Retained placenta**
- **Poor feeding (also mineral deficiency)**
- **Breeding diseases**
- **Difficult calving**

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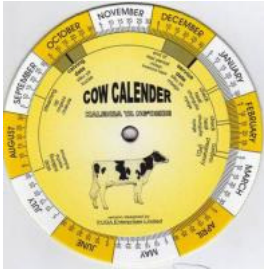
Calving and calf rearing

Calving Preparation

Dry the cow 2 months to calving. Steam it up by giving 2 to 4 kg of good concentrates per cow per day. Introduce in calf heifers to the dairy unit before calving for them to get used. Isolate cows one week before calving. Normal calving will occur 280±10 days from last service.

Cow calender



© CAIS, Kenya

A cow calendar is a very useful tool in estimating calving dates of cows. The cow calendar consist of two separate but connected discs, the lower disc displaying the days of the year and the upper disc the interval between service date, repeat heat cycles, and calving date. It also shows when a cow should be dried and steamed up (stop milking and start feeding to prepare for normal calving and highest possible milk production). Such calendars can be ordered from CAIS (Central Artificial Insemination Station) Kenya. (Contact: CAIS - Tel: 4181325/6 - Email: info@cais.co.ke)

Calving Signs

The animal will portray the following signs before calving:

- **Rigid udder**
- **Clear discharge of mucus from the enlarged vulva**
- **Loss of appetite and restlessness**
- **Relaxation of ligaments on both sides of tail**

Precautions during calving

The following precautions should be observed before calving to ensure safety of the mother and its calf:

- **Pay special attention to calving heifers as they are likely to have problems**
- **Disinfect hind quarters before calving**
- **Ensure that after the calf is born it is licked by the dam and is free of mucus at the nostrils, mouth and eyes**
- **Naval cord should be cut and tied then disinfected with iodine**
- **The newborn calf should be allowed to suckle the mother the first 24 hours to get colostrums before isolating it**
- **Placenta (afterbirth) should come out within 12 hours after calving**
- **A veterinary doctor should be called in case of a difficult calving or retained placenta**

Calf feeding

A successful livestock owner knows that it really pays to take very good care of the young stock. The bull calves can be sold for meat and the heifer calves are the future cows and production animals. Any losses means future income will be reduced.

All newly born calves should be fed colostrums within 24 hours after birth to improve their immunity. Colostrum (the first milk the dam produces after calving) is a very concentrated food and disease prevention medicine for young calves and they must have as much as possible within 24 hours of being born. Without colostrum a calf will be malnourished, grow poorly and prone to diseases throughout its life. Mostly such calves do not survive long. After the first 24 hours the stomach of the calf closes for the antibodies contained in the colostrums and only takes up the nutrients. The colostrums gradually becomes thinner and more like normal milk until after about a week it can be mixed with other milk.

- **Where buckets are used for feeding, clean them thoroughly before feeding calves to avoid infections.**
- **Milk should be fed at body temperature (37ºC) i.e. immediately after milking.**
- **At 2-3 weeks of age a calf should be fed 5 Lts of milk /day.**
- **At 4-7 weeks feed 6 Lts/day (late weaning) or 4 Lts/day plus o.25-0.75 Kg/day of early weaning pellets (early weaning)**
- **If a farmer has to feed milk replacers then it is absolutely necessary to follow manufacturers' instructions for reconstitution.**
- **Calves should be provided with good quality hay and fresh forage by the 3rd week to enable the calf to start developing its rumen. Calves should be left to graze where good pastures are available. The calves should have access to unlimited supply of water and minerals. Calves should be sheltered in a clean and dry environment**

Calf weaning

Weaning is done to enable the dam to return on heat and is recommended at between 3-4

months of age or depending on the weather conditions. Calves should be weaned when there is adequate pasture and is done by separating calves from the dams.

- **Calves are weaned at 12 weeks of age for early weaning or at 16 weeks for late weaning**
- **To wean, you provide adequate amount of solid feed e.g. concentrates, hay and green forages. To be weaned the calf should have increased its girth (LWt) by 2 ½ times the birth weight e.g. if a calf was born at 35 kg LWt. then it should be weaned at about 90kg LWt**
- **Weaning method is by reducing liquid diet gradually over a period of 10 days. Towards the end of the weaning period the calf may be given only one liquid meal per day**
- **For beef breeds calves are left with their dams as long as practically possible. This gives the highest growth rate.**

Calf Housing
Housing requirements:
The calves must be duly protected from cold, rain and too hot sun especially when very young. They must also be kept clean and free from ticks and fleas. Use gentle insecticides like pyrethrum (dudukrin) on very young calves. The tender skin can absorb the more poisonous sprays often used on mature animals.

Calf pen should be 1.5 m long by 1.2 m wide (5x4 ft). There are three common types of calf pens:

- **Permanent calf pen with slatted floor: - It should be 0.6m above the ground. Slats of 2? x 2? timber separated at 1 inch apart and connected by 3?x 2? timber.**
- **Permanent calf pens with cemented floor: these are cubicles, stone built at 1.5m L x 1.2 m W, sloped for free drainage**
- **Mobile or portable calf pens: Roofed and kept outside. Slats are not necessary for this type as it is moved in pasture from point to point every 2 days**

Calf pens should be provided with water in a bucket, feed in feed trough and salt lick. Good

hygiene must be kept by properly cleaning and disinfecting the pen before restocking. Dry straw as beddings is to be provided on cemented floor daily and ventilation and sunlight if the pens are in the house be allowed.

Other Calf Management Practices

Disbudding

Disbudding is done 2 to 3 months of age.

Use disbudding iron or caustic stick.

To disbud, we heat the iron until red hot. Clip off the hair around horn area. Place the heated iron end over the bud at intervals of 5 to 10 seconds, each time firmly but not hard pressure. We stop heating when the colour of the bottom of the bud turns deep cooper and finally apply disinfectant.

Removal of extra teats

If a heifer has more than 4 teats, remove the extra teat. This should be 2 to 3 weeks of age. We cut the extra teat carefully with a sharp pair of scissors and disinfect the scar with iodine.

Castration and calf marking

Castration is done 2 to 4 weeks of age (for dairy) and 6 to 9 months (for dual breeds). We use elastrator, a burdizzo or open method.

All calves should be marked after birth particularly when they are many. This is very necessary for identification and record keeping. Ear tagging, tatooing and branding can be used.

Castration

Castration is done to reduce inbreeding and to achieve well-distributed fat in beef animals. It is the easiest to do it during the first week by applying castration rubber bands to males not meant for breeding.

De-worming

De-worming is the use of medicine to kill worms and other internal parasites through application of the medicine through the mouth. Worms compete for food with the calf leading to retarded growth. De-worming in calves is done as soon as they start grazing and thereafter every 3 months.

Disease control

Dipping or spraying using recommended acaricides does control of ticks and external parasites. This is done to avoid transmission of diseases to the animals. Spraying and dipping should be done weekly.

Vaccination

This is application of protective medicine mainly by injection to control diseases. For calves, vaccination against Brucellosis, Anthrax and Blackquarter is essential. For Brucellosis, it is done at 3-8 months of age while Anthrax and Blackquarter is vaccinated at 6 months of age. Adult to undergo routine vaccinations as recommended against major diseases such as FMD, Brucellosis, LSD, CBPP etc.

Common calf management challenges

Calf scours

Causes: Poor nutrition and feeding e.g. dirty milk, dirty buckets, overfeeding etc.
Signs: Calf scours (whitish diarrhoea), soiled tail, loss of appetite, high temperatures and dehydration.
Control: Reduce or completely withdraw milk for two to three meals. If the above does not work withdraw milk 2-3 meals and then replace it with warm water mixed with ½ tablespoon of baking powder plus two tablespoons of common salt and 110g of glucose (mixed in 4.5 litres warm water). If disease is persistent consult veterinarian. If no veterinarian is available there may be

sulphamidine tablets available from the nearest chemist designed for scouring calves. Use only as directed.

Calf Pneumonia
Causes: The disease occurs if the calf is exposed to sudden chilly conditions (draughty quarters) or poor ventilation.
Signs: Watery discharge from nose and eyes, shallow and rapid breathing, coughing, loss of appetite and high temperatures.
Control: House all calves at least for the first 6 weeks; Avoid draughts; Treatment with suitable drugs. If disease is persistent consult veterinarian.

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Milking

Good milk handling practices

Milk is the main product from a dairy enterprise, produced basically as food for human consumption. Milk is a very good media for bacterial and other micro-organisms development. Clean milk production results in milk that:

- **Is safe for human consumption and free from disease causing micro-organisms**
- **Has a high keeping quality**
- **Has a high commercial value**
- **Can be transported over long distances**
- **Is a high quality base for processing, resulting in high quality products**

Pre-milking

Restrain the cow. Wash udder, teats and flank of the animal with clean water preferably add a

disinfectant. Wipe with a clean cloth (A piece per cow). Apply suitable milking salve on each teat. Check for mastitis with a strip cup or any other method. Dispose fore-milk. Isolate sick animals and milk them last (Their milk should not be mixed with good milk).

Milking

- **Do not excite the animals**
- **Regularize milking intervals**
- **Squeeze the teat and do not pull.**
- **Avoid incomplete milking**
- **Milking should be complete within 8-10 minutes**
- **Use a teat dip after milking**

Milk Handling

- **Use a clean white muslin cloth for filtering immediately after milking**
- **Disinfect, wash and dry the filter cloth after use**
- **Weigh and record milk per cow**
- **Store in cool and clean place**
- **Room used to store milk be without other materials such as chemicals**
- **Deliver milk to the market as soon as possible**

Utensils

Use seamless containers preferably aluminium or stainless steel

- **Rinse excess milk with cold and clean water**
- **Scrub with a brush using hot water mixed with a soap or detergent**
- **Rinse with cold water and place the utensils to dry on a rack**
- **Store utensils in a safe, clean, well ventilated place**

Milker's Hygiene

- **Be healthy and clean**
- **Maintain short finger nails and hair cut (ladies can cover their heads when milking as guard to falling hair)**
- **Avoid smoking during milking time**
- **Wear clean white overall and gumboots**

Milking Environment

- **Locate shed away from odours**
- **The shed can be permanent or movable**
- **Where possible provide a cement floor for ease of cleaning**
- **Clean shed after every milking**
- **Water should drain easily and away from the shed**
- **Provide a clean feed trough, water trough and protected store**
- **Provide clean water**

Housing

- **Construct units according to approved plans obtained from livestock extension office**
- **Such plans gives dimensional specifications and materials, for cubicles, feed troughs, water troughs,**
  calf pens, milking parlor, feed store, floor slope, etc.
- **Use of durable cheaply available materials is recommended**
- **A cemented floor is preferred because of the constant washing required**

House hygiene

- **Remove dung daily**
- **Clean floor daily**

- **Provide clean water**
- **Ensure cubicles and calf pens are dry**

Semi zero grazing

- **Animals are grazed in the morning and stall fed in the evenings**
- **Commonly practiced in medium size farms**

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Products

General information

Dairy farming is a business. Production targets a specific market. Seek market information. Value addition increases product market value. Marketing is best undertaken through groups. Diversification of products widens the market scope. Animals are registered and recorded at the Kenya Stud Book and Dairy Recording Services of Kenya (Nakuru) and evaluated at Livestock Recording Center (Naivasha).

Live animals

- **Animals registered with Kenya Stud book fetch premium prices**
- **Animals of known genetic potential (breeding values) would fetch better prices**
- **Breeder organizations can assist in sourcing and marketing of animals**
- **Heifers and bulls of superior parents would produce more and are bound to fetch more**

For more information, contact Extension agents, KARI, LRC Naivasha and breed societies.

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Beef Management Systems

Nomadic Pastoralism

Nomadic pastoralism involves a seasonal pattern of movement around a more or less regular pattern. This is the most environmentally sustainable livelihood in the arid and semi arid areas. It is practiced predominantly in Kenya Northern and southern rangelands.

Ranching

A system practiced within a defined unit of land. In a ranch it is possible to maintain optimal stocking rates conserve, and preserve pasture and develop livestock support facilities such as dips and water points. This system is practiced in both arid and semi arid areas.

Agro-Pastoralism

A system practiced in semi- arid parts of the country where beef farming is practiced alongside crop farming. Beef farming and crop farming complement each other through livestock feeding on crop residues and crop farming benefiting from manure and animal draught power.

Feedlot system

These are units where immature cattle are intensively put on a feeding regime purposely for fattening to attain a specific market weight prior to selling. The animals are confined like in the zero grazing units in dairy production and are fed on high-energy concentrates. This system is not in use in the arid lands of Kenya.

Beef Calf Management

Good calf management practices ensure fast growth rate, reduced disease incidences and reduced death rates in calves. This ensures reduced cost of production and optimum profitability in beef production. After calving, ensure the dam is cleaning the calf properly and that the calf can stand on its own. Where necessary, the calf should be assisted to suckle The calf should be checked for abnormalities and corrective measures taken.

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Goats

status: under construction

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Introduction

'Goat' is the common name for any of eight species of cloven hoofed, horned mammals, closely related to the sheep. The two differ in that the goat's tail is shorter and the hollow horns are long and directed upwards, backward and outward, while those of the sheep are spirally twisted. The male goats ('bucks') have beards, unlike sheep. Male goats also have a characteristic strong odour that is produced, particularly during the rutting season. The female goat ('doe'), which has smaller horns than the male, is often called a 'nanny' goat. The young are called 'kids'. The male goat is called colloquially, 'billy' goat. The goat's tail is short, bare underneath and usually carried upright. Major scent glands are located around the horn base. They function in stimulating oestrus in male and femal goats improving conception. The goat odour is, however, a detriment to goat keep and meat and milk consumption if not properly controlled. This is achieved by good hygiene practises and correct housing.

The goat, along with sheep, were among the earliest domesticated animals. Goat remains have been found at early archeological sites in Western Asia which suggests that the domestication of goats was originally between 6000 and 7000 BC.
The major contributor of modern goats is the Bezoar goat which is distributed from the mountains of Asia Minor across the Middle East to Sind. Also, unlike sheep, goats easily revert to feral or wild conditions given a chance and populations of feral goats occur in many parts of the world.

The goat is used for meat and milk production. Many parts of the animal are economically valuable for a variety of purposes such as the skins for leather and the pelts for rugs and

robes. All does that have produced kids should give milk but some breeds give more than others and selection processes have resulted in a number of breeds that are kept largely for milk production. Swiss goat breeds are the worlds leaders in milk production.

Goat milk compares favourably in nutritive value with cow's milk. It contains smaller fat globules and as a consequence is easierto digest and does not require homogenisation. It is used extensively in making cheeses. Goat milk casein and goat milk fat are more easily digested than that from cow milk. Goat milk is valued for the elderly, sick, babies, children with allergies, patients with ulcers and even preferred for raising orphan foals and puppies. Because the fat globules in goat milk are small than in cow milk and remain dispersed for longer. Goat milk is higher in Vit A, Niacin, Choline and inositol than cow milk but is lower in Vit B6, B12, C and carotenoids.

Goats which produce fibre e.g., Angora, are generally not as suitable for meat production. This is because they are small framed and produce smaller litters than other goats.
Traditionally, goats and sheep have played a major role in Kenya/East Africa through the ages. These animals have been the main source of meat and skins, contributing much to the social and economic life of people. Some communities kept milking goats, but these have mostly gone out of production, especially with the arrival of the dairy cow in the 20th century. In ASAL areas milk from goats and sheep still play a major role especially in child nutrition.

Milk goats are definitely the way forward for the small farmer. They not only take up less space in respect of both housing and grazing, especially if they are to be kept on nil grazing, but they eat less than a cow and will produce as much if not more milk than the average rural cow.

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Breeds and Crosses

A breed of animal is a group of animals of the same species having similar appearance and qualities and is usually developed by selection.

A cross bred animal results from the mating of two pure breeds of the same species. Very often this cross has qualities which are better than either of the parents. This phenomenon is called heterosis or hybrid vigour and is widely used in livestock improvement.

Cross bred: Pedigree registered Toggenburg buck to a pedigree Boa doe

Goats fall into four categories: meat, wool, dairy and multi purpose. Some goat breeds are dual purpose (e.g. meat and wool, or meat and milk). However, a majority of the current commercial breeds have been developed with one primary product in mind e.g., dairy.

The meat breeds are produced from many goat breeds including milk goats. Some breeds have been selected specifically for meat producton, such as the South African Boer and Gala goats.

When selecting animals, it is important to think about the environment that they are to live in.

Many pure bred animals come from Europe, where the climate is cool and good quality fodder plenty. These goats are not usually suited for hot dry areas with little available fodder.

***Note*: If you are buying milk goats, check the udders to ensure that there is good udder surface and that there are two good teats, and that the teats themselves are not too small. If the udder has small teats, they are very difficult to milk. On a good quality dairy goat the teats should be facing slightly forward for ease of milking.**

Breeds such as the East African or the Galla goat have survived for centuries in East Africa with few problems and have good disease resistance. Farmers who want to improve their indigenous breeds by crossing their goats with exotic milk breeds must make sure they have enough good quality fodder and plenty of water available for drinking. Also improved housing for protection from predators and theft at night will help make the enterprise successful.

Common breeds suitable for different regions in Kenya:

Region	Goat
High altitude	Saanen, Toggenburg, East African goats
Medium altitude	German Alpine, East African goats Gala, Boer, Toggenburg, Angora, E.A goats, Gala Boer
Low altitude	East African goats, Gala, Boer

East African Goat

This is one of the most successful domestic goat breeds suitable for the semi arid lands. They are found all over East Africa from the desert to urban areas. Their colour ranges from pure white to black over a variety of spotted and reddish brown colours. The

9th month well grown East African doe

© Val Corr, Naivasha, Kenya

males often have a pronounced mane running the full length of the back. Horns vary from 2.5 cm to 20 cm long. Tassels (sometimes referred to as "toggles", which are situated at the top of the neck, behind the jaw) are found in 30% of the breed.

Body weight: Males up to 35 kg, females 25-30 kg
Sexual maturity is usually reached in 5-6 months, but growth rate is slow. Yearlings seldom weigh more than 20 kg. They are kept mainly for their meat, as milk production usually is only enough for one single kid. They do have a potential for selection and are useful breeding stock for upgrading breeding. In their present unimproved form their greatest advantage is the ability to survive in almost any environment.

1 year old East African buck crossed with a German alpine

© Val Corr, Naivasha, Kenya

Galla Goat

Galla are indigenous to the Northern areas of Kenya. It is also known as the Boran or the Somali goat. They have further been


Galla buck

© Val Corr, Naivasha, Kenya

classified into 2 sub types, a short eared medium sized goat called "Degyir" and a larger pure white type called "Degeun". Adult bucks of the Degeun type can weigh up to 70 kg, while a female will reach a kidded weight of 45-55 kg.

In order for the Galla goat to comply with the Kenya Stud book, all Gallas must be white haired with black skin, nose, feet and under tail.

A third sub type of Galla is kept by the Boran, which has colour around the head and lower legs with a black stripe down the spine. These are reputed to be the best milk yielders of all the Galla type goats. Galla females are long lived and will continue to breed and rear healthy kids up to 10 years of age.

Galla do not like cold wet climates and thrive best in low altitude, preferably in acacia bush country. They have a wonderful high growth rate after prolonged droughts and their larger size enables them to reach browse that the smaller East African goats cannot reach.

Galla doe

© Val Corr, Naivasha, Kenya

Boer

Originated in South Africa. White with red/brown head and neck. Prominent horns and broad drooping ears. Well muscled and strong boned. High fertility with 50% twins and 7% triplets. They respond well to concentrate feeds. The breed is valued for its meat and milk. Milk yield, however, is relatively low, ca. 0.7 - 1 lit/day. Butter fat 6%.

Mature in kid pure bred boer female

© Val Corr, Naivasha, Kenya

Black head boer ram

Alpine

Originated from French/Swiss and Rock Alpine breeds. Ears are pricked and the hair is long. The goat is medium size. Colour black and brown but considerable variations occur. May be horned or polled. Horns are scimitar shaped. The adult male weighs 65 kg, female 60 kg. The breed is valued for its milk and meat. Milk yield 0.9 - 1.3 lit/ day. Butterfat 3.6%.

Alpine doe

© Val Corr, Naivasha, Kenya

Toggenburg

Originated from Toggenburg in Switzerland. Colour: brown, chocolate, fawn with white line each side of the face from above the eyes to muzzle, edges of ears, on rump and tail. Legs white from knees down. Males tend to have longer hair than the female. Adaptable to variety of climates. There are two sub-types of Toggenburg:
The British Toggenburg males weigh up to 100 kg and females about 70 kg.
The Swiss Toggenburg males weigh about 70 kg and the females about 50 kg.

Pedigree in kid maiden Toggenburg

© Val Corr, Naivasha, Kenya

Suffer from heat stress in hot climates. Do not thrive if badly housed, kept on poor pasture or put away when they are wet. These are 'high quality animals and should only be kept if conditions are right. For smaller farmers and, particularly, nil grazing situations, cross bred Toggenburgs would be a better option.
Purpose: milk production and cross breeding (improving local breeds). Milk production potential: 5 litres/ day under good management . Butter fat 3.8%. Average litter size: 1.8

Mature pedigree Toggenburg buck
© Val Corr, Naivasha, Kenya

Saanen

Saanen goat
© Wikipedia

Originated in West Switzerland. The breed is large and white/ biscuit in colour with black spots on nose, ears and udder and with pink skin pigmentation. Ears point forwards and upwards. The conformation is good and udders tend to be very well developed. Short coat. Mostly polled. Hermaphrodism is common. This is associated with the gene for polledness and it is adviseable to only keep horned bucks for breeding. The face is straight and slightly dished. Does not respond well to strong sunlight and in very hot areas performs best under shade. Mature male weighs 80-100 kg while mature female weighs 60-70 kg and the breed has a high twining rate. Saanen have have outward curving horns.
Purpose: milk production, up to 7 litres of milk per day under good management. Butter fat 3.5%.

The Dual Purpose Goat of Katumani

Katumani Research Station is offering dual purpose goats for cross breeding with the local East African breed. The dual purpose goat is reportedly a 4-way cross from Galla, Nubian, Toggenburg and East African. The cross breeds have high twinning rates and faster growth as well as larger body size than the local breeds.

The cross breeds fetch double the price compared to the local goats, due to larger body size and more kids due to high twinning rates. This introduction has led to much higher profits from goat rearing among the farmers undertaking this practice. (Personal communication from R. Muthama, Katumani farmer and Dr. Kariuki, Director, Katumani Research Station, Kenya).

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Breeding and herd management

Inspection and evaluation of a goat
After determining the breed and sex of the goat the next useful step is to examine the teeth. Breakdown of the teeth is a very common reason for culling small stock under range management, as poor quality teeth will affect the ability to browse and feed well.
The Galla goats have very strong teeth well able to keep them healthy during a long life. Worn teeth indicate old age. Goats which do not have healthy teeth cannot feed properly, and will not gain weight at the expected rates. Neither will they be good breeding stock. Make sure the lower teeth meet evenly with the upper teeth.

Ageing goats by their teeth:

Age	Teeth
Under 1 year old	milk teeth
1 - 1 1/2 years old	2 teeth
2 years old	4 teeth
2 ½ years old	6 teeth

1 1/2 - 3years old	Full mouth
Over 3 years old	Worn teeth
Aged	Gumming

The buck:
Do not use bucks with one or no testicles for breeding. Also those with swollen testicles should be refrained from breeding. A breeding buck should have 2-8 hard teeth. Breeding bucks should have superior qualities, such as body size, muscle conformation (the more muscle the more meat and the more profit). Breeding bucks should have strong masculine necks and heads. A noisy buck is said to be a useful buck.

The doe:
The udder should be soft to the touch with two functional teats. Any hardness is a sign the doe has had previous problems most likely with mastitis. A doe with a damaged udder may not be able to produce enough milk to feed her young ones. Look for good strong legs. Weak or bent hind legs will make the goat unable to feed on good browse. Blind females will not be able to find good food in a range style management.

Body condition:
Good breeding goats should not be thin and nor should they be allowed to carry too much fat. Thin goats will not come into heat, if mated they will either abort or reabsorb the foetus into the body at an early stage. Those who manage to give birth may not be able to feed and rear a kid satisfactorily. The dairy goat is naturally more lean than a meat goat.

Milk goat in good condition

Culling:

At the start of each breeding season or in the case of ASAL areas, at the end of each rainy season when a drought is expected, a good goat manager inspects his/her flock and determines which ones are to be culled (butchered, sold for meat or fattening by other farmers/pastoralists with more grazing available). Unproductive and unwanted goats are eliminated from the flock in order to improve the level of productivity. This enables the breeder to maintain the flock at a high level of productivity.

Starting with the poorest animals, the following are traits that should be avoided in a prosperous breeding herd:

- **females with poor udders**
- **females who have been barren for 2 or more breeding cycles**
- **females with a history of aborting**
- **skinny females**
- **animals with poor teeth (dry season browsing need good teeth)**
- **bucks with faulty testicles**
- **bucks with physical deformities**
- **shy and timid bucks (seen to be poor breeders)**


Milch goat in poor condition
© Val Corr, Naivasha, Kenya

Improving the herd

Generally there is little or no mating management by farmers of their flocks. Mating management is a very valuable tool to improve the flock. Good quality bucks of known breed with highly productive dams and grand dams have the ability to improve its offspring both in terms of size, bodyweight, and milk production. The Galla goats particularly have good genetic potential for breed improvement, and where the climate allows cross breeds could be considered. Males not to be used for breeding can be either castrated or fitted with an 'apron' during the mating season.

Factors affecting fertility

- **Genetic Factors. The genotype of individual breeds is an important determinant of fertility. In addition conception, twinning and kidding intervals have an effect. Fertility and productivity increase with age.**
- **Environmental factors. As well as ambient temperatures and seasonal changes, management factors including handling of bucks and does at mating, detection of heat, time of service, nutrition, disease and parasites are important factors. Good nutritional management is important and insufficient dietary energy and protein levels are often limited factors. It is essential that rations provide an adequate supply of both energy and protein.**

Breeding Programmes

Planned breeding programmes yield the best results when the breeder considers the individual production characteristics in goats and how they can be passed on to offspring. The breeder must also be able to match these characteristics to consumer requirements.

Objectives for Breeding Plans

Distinct objectives are essential to a breeding plan. The breeder must aim to improve productivity of meat, milk, fibre or skins or some combination of these. The definition of objectives concerning productivity from goats is related to the characteristics of the product and the characteristics of the goat. The latter include the following:

1. Reproduction rate - litter size per birth or per year

2. Efficiency of feed conversion to animal production - rapid growth rate for kids.

Both characteristics are assessed simultaneously as the weight of kid weaned per unit of feed consumed by does.

Both quantity and quality must go together for efficient production. High growth rate and production of the maximum number of goats for slaughter should be associated with an acceptable distribution of fat i.e., sufficient to improve the quality of the meat but not so much as to have a low consumer preference.

Inheritance of Characteristics

Respectability and heritability. The phenotypic expression of characteristics is the observable trait. Thus the length of ear in a goat is the phonotypic expression of the genes that regulate ear length. The breeder can only plan according to the trait observed. Repeatability and

heritability are two kinds of observation that the breeder can use.

Repeatability. This refers to the permanence of a phenotype from one observation to the next. It is a measure of the extent to which superiority in any one character is maintained throughout the lifetime. Should goats in a flock tend to rank in approximately the same order with regard to a certain character, year after year, in spite of environmental changes, the particular character is said to have high repeatability.

Heritability. This is concerned with the constancy with which the phenotype is passed from parent to offspring. It expresses the proportion of total variance which can be attributed to average effects of the genes. Alternatively, heritability is the degree of inheritance of the trait.

Selection. Individuals selected must possess desireable characteristics which have good repeatability and heritability and will, therefore, be passed on to offspring. Selection aims to change the gene frequencies in order to improve the phenotypes in subsequent generations. Selection may be direct or indirect. The direct method selects goats having the best expression of the trait to be improved. Indirect selection improves a trait by selecting goats with a related trait. The effectiveness of indirect selection depends upon the correlation between two traits. This is of great importance since animal breeding usually involves more than one trait. An example of indirect selection is given by high growth rate, where selection for this trait is likely to improve early maturity and slaughter weight and also the efficiency of feed conversion.

Sex Ratio. The sex ratio gives an indication of the proportion of males to females born for individual breeds of goats. The ratio is weighted more in favour of males than females for horned goats. The reverse is the case for polled breeds (such as Saanen). In t he case of Saanen however, abnormal ratios occur with the production of intersexes or hermaphrodites. This is due to the presence of a dominant gene which prevents horn growth and is closely associated with abnormal development polled does. Genetic males, whether polled or horned, are normal.

In view of this it is important to mate only polled females to horned males or polled males to horned females to reduce the production of polled females.

Desireable Characteristics in the Buck

- **He should be the heaviest goat in the flock with a wide chest and well developed barrel. A straight body in excellent condition and strong legs, both fore and hind, are necessary.**
- **There should be a complete absence of ay physical defects e., twisted legs, overshot or undershot jaws.**
- **He should be a twin (in order to pass on the twin trait)**
- **He should be aggressive**
- **He should possess a rugged mane on the neck and shoulders as this reflects breeding ability**

Breeding dairy buck in good condition

© Val Corr, Naivasha, Kenya

Desireable Characteristics in the Doe

- **She should be a large animal, excellent on conformation with a well developed body which displays the particular breed characteristics**
- **For meat goats the rectangular conformation of the 'blocky' meat animal should be apparent. The dairy animal should display the wedge shaped conformation typical of a good dairy animal.**

- **She should be a twin (in order to pass on the twin trait)**
- **She should be of a good temperament, particularly for dairy goats. Docility and good mothering ability are good features.**
- **She should be a good milker; for dairy goats records of performance of the dam can give information about milking ability**

Dairy doe in good condition
© Val Corr, Naivasha, Kenya

Mating Systems
The genetic quality of goats in East Africa (EA) is often low and thus productivity is low. This is due to the inadequate identification of productive characteristics in individual breeds that could be exploited and selected for in order to increase productivity. Planned breeding is the exception rather than the norm in most of East Africa. Even where promist characteristics are identified, inadequate selection and the absence of a long term sustained effort mean that breeding practice is poor. Goat breeding in EA relies on substitution or modification or upgrading.

Substitution. Substitution refers to the replacement of existing breeds with introduced breeds. This is usually a large scale operation and very expensive. This method is advantageous under the following circumstances:
1. Where the existing population of indigenous goats is small
2. Where level of productivity of indigenous goats is low
3. Where the requirement of animal protein from goats is urgent and demands accelerated development.

4. Where the ecological environment is suitable for large scale goat production.

It is rarely desireable to obliterate the existing population of indigenous goats. Native breeds are likely to be well adapted to their environment, have good disease resistance and high fertility. These qualities can be exploited in breeding plans. Large scale introduction is done in order to increase numbers, and to improve the quality of the indigenous breeds. In this way crossbreeds are substituted for the native breeds.

Upgrading
Upgrading the genetic quality of indigenous breeds is probably the most popular and widely used breeding method in EA. This involves the importation of an improved breed. This breed is then used to produce increasing proportions of its characteristics in successive generations. It should be noted that there is a number of generations between the first cross and the grade does. The variation in the genotypes produced is quite considerable and necessitates culling to maintain uniformity of the herd.

Upgrading indigenous goats with one or more temperate breeds is common in EA. Likewise one or more dairy breeds have been used to upgrade indigenous goats for milk production. Probably the best example of upgradaed goats are the indigenous goats of EA with imported Swiss and German dairy goats.

It is pointless keeping a buck unless he is going to improve your herd. It takes up the same amount of space and eats the same amount of food as a quality goat. Alternatively, use a 'rotation buck' or take your does to a quality buck on another farm.

Crossbreeding
Crossbreeding refers to the crossing or mating of two pure breeds, but the term is frequently extended to include the progeny of purebred sires and crossbred females. When two purebreds

are used, characteristics of the first cross animal should show:
1. Outstanding individual merit
2. Intermediate expressions between the parent types and
3. Resemblance to one or other of the parent types.

Crossbreeding of goats is widely practised throughout EA, especially between indigenous goats and Toggenburg and French/German Alpine breeds as well as meat goats/dairy goats.

It should be the objective of the breeder to produce offspring superior to both parents. This is achieved when the progeny resulting from crosses demonstrate extra or improved performance abe the average of the parents (heterosis or hybrid vigor).
There is no doubt that crossbreeding is an important method of commercial goat production. The vigour, thrift and general excellence of the first cross goat are features that are especially apparent and which can be measured accurately in terms of increased returns. As goat production becomes more intensive for both meat and milk production, it is likely that cross breeding and exploitation of hybrid vigour will become more popular.

Age at first mating: Females should have at least two hard teeth (18 months of age) before being mated. If mated younger with too low body weight, this may result in aborting or inability to feed and care for the kid(s). As a result of such early mating, the female's body growth will be stunted, and the kids will grow poorly and be of little value.
Mating usually takes place during the rainy seasons, ensuring enough feed for the young ones during the next rainy season.
Gestation period: 148-160 days.
Once mating has taken place the doe should be observed for 21 days and again at 42 days to check for return of heat. After 42 days she should be considered in kid.

Management of breeding does

The management of the breeding doe is related to 3 separate physiological stages.
1. The dry period (weaning to mating) - approximately 3 months
2. The pregnancy period (mating to kidding) - approximately 5 months
3. The lactation period (kidding to weaning) - until 2 months into next pregnancy

If a doe does not dry off naturally the farmer should, at approximately 2 months into next pregnancy, strip the goat of her milk in the evening and apply 1 tube to each teat of 'Dry Cow'. The goat should not be milked again, even if the udder appears to fill. She will now be 'dried off' in preparation for her next delivery.

The Dry Period
A dairy goat's milk production will drop at approximately 8 weeks after conception and, by approximately 14 weeks, she may dry herself off. If not, it is suggested that she should be 'stripped' after evening milking and a syringe of 'dry cow' should be infused into each teat and she should not be milked again, even if she appears to have a full udder. This will slowly disappear.
The doe is least productive during the dry period. At this time the doe recovers from the stresses of the previous pregnancy and lactation. The endocrine system is readjusting to the next service period and pregnancy.

The Pregnancy Period
The development of the foetus for the first 3 months of pregnancy is a slow process and no appreciable increase in the food requirement is needed. During the last 4 - 6 weeks before kidding however, the growth of the foetus is sufficiently rapid to deplete the food reserves o the doe. Thus the quantity and quality of the feed given over this period should be sufficient to meet the requirements of the foetus as well as those of the dam in preparation for parturition. She will need more food to keep herself and the unborn kid growing. By the time she is due to kid she should be receiving as much as you would expect her to need as a milker. The last week prior to kidding, add more bran to her mixture.

At 6 weeks before kidding (16 weeks gestation) there will be a softening around the tail. This is because the pelvic bones are softening in preparation for the birth. The udder will start to expand. At the time of kidding the udder will fill rapidly and harden. If the bag becomes too full, and hard, milk must be taken off or she may develop mastitis and the kid may not be able to suckle.

Good feeding during pregnancy produces greater development of udder tissue and ensures a high milk i potential. A higher level of food offered for the last 2 months of pregnancy has the following advantages:
1. Low doe and kid mortality
2. The kids are given a weight advantage at birth
3. Milk flow in the doe is increased causing a greater live weight gain in the kid and thus a heavier live weight of adult stock.
It is emphasised that during this period there should be no drastic changes of feed. Any change must be done gradually in order to allow adaptation. Water and mineral licks should be provided at all times.

During this period pregnant does are housed in large pens. Towards the end of pregnancy, individual does can be confined to pens where the kids are born. Where the floor is made of timber or concrete it is advantageous to use hay to make the doe more comfortable.
It is high recommended that goats are kept off the ground on slatted floors and not on a concrete floor as they do not drain properly, are uncomfortable and cold (see housing). After weaning, the does can be divided into two or three groups, and fed according to their condition. With small numbers, the animals can be hand fed individually. All does should, however, be exposed to a rising plane of nutrition, a process referred to as flushing in preparation for pregnancy. Flushing stimulates the number of ova shed, thus increasing the potential for more eggs to be fertisised and resulting in higher kidding percentages.

Kidding

1. The first sign of kidding is uneasiness, including restlessness, sittng down and getting up and smelling the ground. When this happens, kidding can be expected to occur within 1 - 2 hours.
2. Appearance of the water bag
3. Onset of contraction
4. Appearance of part of the kid

The appearance and method of presentation of the kid determines whether the doe needs any help. Abnormal presentation includes the following:
1. One leg held back
2. Two legs held back
3. Kid upside down
4. back to front presentation

Whilst birth is a natural process it should be observed carefully since many births are multiple. Note: After delivery watch for the afterbirth. This should be removed and buried or burnt. It is adviseable NOT to let the doe eat it.
A doe in distress must be given time to help herself before she is assited. It is important to ensure that all ALL kids are removed from the womb of the doe.

There are 3 basic rules in successful kidding management:
1. Hygiene. Kidding area must be clean. Make sure the female is in a clean dry place when she gives birth.
2. Shade. The kidding should take place under a shelter or shade. A new born kid has a small body size and is born wet. In a cold environment the evaporation of the birth fluids from the skin can drop the body temperature of the kid very quickly, and unless the mother or handler can dry the kid quickly, it will die with cold. In wet cold conditions a kid can die in 10 minutes. In arid and semi-arid areas on the other hand the temperatures in direct sunlight can easily be

above 40°C and kill the kid by too much heat. Therefore a clean shady place should be provided for the kidding female.
3. Water. At the time of kidding a female will loose a lot of body liquids very quickly. She will also start producing milk and it is essential that kidding females have enough clean drinking water available to restore the liquid balance in the body.

Assessment of weight and body condition
In the absence of a weighing scale the weight of a goat can be measured by measuring the chest circumference (girth) right behind the front legs.

Heart girth in cm and the corresponding estimated weight in kilos is given below:

Heart girth (cm)	Weight (kg)
63	20
65	22.5
68	25
70	27.5
72	30
76	35
80	40
84	45
88	50
91	55
95	60

98	65
101	70

The Lactation Period
When the kids are born they have to be managed so that the doe produces milk both for the needs of the kids and for domestic or commercial purposes (see feeding kids).

Pregnant Dry Does
Pregnant dry does should be fed so as to rebuild any lost body reserves, provide for the developing foetus and to build some reserve fat before kidding. Free access to good pasture and roughage plus concentrates at 0.2-0.7 kg per, depending on condition of doe. Yearling does should be fed enough for maintence and growth but not enough to fatten them i.e., 0.2 - 0.7 kg per day should be sufficient to obtain the desired growth rate. Browse, good pasture and high quality hay and a place to exercise are desireable.

Breeding Bucks
A breeding buck needs good quality hay and pasture as well as 0.45 - 0.9 kg concentrate (depending on size of buck) to keep him healthy. Feeding should be enough to keep its weight steady but not too fat. A fat buck will not be active. Give more feed two months before the buck goes to serve the does. This will improve the bucks sperm and make it more active. When a buck is being used a lot to serve does, it should be separate from other goats for about 2-3 hrs per day to allow time to eat as well as serve the does. Lots of fresh and clean water needed all the time must be able to lick the mineral at any time.

Ratio of Bucks to Does
It is important to use an optimum ratio of bucks to does in order to achieve good reproductive efficiency. A suitable ratio for EA is 1 buck to 40 does. Under more controlled and intensive conditions, hand serving can increase the number of does. Care should be taken that a buck is

not allowed to cover his own prodgeny as this can lead to a weakened herd and, in some cases, birth deformities.

Reproductive Behaviour
Planned breeding requires an understanding of the characteristics in goats that are transmitted from generation to generation. It is many concerned with the genetics of entire goat populations. One objective of animal breeding is to increase the frequencies of desireable genes so as to achieve the ideal genotype which will give the characteristics required in the population.

In practice, however, breeding for the ideal type is not easily realised. There is tremendous genetic variability inherent in individual breeds of goats. Most of the characteristics that are important to the animal are influenced by other factors as well as by the genes and are, therefore, highly susceptible to environmental factors over which the breeder has no control.

Live weight at a given age, or milk yield per lactation are two characters of economic significance that can be manipulated by use of the quantitative data. Qualitative traits such as presence or absence of horns are also of some importance in animal breeding. In the Saaned breed of goats for example, the gene for polledness is associated with hermaphroditism and polled goats should be avoided in breeding programmes. Horn bucks are generally used.

Sex Cells and Chromosome Number
Reproduction in goats as in other animals, is brought about by the fusion of two cells, one from the male and one from the female. These cells are derived from the parental gonads and, therefore, retain the characters of the parents; the chromosomes in the sex cells are constant and characteristic of the species. The chromosome number is 60 for goats and 54 for sheep. The chromosomes, found within the nuclei, include the genes which control the characteristics of the individual.

Puberty

Puberty in goats as in other farm livestock is the period when the animal becomes sexually mature. It preceeds adulthood, and is reached at an age which varies considerably from breed to breed and also among individuals within a breed. In goats, sexual maturity is reached quite early, but mating should be delayed to ensure that the dam is able to accommodate the foetus without having to compete with available nutrients for her own growth.

In S. Africa, it has been demonstrated that puberty in male Boer goats was reached at 157.5 days old (22.5 weeks) and counts of morphologically normal sperms rose from 36.5% to 89.8% in the 8th week.

Breeding Periodicity

Natural breeding cannot be accomplished until goats mate and reproduce. Bucks and does, therefore, must be brought together when they are considered to be sufficiently mature. Mating is also conditioned by various environmental factors, including nutritional state, ambient temperature and the use of artificial insemination (AI) (not readily available in EA). In bucks, libido or sexual excitement is exceptionall high, while does are more passive.

Reproduction in Bucks

Sexual activity in bucks commences with the formation of spermatozoa and the fluids which together comprise semen. The sperms are stored in the epididymis where they can remain fertile for up to 40 days and retain their motility up to about 60 days. Beyond this time they disintegrate and are absorbed.

Note: DO NOT 'play' with young bucks. If you do, they may well become a nuisance when they are mature. A mature adult can weigh up to 80 kgs, may have large horns and could be a liability if he grows up thinking humans are 'play things'.

Reproduction in Does

Excitement in does occurs periodically and is under endocrinal control. At periods of excitement the doe is said to be in heat or oestrus. Oestrus is brought about by ovarian activity under

control of the anterior pituitary gland. In the tropics (i.e., EA) oestrus activity is greater than in temperate climates, indicating the effect of high temperature on the endocrine system.
Indigenous goats tend to have continuous oestrus cycles, whilst exotic breeds tend not to have entirely continuous cycles.
The average length of oestrus cycle is 18 to 21 days but it can vary from 18 to 24 days. The presence of the mal can trigger oestrus.

Oestrus in does is characterised by the following symptoms:
1. Continuous bleading
2. Wagging of the tail rhythmically from side to side
3. Redness and swelling of the vulva
4. Mucus discharge from the vulva
5. Mounting of other goats, and allowing mounting by others
6. A lack of interest in feeding
7. A drop in milk production in some lactating does.
Ovulation occurs 12 to 36 hours after the start of oestrus and mating should be arranged accordingly. There appears to be no obvious rhythm in sexual activity during pregnancy and the interval between heats during gestation cannot be predicted.

Fertility
Normal fertility is defined as the regular production of viable offspring. Goats are considered to be fertile if they produce normal spermatozoa or ova capable of fertilisation. Prolificacy on the other hand refers to capacity of goats to produce many progeny. Fertility and prolificacy are used simultaneously to describe the reproductive capacity of individual breeds.

Fertility in goats is most commonly expressed as:
1. Services per conception
2. Litter size
3. Kidding rate or percentage

4. Kidding interval
5. Service period
6. Non return rate

Other methods include:
1. Age at puberty
2. Age at first kidding
3. Regularity of oestrus cycles
4. Interval between first servie and conception
5. Interval between kidding and first oestrus (post partum oestrus)
6. Percentage of does pregnant at first service
7. Average number of kids born per lifetime
8. Magnitude of reproductive problems in the flock

Services Per Conception
This refers to the average number of services required per conception or per birth carried full term in the flock. This assumes that does will be mated under controlled conditions which allo recording of the bucks used and services performed. Records should always be kept.

Kidding Rate or Percentage
This relates to the number of breeding does mated and is usually calculated in goats in one of the following ways:
1. The number of kids born in comparison to the number of does exposed to the buck
2. The number of kids weaned in relation to the number of does mated.

The first method is by far the more common since it is an obvious measure of flock fertility. The second method is influenced much more by management than the first and may not be as accurate. However, the number of kids weaned on a flock basis is a very good index of the level of management in the herd and can be expressed as kid rearing percentage (the number of kids

reared per 100 breeding does. If 100 breeding does were exposed to bucks, and 140 kids were born alive, then the kidding percentage would be calculated as: 140 over 100 multiplied by 100 = 140%.

Kidding Interval
The average kidding interval is the number of days between to successive kiddings. This is a useful comparison of fertility and productivity between breeds. The interval comprises the service period (the period between kidding and conception) and the gestation period. Thus, only those does that kid regularly and ar persistent milkers are accounted for.
Gestation periods vary from 144 to 160 days (usually 150 days). This variation relates to environmental factors including ambient temperature, time of the year, breed, size and age of goats and food availability.
It is a common practise in EA to return the doe to the buck as soon as possible after kidding. This should not be recommended (especially in dairy herds) if a good quality herd is to be maintained. If the doe is not allowed sufficient time to recover from the kidding, her kids may be stunted as a result and her milk production could be seriously compromised.

It is inadviseable to mate a doe too young or, alternatively, before the farmer considers she is fully developed (some individuals may take longer than others) because of the competition for nutrients between the mother and the foetus for growth. The use of bucks and does at the right age and weight means efficient husbandry management. Age, therefore, is not a good criteria for the first service. Weight is a better indication of readiness.
The age at first kidding should be between 15 and 24 months, which when allowance is made for gestation, means that the doe should be between 10 - 20 months old at first service. 18 months is considered an optimum age.

Feeding the newborn up to 3 months
Newborn kids should be fed on colostrum within 24 hours and should be with the doe and allowed to suckle as much as they need. After one week: - kids should be provided with small

quantities of good clean feed e.g. sweet potato vines, tree legume leaves or natural tree leaves. Kids should continue with milk for the first three weeks and thereafter be allowed to feed on milk combined with fresh fodder up to 3-4 month. Provide fodder and water to kids all the time to enable them learn to eat gradually. A poor start will affect the future productivity of that kid when it grows up to adult.

- **0-4 weeks free suckling**
- **4-8 weeks suckling day time**
- **8-12 weeks suckling twice a day**
- **12-13 weeks suckling evening only for 1 week**
- **13-14 weeks suckling in the evening, every other day then weaned**

Management of Kids

The management of the new born kid entails the following practices:
1. Tickle the tongue of the kid, this causes coughing by a reflex action which stimulates the respiratory system and clears the airways.
2. Place the kid near the mother who will begin to lick the young. Hold the kid if need be until this is done. If the kid appears to be cold you may have to assist by rubbing with a dry towel.
3. Check the teats of the dam to see that there is sufficient milk. Some does do not produce sufficient milk for some hours. It is essential that the kid sucks colostrums as soon as possible as this stimulates the gastrointestinal reflexes, and helps pass the muconium. If the kid has to be fed from a bottle ensure that the bottles and teats are properly sterilised before every feed.
Note: DO NOT be tempted to subsidise with cows milk if this can be avoided.

Mortality is highest during the first week of life. Among single births losses tend to be highest among the heavier kids. In twins and multiple births the lighter kid is most susceptible. Weak kids are usually the result of difficult kidding or being allowed to catch cold after birth. Kid

mortality can also be caused by milk fever, malpresentation, unsound udders, death of the doe or accidents.
Colostrum is thick, yellow and custardy in appearance. It is vitally important as it supplies essential minerals, vitamins and antibodies to the newborn kid and acts as a laxative which clears the digestive system of meconium. The first excretia of kids is black (meconium) but changes once milk is digested, and turns yellow.

At birth, colostrums is the first food of the kids and should be given for 3 days. Colostrum stimulates the alimentary system and confers an initial immunity to disease on the kids. With dairy goats the kids are either bottle or pan fed (not recommended if at all possible). In either case nipples, pans and containers must be thoroughly cleansed before every feed. Lukewarm milk should be fed using 0.9 - 1 litre spread over four feeds. From 4 weeks to weaning the kids should be allowed to feed three times a day. If the kids are separated from the mother it is essential that the farm ensures that they area receiving sufficient milk. Under feeding will result in stunted youngsters who will grow into weak adults.

Young Kids. The best results are achieved if kids are left with their mother for the first month. This will ensure a healthy well grown youngster. If the kid is to be restrained from suckling, where possible do not be tempted to supplement with cows milk. It is essential that the kid receives colostrums (first milk) for three days in order that it passes the muconium. If kids are restrained it is essential that they are allowed to suckle sufficiently at least three times per day to satisfy them in order that their growth is not impaired.
In the event of triples, one kid (the smallest) may have to be bottle fed with goat milk from a bottle. The bottles MUST be sterilised between feeds to avoid gastrointestinal infections. If small kids are done properly, their reduced birth weight should be insignificant and they will have caught up with their siblings by three months.

Pregnant does in dry lands. As pregnancy progresses, the nutritional demands of the female increase. If the goat is heavily pregnant towards the end of the dry season, 4 things will happen

at the same time:

- **The food value of the forage decreases every day as the dry season continues**
- **The nutritional demands of the unborn kid (foetus) is growing daily**
- **As the foetus grows, the volume of the uterus expands, thus reducing the room available in the stomach to store and digest food**
- **As the female's body weight increases, the stress on her legs become greater and her ability to browse and find good feed is reduced.**

Stress and rough handling during this period can cause the female to abort, and part of the stress is the poor quality of the feed available. Therefore it is important to look for good cheap feed for these pregnant does. This is a bad time to transport goats (to livestock shows or for sale) as the stress can cause abortion.
If possible the pregnant does should also have access to mineral salt blocks, shade and plenty clean drinking water.

Record keeping
For good management a farmer should keep the following simple records (Record sheet for cows, Birth dates, Birth weights, Sire and dam, Milk records, Treatment records, Service dates It is very important to keep breeding records and, where possible, to register the goats with the Kenya Stud Book. Your records should include: date of covering; buck used for covering. It is not adviseable to cross animals to their siblings or parents. This can lead to a weakened offspring and, in some case, birth abnormalities.

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Housing

Bomas

All over Africa, animals are brought into bomas at night to protect them from theft and predators. These bomas are usually sited near homes where they can be easily supervised. Boma walls are usually made from thorny branches piled in a circle. If possible it is advisable to site the boma
a) under a tree for shade in the mornings and
b) on sloping ground so that urine and rain will not make a mess of all the manure.

If the boma is swept out daily, it can be used for a long time. The manure collected is excellent fertilizer for crops, and can either be put directly on the shamba, or sold to farmers in need of the commodity (see manure and compost).

Advantage of bomas:
This practice of bringing the flock to one point every evening has the advantage that each individual can be checked, and problems dealt with.

Disadvantages:

- **Bomas, unless kept very clean, concentrate parasites, viruses, skin infections and other diseases in one place. Many of these harmful agencies can survive and multiply in the boma over a period of time. Examples are: foot rot, ringworm, pneumonia, internal parasites as well as communicable diseases such as brucellosis, Rift Valley Fever etc.**
- **During the rains the accumulated manure should be removed or it will become a total quagmire, and will cause a high percentage of deaths of animals especially young stock.**

Zero grazing housing units for goats have been constructed all over the highlands, many of which are very dark, too small and giving the goats no space for exercising or browsing as is their nature.
Goat pens must be well ventilated, but covered and protected from wind and rain, as goats

quickly develop coughs and colds if they are housed in damp or drafty pens. Raised houses with slatted floors are the best design and are much easier to manage, keep clean and are more comfortable for the goat.

The house must be of adequate size for the goat to lie down and walk around. It must also be of adequate size for a doe to be comfortable with her kid for the first month. In zero grazing situations the exercise pen must be big enough for the goat to move around freely and, where there are young stock, there should be obstacles for them to play on; things such as an old tyres, large stones etc can be placed in the kid pens for their play and exercise area.
This is essential for strong bones and good muscle development. If goats are kept in areas that are too small they will become bored, depressed and it will affect their milk production. Stressed animals are less resistant to diseases and are less productive than happy healthy animals.

A Good House Means Healthy Goats
A good goat house will make keeping goats easier. It should be rain proof, damp proof, well ventilated if the environment is cold and windy, free from sharp objects that cut the goat, free from direct wind, pest and wild animal proof.

Building specifications for dairy goats
Houses should be raised at least 1.5 feet (= 0.5 m or just below knee height) from the ground. A slatted wooden floor is very important. This has small gaps about half an inch wide (or the width of a side of a match box) between the planks or rafters. The gaps must not be large enough for the adult goats or kids feet to go through as this can cause serious injury. Use of local materials means you can use off cut planks, etc. To facilitate the cleaning, goat houses should measure 1,5 m x 1,5m x 1m high.

Goat housing

© S. Fontana, BioVison

A good ventilated goat house with a slatted floor measuring 5' x 5' x 3' high (1,5 m x 1,5m x 1m)

© S. Fontana, BioVision

Types of houses

Mud houses (for cold areas)

This is the cheapest house to build because it uses local materials such as posts, mud, rafters for floor, nails and grass for thatch roof. When placing mud, make holes in the wall slanting down so that the wind does not land directly on the goats.

Off-cuts house
This house costs a little more but it lasts longer. Building materials are posts, off-cuts planks, nails, iron sheets or grass for thatching, wood - rafters or planks for the floor.

House Partition (for nil grazing)
There are two main areas of the house, the sleeping area and feeding area. Sleeping area has wall right around with a door. It must be roofed with lots of air being allowed in (i.e. well ventilated). Feeding areas should be open and not roofed, to allow goats to enjoy some sun. It should be fenced right around with a door/gate provided. There is need to provide for feed trough/water area, place for handing fodder (feed racks), floor with slats to let manure fall through to keep feed and animals clean and dry; place to handle mineral block (where it cannot be rained on).

Feed trough. A goat does not like to graze on the ground like a sheep or cow. Goats like feeding at a knee high on the bush or goat house wall. Goats need to be able to drink fresh water at all times.
The feeding area is built 1 metre (3 feet) above the platform with rafters, off-cuts or timber. Troughs must be easy to clean. Floor of trough can be made of off cuts but must be able to hold hay. Feeding space is 0.15 cm per mature goat.

Water Trough. A water trough is placed 1 foot above the floor in the feeding area. Or a 5 litre can is hanged on the outside of the door to the sleeping room. The door should have a small window or a slot so that goats can have access to water day and night.

Kid pen (Zero Grazing). In the case of Toggenburgs and other dairy goats, they often give birth to twin kids so don't make the pen small. Kid pen should be for at least 6 kids.

Hay barn/store. It is important to store fodder, for use during the dry season. Hay barns are built adjacent to the goat house that is roofed and has a slatted floor to allow air to pass

underneath. It is very important that the hay is not allowed to get wet, otherwise it will 'mould' and spoil and the goats will not eat it.

Mineral trough
Mineral trough should be made where the goats sleep, 1 foot square box is ideal for this purpose. A halved long plastic container nailed to the board, at least 1 foot wide can be useful. Or just as good - hang the salt so that goat has to reach for it.

Milking bale

© Val Corr, Naivasha, Kenya

Milking parlour
Make a milking parlour where needed. Before milking clean the udder with a warm, wet cloth. The teats should then be lubricated with milking salve. Goats teats should NEVER be 'pulled' when milking. They should be gently squeezed. When you let go the teat will fill with milk ready to be squeezed again. If the teats are pulled the inner membrane will be damaged, resulting in a very painful and/or 'droopy' teat. This makes for much less efficient milking and is more difficult for the kid to suck from.

Feed trough attached to milking bale
© Val Corr, Naivasha, Kenya

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Nutrition - Feeding

Goats are inquisitive feeders and will walk long distances in search of food. Herbage is, therefore, an important par of their diet. This is a difficult requirement to meet in the case of zero grazing. Goats are browsers and eat variety of plants/feeds when left to find their own food. This ensures a balanced diet according to their individual needs. Goats are able to distinguish between bitter, sweet and sour tastes and show a higher tolerance for bitter tasting food than, say, cattle. They relish variety and will not thrive when kept to a single type of feed for any length of time, which is often the case when goats are kept in zero grazing situations. They enjoy a variety of grasses, shrubs and plants. They tend to prefer to nibble at the shoots and leave the stems. Palatability appears not to be their main consideration. They look mainly for a variety of feeds.

The mobile upper lip enables the goat to browse a variety of plants to meet its nutrient requirements and up to 80% of their total intake may be taken as browse. When browse is not available they are, however, quite capable of utilising grasses and other crop residues. A variety of grasses can be grown suitable for goats. They generally prefer the less coarse grasses such as napier. Wild legumes are also a beneficial part of the diet.

Goats greatly benefit from a wide variety of tree leaves and make good utilisation of woodland vegetation. Like all other animals goats need sufficient feed for:

- **Maintenance of body weight and condition**

- **Production of meat/ milk (There will be very minimal production/ growth rate, unless the goats have access to more feed than they need for body maintenance)**

Goats get bored when fed on the same feed every day. They are clean feeders and will not eat feeds which are not fresh and nor will they eat dirty feed e.g. napier with mud splash from rain. Goats do not like sticky, mouldy, wet or dusty feeds.Goats need the same balanced ingredients as other creatures, only proportions vary according to the stage in the life cycle:

1. Proteins are needed for growth, production of meat and milk as well as reproduction. Proteins are found in:

- **Legumes such as Lucerne, green beans (this is not advised *see following), cowpeas and other wild legumes (sweet potato vines, acacia leaves etc.**
  Note: It is not adviseable to feed green beans or bean/pea hay. Goats have a natural clostridia content in their digestive system. Beans and legumes can increase this content to such an extent that it will become toxic. Symptoms area sudden, and death nearly always results (see diseases).
- **Dairy meal, cotton seed cake, sunflower cake, soy bean cake and other oil seed cakes (the 'cakes' should be fed sparingly)**

2. Energy feeds (carbohydrates and fats) are needed for maintenance of body condition, fattening, all body functions, in general for anything to work. Energy feeds are for example:

- **Grains such as sorghum, maize, millet, barley and wheat can be fed in small quantities. Green maize husks should be fed with caution. The carbohydrate and sugar content is very high, therefore very palatable. Especially in a dry period goats will gorge themselves resulting in 'Carbohydrate Engorgement'. The symptoms are very difficult to reverse, there is no treatment and mortality is very high. If caught very early it can be treated by a period of starvation, but success is limited.**

- **Grasses: napier grass, kikuyu grass, or any green grass**
- **Hay, dried grasses/weeds are an essential part of a goats diet.etc**

3. Fibre is needed to keep the rumen (stomach) in a healthy working condition. Fibre is found in all plant material. Old dry stems of plants (DO NOT use dry legume hay. The clostridia content of this is higher than green legume) are almost pure fibre.
Young green plants have less fibre and more nutrients. Ruminants such as goats can digest a large amount of fibre, but do need supplements, especially if all the available fodder has dried out. If goats get too little fibre they tend to either suffer from bloat or from indigestion (badly functioning stomach).

4. Molasses added to the water is much appreciated by goats. This can be given from a large bucket when the goats come in for milking. They should be allowed to drink from this freely. Molasses assists with the fermentation process that takes place in the rumen. Dairy goats carry very little fat, so it is important that there is good rumen action at night to keep them warm. Molasses is also an excellent source of vitamins and minerals.

5. Minerals
Minerals constitute an important part of the diet. Symptoms of mineral deficiency which, if ignored, could result in death and will definitely affect production. Minerals are needed for maintaining fertility, building body condition, keeping body functions healthy. Minerals are found in weeds, salt licks, etc.Excess in one or more minerals is also undesireable.
A number of minerals are essential and are classified into 2 groups ? macro and micro elements. The macro minerals include: calcium, chlorine, phosphorous, potassium, magnesium, sodium & sulphur. The micro elements which are required in much smaller quantities are: cobalt, copper, fluorine, iodine, manganese, molybdenum, selenium and zinc.
There may also be a need for other trace miners such as barium, bromine, cadmium, chromium, nickel, selenium, silicon, strontium and tin.

6. Vitamins

Vitamins are essential food substances and are required in very small quantities. They are usually classified into 2 groups: fat soluble and water soluble vitamins.

- **The fat soluble vitamins are: Vitamin A (present in plants), Vit D, D2 and D3, Vit. E and K**
- **The water soluble vitamins are: Vitamin B, B1 (thiamine) B2 (riboflavin), B6 (pantothenic acid, folic acid, biotin), B12 (cobaltamin), Vit C (ascorbic acid).**

Most of the above are widely available in feeds and green leafy materials and in cereal grains. Some of the B vitamins are synthesised by the intestine microflora when cobalt is present. A practical way to ensure that vitamins and minerals in the correct amounts are incorporated in the diet is to feed them as supplements. There are many supplements available on the local market.

How much feed?

The amount of feed needed by goats depend on their size and stage of development. As a general rule of thumb, an animal will need 3,5% of its bodyweight daily in the form of dry matter in feed to satisfy its appetite. An animal will produce nothing and eventually die if its appetite is not satisfied. A 40 kg goat will thus need 1.35 kg dry matter per day or almost 500 kg in a year. Most FRESH forage contains about 33 % dry matter as an average. The 40 kg animal will then need 4 kg of fresh forage every day or its equivalent in dry forage and feed, which makes about 1500 kg per year.

The main difference between a goat and a cow or a sheep is that the goat has a much (delete) bigger rumen in comparison to its body size than the other two animals. The rumen of the goat can be as much as 1/3 of the total body volume. This makes the goat a very efficient converter of rough feeds/ browse, but the process uses up a lot of energy and there is also a need for minerals especially phosphorous. One reason goats prefer browse bushes and trees is that these plants are deep rooted and bring up many more essential minerals from deep inside (delete) the soil that the goat needs, than shallow rooted plants do.

Dairy goats are much more discerning browzers than other goats. They will graze, as a herd, on one particular food for a short period of time before moving on to a different plant. They do not, therefore, do nearly so much damage to the environment as other goats and it is rare, even in a drought, to see them strip a tree until they kill it.

In comparison to a cow, a goat

- **Produces more milk from the same quantity of nutrients**
- **Uses less food per kg bodyweight for its body maintenance than a cow**
- **Uses more food per kg bodyweight for digestion and metabolism than the cow**

Milk goat feeding

Feeding the dairy goat after kidding: The doe requires sufficient food to feed her kid and to maintain her own weight She can be supplemented with at least 200 gm/day of dairy meal. Ration can be reduced to 100gm/dax during the 3rd month after kidding.

The diary goat gives as much milk as it is given the right food. Some preferred feeds include:

- **Sweet potato vines: This is liked very much by the goats. It gives tubers for the family to eat and the vines can be fed to the goats. It can be planted beside riverbeds, steep parts of the shamba and on road side edges. Useful in feeding kids whose mothers died early in their life.**
- **Napier: Napier can be planted along river beds, soil terraces or road reserves. Where a farmer has a big shamba, napier is planted near the home to save time for other work while tending to the goats. Good napier needs generous application of manure and needs weeding. Where new fields are being planted mixed cropping with desmodium improves the quality of the fodder. If you plant napier around your maize, it stops maize stalk borer.**
- **Fodder trees and legumes: These have lots of protein. and only a little is needed at a time. The trees and legumes should be planted along the fences and terraces. Leucaena is good in fences. They do not need a lot of work once they are planted. Deslodium: when available**

should be inter cropped with napier. Calliandra does better in high altitudes (tea zone 3) than leuceana. Do not forget many weeds also make good fodder.

Maize: While maize is grown for farmer's food, there is a lot of fodder which can be used for feeding the goat without stopping the Farmer from a good maize yield. Thinning - all the extra maize seedlings that grow from the same seed hole should be thinned and dried a little before feeding to the goats. Remove extra leaves - this should start with the leaves below the cob as soon as the cob can be seen. Cutting the tops - this should start after the grains have hardened. Stovers - these should have sweeteners (molasses) added or sprinkle common salt after chopping. Broken grains - these are very nutritious especially after a heavy harvest but should be fed carefully to avoid grain overload. (Carbohydrate Engorgement) Dry feed intake in the tropics is around 4 - 5% of live weight. Where goats have several functions the intake of dry matter is relatively higher than for dairy goats.

Rolled Barley: Rolled barley should never make up more than 25% of the ration as too much can be poisonous to goats.

Dairy Meal: For heavy milkers this should make up ¾ of the ration with bran added. There are many different varieties on the market, some of which are much superior to others. Make sure that the meal has a pleasant smell and texture.

Silage

Silage is of little use for goats. Most goats will not eat it. Badly made silage can cause listeria which must be avoided at all costs.

Recommended feeding for lactating does

Concentrates 16-18% protein	**0.3-0.8 kg/day**
Grass with legumes (fresh)	**1.8 - 2.5 kg/day**
Grass/grass mix (fresh)	**2-3 kg/day**
Grass/grass mix (dry hay)	**0.7 - 1 kg/day**
Grass with legume (dry)	**0.6 - 0.8 kg/day**

During this period pregnant does are housed in large pens. Towards the end of pregnancy individual does can be confined to pens where the kids are born. Where the floor is made of timber (it should be slatted) or concrete (not recommended) it is advantageous to increase the amount of bedding so that the doe is comfortable.
The dairy goat has enormous potential for converting roughage as a means of making milk. Her capacity, relative to her size, is far greater than that of a cow. Use should, therefore, be made of this ability to use roughage. A stall fed (zero grazing) milker will astonish the owner for her constant demands for more food. Therefore, good hay is a very important part of her diet. Zero Grazing dairy goats require the same hay and concentrates with added green fodder. The feed requirements of the lactating doe are much greater than it is during pregnancy and the provision of better quality feed during lactation is essential. Feeding during lactation is the primary influence on initial and total milk yield.

It is VERY important that the lactating doe has access to plenty of clean drinking water. This is essential for a good milk yield.

Weaning

Weaning can be done at any time up to 6 months. Time of weaning depends on the type of doe.

Does reared for meat feed their kids for longer; weaning is delayed and the kids usually run with the doe for 3 months.

Early weaning is more common for dairy does and usually kids are separated after birth. They MUST be allowed to feed on the colostrums for 3 days. It is important that the kids must be allowed sufficient milk to satisfy them in order that good growth is ensured. Maintaining a suitable weaning schedule assumes that there will be control over the breeding animals at all times. In many parts of East Africa, however, especially under extensive management conditions, this is not always possible. More efficient husbandry would improve the system. The kids usually begin to nibble at solid food such as leaves, grasses and dry food at 2 ? 3 weeks. This stimulates rument activity. At this time the kids show increasing activity and they require space for exercise and plenty of access to sunlight.

Protein Requirements

The minimum protein requirements range from .590 gr digestible crude protein (dcp) per Kg. Whatever the diet, it is essential that adequate energy is provided. Fibrous diets may, therefore, require supplementation. The mean maintenance requirement is 182 g dcp/kg body weight.

Water

Water is needed for survival. Lack of water will kill an animal faster than lack of any other food constituent.Goats are efficient water convertors. They have a low rate of water turnover per unit of body weight. Ample quantities of water are essential for high milk production and for maximum growth and mohair production. The water requirements for meat animals, while still essential, are relatively less. The demand for water increases in the dry season when ambient temperatures are highest. Goats pant less than sheep, they do not sweat and lose less water in their feaces and urine. When water intake is low the excretion of urine is reduced. In EA it is thought that tolerance to heat stress is due to the resistance to the absorption of radiant heat

by the shiny coat, reduced water loss in urine and feaces and increased ventilation.

Growth Rates

After birth the most rapid gains are during the first 4 ? 6 months. High birth weights are, therefore, important. Female Toggenburg kids reach 50% of their mature weight by 4.5 months. By comparison Saanen kids reach 50% of their mature weight by 8 months. It is, therefore, essential that kids management is of a high standard if their full potential is to be reached. Nutrition definitely has a significant effect on the growth performance of growing kids. If light weight kids are managed properly and fed sufficient milk through the first three months, there should be no difference between it and it's heavier siblings.
A sufficient intake of energy and protein is required for good reproductive performance. This will encourage sexual maturity and conception, and ensures a smooth pregnancy, resulting in kids of high birth weight and strong constitution.

Digestive Efficiency

Goats are efficient digestors of coarse feeds. However, unless concentrate feeds are relatively cheap, and justified by increased milk production, there will be little profit in feeding concentrates. Good quality legume hay such as Alfalfa (lucerne) and pigeon peas are valuable and should be used where possible. When these feeds are not available a concentrate of 16 - 18% crude protein is required, especially when grass is the only ration. Other products such as sweet potatoe vines, ground nut (peanuts) vines and tree leaves are good fodder.

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Health and Diseases

Health of goats

If animals are well fed, well watered and well managed disease is rarely an every day problem. Goats are generally tough and resilient. Problems come when a farmer begins to expect greater production from his animals by crossing them with exotic breeds. More intensive management is required the more an animal is expected to produce, and this management does not depend on sticking needles in animals. A good goat manager will know the requirements of his/her goats and take great care that their needs are well taken care of. A healthy goat has

- **a smooth shiny coat**
- **bright eyes**
- **good appetite**
- **easy quick movements**
- **will rest and chew cud regularly**
- **will pass normal feaces and urine (color and consistency can change with change in feeds)**
- **normal body temperature of 40°C (+- 1°C) higher in the morning than in the eevening.**
- **normal respiration rate of 12-15 breaths per minute (faster in kids).**

Diagnosis of sick animals

The early awareness of sickness in animals is important to successful treatment. The longer an animal is sick the more difficult it will be to cure. Early signs of sickness:

- **Stops eating and possibly also drinking**
- **Becomes dehydrated**
- **The temperature rises**
- **Respiration rate increases**
- **The animal becomes dull and lags behind the others**
- **The coat becomes rough and looses its shine**

Always observe a sick animal before rushing into conclusions. Take its temperature, look for

outward signs such as coughing, wounds, diarrohea etc.
Dehydration (lack of liquid in the body) can kill the animal, so the first thing is to provide the animal with shelter and plenty of clean drinking water. Then the sick animal needs energy to fight off the disease. A thin porridge made with any clean grain flour and boiled up with a bit of salt, sugar or honey and cooled is a good supplement to feed a sick goat.
Depending on the size of the goat they can be given up to 4 bottles a day at regular intervals. Alternatively make a rehydration solution from 1 liter of boiled water, 4 tablespoons of honey or sugar and 1 teaspoon of salt and give as a drench. A sick goat will respond better to treatment in the company of another goat. In the case of constipation a very simple remedy is 1 egg / 250 gr sugar beaten well together and fed slowly to the goat with a syringe. If symptoms persist, consult your vet.

Feeding sick goats
Feed goats well when ill. Good feeding will give strength. Small, weak, young and sick goats should be fed separately. Follow the best way to feed goats carefully and handle them gently. Diseases and parasites are one of the main constraints to goat production in Africa. In addition, diseases and parasites reduce the condition of goats, severely affecting overall production. Disease, parasites, low nutrition, poor management, lack of sanitation and hygene affect the health and performance of goats. Poor feeding and management reduce the resistance to attack by disease and parasites.

Listed below is a brief account of the more important aspects of goat diseases. Farmers should seek veterinary assistance whenever in doubt about appropriate prevention and control.

PPR (Peste des Pestes Ruminants)
Also known as goat plague or rinderpest. This is a serious viral infection. The clinical symptoms

and PM results resemble those in cattle with rindepest. The infection has a 4-5 day incubation which is followed by pyrexia (high fever) lasting 6 - 8 days. The spread of the infection is primarily respiratory, through nasal execution. Mortality is high within a week and the disease can be followed by secondary pneumonia. Kids are much more affected than adults.

Symptoms:

- **High fever**
- **Oral necrosis**
- **Catarrh**
- **Nasal discharge**
- **Diarrhoea**

Prevention:

- **Annual inoculation**
- **Slaughter of infected and exposed animals**
- **Restriction of animal movement to control spread**

Treatment/Control: No effective treatment.

Contagious Caprine Pleuro- Pneumonia (CCPP)

Contagious caprine pleuro-pneumonia, or CCPP, is a highly contagious respiratory disease. Infected goats infected become very sick and often die. The disease is caused by two different Mycoplasma bacteria (*Mycoplasma capricolum capripneumoniae* - also known as Mycoplasma F-38 and *Mycoplasma mycoides* var. *capri*). Transmission is by droplet infection from nasal discharge, especially if goats are confined. The mortality rate can be 100%.

Prevention:

- **Quarantining for several weeks any animals coming new to the farm before introducing them into the herd, especially if the goats came from countries known to have the disease.**
- **Thorough cleaning and disinfection of the premise**
- **Slaughter of infected and exposed animals**

- **Restriction of animal movement to control spread**

Treatment/Control:

- **Contact your veterinary immediately**
- **Antibiotics such as Tylosin and Baytil can be used.**
- **Vaccination is the best control.**

Pneumonic pastuerellosis (PP)

Caused by two Pasteuerella micro organisms (p haemolytica and p. Multocida type 11). It is spread by droplet infection and outbreaks are usually sporadic. The clinical symptoms are similar to those in CCPP. The disease seems to be triggered by stress and as a result is often referred to as 'shipping fever' as the disease often manifests itself after transportation.
Treatment/Control:

- **Yearly vaccination**
- **Elimination of stress factors in the management and handling of animals**
- **Antibiotics such as Tylosin and Baytil can be used**

Haemorragic Septicaemia

A particular strain of pasteurella multocida. Type 1 is the case of Haemorragic Septicaemia. Animals under stress are particularly susceptile. It is spread by carrier animals by droplet infection. Virulence increases after rapid passge through a number of animals.
Treatment/Control:

- **Antibiotics such as Tylosin and Baytil can be used.**
- **There are several vaccines on the market which can provde up to 2 years immunity. Vaccine should be administered 2 months before stress (i.e., transport) or just prior to the rainy**

season in humid areas.

Foot and Mouth Disease (FMD)

FMD affects all cloven hoofed animals and is prevalent throughout East Africa. The disease is transmitted by direct contact or by material contaminated with discharge lesions. Incubation 3 - 8 days.

Symptoms:

- **Salivation and foaming at the mouth.**
- **Formation of vesicles (blisters) in the mouth, feet and liver.**
- **The feet are painful thus movement is restricted. For the same reason the animal finds grazing and eating difficult.**

Treatment/Control:

- **Since the disease is spread by contact with infected animals, every precaution should be taken to minimise contact. Movement should be prohibited and foot baths should be used on infected farms.**
- **Vaccination is highly recommended at the onset of an outbreak. However, the vaccine is not always readily available.**

Orf

A viral infection spread by droplets and saliva. Symptoms similar to FMD but not as serious. Lesions on mouth and nose. In severe infections lesions can spread to genitals. Infection in well fed animals usually disappears after 3-4 weeks. Mortality rate: low but growth and productivity affected due to painful feeding.

Treatment/ Control:

- **No effective cure known.**
- **Vaccinate at first signs of outbreak**

Coccidiosis

The disease occurs primarily in intensive units where adults and kids are housed together. The disease seldom occurs under extensive and good management.

Symptoms :

- **Foul smelling diarrhoea (with no blood).**
- **Temperature rises and there is no interest in food.**

Prevention/Control:

- **Administrate Sulphamezathine for 5 days.**
- **Isolate infected animals**
- **Effective sanitary measures are essential. Infected stalls and feed pans should be thoroughly disinfected and rested for 24 hours before reuse.**

Anthrax (Miltsiekte)

The disease is caused by the bacterium *Bacillus anthracis* (similar to botulism). Acute death without any symptoms. NEVER OPEN THE CARCASS. This will spread the disease which is HIGHLY CONTAGIOUS, even to humans. Disease is spread by water and food comtamination with blood and excretions or by wound infection (puncture wounds by thorns). Incubation period 1-3 days.

Symptoms:

- **High fever, shivering and trembling, sometimes diarrhoea. Sudden death**
- **Rapid bloat and decomposing of the carcass.**
- **Rigor mortis DOES NOT occur. After death, blood appears at the natural openings (nose, anus etc.,)**

Treatment/ Control:

- **No treatment as disease is noticed too late.**
- **The best prevention is annual vaccination if there are known cases in the area during the previous 5 years.**
- **Do not let animals graze near the infected area.**
- **NOTIFY THE VETERINARY DEPARTMENT IMMEDIATELY. This is a notifiable disease.**

Clostridial diseases

Tetanus (Lock jaw)

The caused by a neurotoxim produced by the *Clostridium tetani* bacterium. Spores enter the body through wounds (i;e., following castration, ear tagging, thorns and puncture wounds etc.,) The toxin affects the central nervous system producing symptoms including: erect ears, elevated tail, extended neck, standing with forelegs and hind legs extended. The animal cannot eat or drink, is sensitive to any light touch, sharp noise or bright light. Animal may lie down on its side with stiff limbs stretched out and off the ground. Mortality is high and, even if an animal recovers, their productive life will be severely impaired. Recovery is very much dependent on the standard of care of the sick animal.

Prevention/Control:

- **Keep the animal in a dark and quiet place.**
- **Treat the animal with penicillin.**
- **Animals should be vaccinated before kidding, then annually.**
- **Infection is always caused by hygiene (i.e, puncture wounds, castration etc.). Disinfect any and all wounds. Castration with elastic bands should be used with caution.**
- **Infected carcasses should be handled with care and incinerated.**

Black Quarter

Caused by the *Clostridium chauvoei* bacteria. Symptoms include fever, loss of appetite, stiffness and swelling of affected area. Initially the swelling is hot and painful, but soon becomes cold and painless. Overlying skin becomes dark. Treatment should commence as soon as symptoms commence. Mortality is high and occurs within 24-36 hours.
Treatment/Control:

- **Treat with penicillin or oxytetracycline (usually unsuccessful).**
- **Disease is almost always the result of infection of a wound caused by management practices (castrating etc., and environmental causes (thorn punctures).**
- **Vaccination annually (vaccine may not be readily available).**
- **Hygiene is very important.**
- **Carcasses should be handled with care and incinerated.**

Enterotoxaemia (Pulpy Kidney Disease)

Caused by *Clostridum welchi*. An acute, often fatal disease, affecting goats of all ages (often those that appear fittest succumb). It is an epsiton toxin produced by bacterium clostridium

perfringens type D. The onset is usually very rapid. Animals may be normal in the morning but dead by nightfall. Whilst the clostridium bacteria is present in the intestine of all goats, given favourable conditions (i.e., high levels of grain or carbohydrates) it can grow rapidly, resulting in toxicity (the disease is sometimes referred to as 'carbohydrate engorgement').
The main danger is the first few days after a change in diet (i.e., poor to rich pasture or the sudden addition of high carbohydrate food such as green maize husks.. PM will indicate a rumen packed with undigested carbohydrates and fluid throughout the gastric system. After death fluid may be seen to pour from the nose and mouth. The disease is nearly always fatal and symptoms are almost impossible to reverse.
Prevention / Control:

- **Vaccination annually**

Botulism (Lamsiekte/gallamsiekte)

Caused by *clostridium botulinim* bacteria;. These bacteria form spores which occur in the soil and can lie dormant for many years. Make sure animals do not suffer from mineral deficiency or show signs of pica (animals start eating soil or bones, as these can harbour the spores).
Infection in well fed animals usually disappears after 3-4 weeks Symptoms:

- **Lesions on mouth and nose. In severe infections lesions can spread to genitals.**
- **Stiffness of the limbs noticed in leg and neck muscles followed by partial or complete paralysis of all muscles.**
- **Tongue may protrude. In less acute cases animals have difficulty feeding and drinking.**

Prevention:

- **Annual Vaccination is the best prevention (especiallay if animals are fed with chicken litter).**

Treatment/control:

- **No treatment.**
- **Carcasses should be handled carefully and incinerated**

Brucellosis

Brucellosis is not common in goats. It is a particularly dangerous infection as it can be transmitted to humans through milk. Brucellosis is caused by one or ore variants of Brucella bacteria of which *B. melitensis* is particularly important. Contagious abortion may result. The infection remains and the aborted does will not breed.

Prevention/ Control:

- **Vaccination of male goats at weaning is recommended.**
- **Males should be tested for diseases before introduction into herd. DO NOT vaccinate female goats if they are pregnant as this may cause abortion. It renders bucks sterile**
- **Remove infected animals from the herd.**

Caseous lymphadenitis (Cheesy gland disease/pseudotuberculosis/absesse)

The cause is *Corynebacterium ovis* bacteria. The symptoms include development of one of more abscesses in the lymphatic glands.

Prevention:

- **Animal vaccination (not readily available in East Africa)**
- **Good herd hygiene.**

Treatment / Control:

- **Open mature abscess with a clean scalpel or knife on a soft spot. Squeeze the puss out of the abscess and collect it in a tin or plastic bag (DO NOT leave it lying around. Burn it or discard it where animals and humans cannot come into contact with it.)**
  Flush the empty abscess with hydrogen peroxide, followed by a flush with a solution of salt

water.
Fill the empty abcess with Iodine or Betadine and spray with a disinfectant spray (gentian violet is excellent)

- **No other adequate control treatment.**

Mastitis

Both acute and chronic forms may be encountered. The disease is caused by different types of pathogenic bacteria but Staphylococcus and streptococcus agaiactiae are common. Generally caused by bad hygiene and poor management at milking time. Infected does have swollen, hot udders (sometime only part of the udder is affected). It is extremely painful and, if left untreated, further serious complications may follow and milk production will be impaired. Severe cases can be fatal if left unattended.
Prevention/Control:

- **Absolute cleanliness at milking is essential.**
- **Infected does, after stripping the milk, can be given infusions of streptomycin or terramycin creams through the teat (not as effective) .**

Hypocalcaemia (Milk Fever)

All milk goats suffer a fall in levels of blood calcium and phosphorous at the start of milking. In some instances the fall of blood calcium is so great that milk fever is the result. It is commonest in young does and high yielding first kidders, but it can occur in late pregnancy, during kidding and at any stage of lactation especially in high yielders. Milk Fever may occur soon after kidding. Symptoms include loss of appetite followed by restlessness, excitement and trembling.

Inco-ordination will be followed by coma.
Treatment:

- **Seek veterinary assistance immediately**
- **Affected does need 80 - 100 ml calcium boroglucomate with magnesium and phosphorous injected subcutaneously.**

Transit Tetany

Can occur in milkers, dry does and male goats. It is caused by a combined deficiency in calcium and magnesium cauised by stress i.,e fear and transport.
Signs and treatment as in milk fever.

Problems Associated with Kidding.

Abortion . Abortion is a premature expulsion of the foetus. This may be caused by specific infections i.e., toxoplasma, Chlamydia and campylobacter, or as a result of a general infection. Most abortions, however, result from non infection causes such as stress (transportation or chased by dogs for example), or by drugs such as prostaglandins (steroids) poisons, malnutrition and, sometimes, where there are multiple foetuses present. Gloves should always be worn when handling aborted tissue. Pregnant woman should NEVER handle aborted tissue. Seek veterinary assistance on any abortion.

Vaginal Prolapse. This is the protrusion of the vagina through the vulva caused by response to excess abdominal pressure. It is more common in multiple births. It can also be hereditary. Seek

veterinary assistance immediately.

Mummified Kids. Muffified kids are produced if the kid has died in the womb for any reason. It is not uncommon to have normal kids produced with a muffified kid. These are sometimes retained for some months and then expelled as bits of bone and tissue. If kids are left behind this may cause infertility, serious infection or even death.

Uterine Prolapse. This is when the entire uterus is expelled via the vagina. It is a rare condition, occurring soon after kidding and may be subsequent to a retained placenta. Seek veterinary assistance immediately. In the meantime, keep the doe warm to prevent shock and keep the uterus as clean as possible (wrap it in a clean cloth).

Vulval Discharge. An odourless, reddish discharge (lochia) is normal for up to 14 days post kidding. If the discharge is darker and stickier than normal, or if it contains pus (indicating metritis) or if the goat seems unwell or is milking poorly, seek veterinary assistance immediately.

Retained Placenta. The foetal membranes should be expelled within 12 hours of kidding. Seek veterinary assistance if the placenta has not been seen. An ignored retained placenta will, nearly always, result in death.

Ovarian Cysts. Cystic ovarian disease in goats is an important cause of reproductive failure. The disease shows itself by short cycles with continuous oestrus (going on with heat) without conception. When the goat is in season it will bleat (make noise) a lot and show nymphomaniac

behaviour (wanting to mate all the time).
Cycstic ovarian disease has been proved to be linked to animals that grase clover and legumes in large quantities.
Prevention/Treatment: 1500 - 2500 iu humanchorionic gonadrophin (a drum which not readily available in East Africa). An alternative treatment is prostaglandin F2alpha which is available in most agrovet shops.

Malpresentations. These are not beyond the capabilities of a good stock manager. Clean your hands thoroughly and, holding your lubricated fingers in a cone shape, insert them gently into the birth canal and when you know what part of the kid is being present, gently manipulate the kid so that it's head is resting on the two front feet. This may require gently pushing the kid back into the uterus in order to make more room for the manipulation. If the head is not visible the body of the kid needs to be pushed back until the head can be dropped into the correct position. Natural bath should follow.

Nasal Bot. Caused by flys which lay eggs in the nasal cavity. The maggots move into the sinus cavities. Symptoms include coughing, thick whitish mucoise discharge from the nostrils. The most effective treatment is Multidose available in most veterinary pharmacies. Some anthalmintics include nasal bot.
Treatment / Prevention: The best prevention is control of fly and breeding areas (damp dark corners - such as under water buckets are preferred .

Rift Valley Fever (Ensootic hepatitis/RVF). This disease is rainfall related and spread by mosquitoes (Bunyavirus). The onset of symptoms is fast. They include high temperature, stiffness, tremors and distress. Adults abort. Mortality can be high. No treatment .Vaccination is recommended at the first sign of an outbreak. (once per animal - lifelong immunity. However,

vaccine is not always readily available.

Heartwater (Rickettsiosis). Caused by *Cowdria ruminantium* (Rickettsia).spread by the Bont tick. Symptoms include loss of appetite, listlessness, rapid breathing followed by muscular tremors, circular movements, grinding of the teeth. Recovering animals show diarrhoea. Immune animals show slight fever. Mortality rate: Very high especially in young stock however, this disease is seldom seen in goats. Disease agent: A parasite by the name Cowria ruminantium spread by the bont tick.
Prevention: Weekly dipping or spraying with recommended acaricides to kill the ticks spreading the disease.
Treatment: Administration of a broad spectrum antibiotic can be effective if disease is caught in early stages. Treatment should start as early as possible, prefereably before the nervous symptoms occur. Antibiotics such as Oxytetracycline can be used. Do not import animals from a heartwater free area into a heartwater area without vaccination.

Trypanosomiasis

Only seen in areas of EA where the Tsetse fly is present. Caused by infection by the Tsetse fly. Symptoms include: yellow membranes and gums, lethargy, high temperature, reluctance to eat. Control by using 'pour ons' such as Typertick. Treatment for sick animals - Samarin. Consult your veterinary officer
NB: Where vaccination is recommended, various factors have to be taken into account such as area, the diseases which occur in your area and the management system. It is adviseable to vaccinate a month prior to kidding so that the immunity can be passed through the placenta to the unborn kid. Some of the above mentioned diseases are more prevalent during the rainy season. It is therefore, where appropriate, to vaccinate before the rainy season commences. If in doubt always consult your veterinary officer.

Foot Rot

Mainly caused by *Fusiformis nodasus*. Caused by continuous grazing or being housed on wet pasture/bedding. Not fatal but causes serious loss of production as the animals movement is restricted as their feet can become very painful. In extreme cases animals may not be able to move at all.
Prevention / Control : Hygene management is essential to avoid Foot Rot. The affected are of the foot must be well washed with a formalin solution / or copper sulphate. Foot rot spray should be applied until the infection is cleard. Avoid grazing /bedding animals on continuously wet pasture/housing and avoid stagnant water. Regular foot care is a good prevention.

Internal Parasites

Helminths (worms) are probably the most damaging parasitic infection in goats. Larvae build up in the herbage during the rain season. The extent of the infection will depend on the method of grazing management. Rotational grazing can help reduce the incidents of infection. A variety of helminths aaffect goats and include nematodes, cestodes and trematodes. These include *Haemonchus contortus* (barber pole worm), liverfluke, roundworms, lung worms, tape worms, etc.
Symptoms: swelling under the jaw, loss of body condition, dioarrhea, pale gums, thick nasal discharge, signs of worm presence in faeces.

Nematodes, cestodes and trematodes

***Heamonchos contorous* infection is greater in young animals. The critical period is up to 4 weeks of age. Pregnant does should be treated prior to birth and young stock should be treated by 2 weeks. Adults of the major intestinal parasites live in the animals gut where they mate. The**

eggs pass out with the faeces onto the pasture. When conditions are suitable the larvae hatch and are then ingestsed by grazing animals.
Prevention/Control: The control of infestation calls for good livestock management. Well fed stock suffer less than do poorly fed animals. Control is achieved by regular drenching with broad spectrum anthalmintics. There are a wide variety available and it is therefore adviseable to alternate to ensure that all helminths are covered. Keep goats in clean houses or bomas to avoid build up of a worm infestation. Routinely dose adult goats before mating, all kids at weaning and all stock before each rainy season. Alternate brands to avoid immunity to infestation. Keep goats in clean houses or bomas to avoid build up of a worm infestation. Routinely dose adult goats before mating, all kids at weaning and all stock before each rainy season. Alternate brands to avoid immunity to infestation.

Bloat

Most often occurs when animals consume large quantities of grain or very green matter, especially in a dry season. Changes in feeding of grains and concentrates should be done gradually. Acute cases of bloat can follow the feeding of large amounts of dried alfafa leaves. If animals are eating lush leguminous feed they should have access to plenty coarse roughage.
Control / Prevention: Use 'Stop Boat' at 1 ml per 40 lit in the water at the first signs of boat or if there is a sudden 'flush' in the grazing following a prolonged dry period. Use for at least a week.

External parasites

Such as ticks, fleas, lice and mites, are dealt with by routinely dipping or spraying animals with recommended acaricides. External parasites transfer diseases between animals by sucking blood and should be kept firmly under control. When fleas and/or lice infest goats it should be dealt with promptly to avoid secondary infections of the skin, mange and, in serious cases, anaemia ? all of which have an adverse affect on the welfare and milk production.

Tethering

Goats should NEVER be tethered by a leg. Always tether from the neck. This can be done by tethering to a peg allowing the goat to graze freely in a circle. Care must be taken that the tether does not wind round the peg continuously, preventing the goat from moving freely. Alternatively, the tether can be on a ring onto a ?picket line? or wire tide between two posts or trees. This allows the goat to move up and down the wire. Care should be taken that the tether is not so long that it can wrap around the goats neck or so short that the goat cannot move freely or lie down. Fresh water must be available to tethered animals, and where possible, shade should be available.

Management of Breeding Bucks

Male goats are fertile at an early stage and, consequently, it is usual for them to be managed separately. Bucks exude capric and caproic acids in their coat, which can contaminate milking buckets and cause odours in the milk. It is adviseable, therefore, to house the bucks separately. The buck must be kept in good condition and fed adequate amounts of feed. An underfed buck will become sluggish. Exercise is important and provision should be made, where possible for them to have access to a yard.

Ear Marking

When this is done at weaning it causes least interference. Two types of ear marking are generally practised:

- **Tattoo: The usual method of tattooing is when tattoo marks are pierced on the inside of the ear and rubbed with Indian ink. The imprint lasts for a long time.**
- **Tags:Ear tags can be clipped on the ear of the kids. The tags are made of metal or plastic**

and individual goats identities can be printed on the tags. The tags often fall off so that this is not the most reliable method.

Other Methods: Paint or ink can be used to mark the side of the animal. This has the disadvantage of not being permanent and of possible damage to the skin. A string or cord bearing a tag can be placed round the neck of the animal but the tags fall off easily, particularly if the string is not of good quality.

Castration

Goats are castrated when they are surplus to breeding requirements and destined for slaughter. Castration of male goats eliminates odours in the meat, rendering it more palatable. The following methods of castration are practised usually at weaning when the animals suffer least.

- **Knife: this is a crude method and is NOT to be encouraged. The testicles are removed with a knife. It is IMPORTANT to use disinfectant to seal the wound. Care should also be taken not to include the two tiny 'teats' near the base of the testicles.**
- **Searing Iron: A searing iron, heated either by burning in the fire or in an oxy-acetylene flame is gently used on the scrotum. The heat also seals the wound and prevents any entry of germs. The kid needs to be restrained and help upside down during this operation. It should be noted that both above are extremely painful and stressful to the kid and should be avoided where possible.**
- **Bloodless Castration: Two techniques are employed here:**
  - **Use the Burdizzo castrator which crushes the spermatic fords.**
  - **Use of rubber rings. Tiny rubber rings about 1 cm in diameter are placed over the scrotum of the male kid. The pressure of the rubber ring in association with the growth of the kid restricts the blood supply eventually causing the testicles to dry up and fall off. When this happens it is important to check that there is not an open wound.**

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Products from goats

Efficiency of Production

Efficiency of production in farm animals is defined as product per unit of food eaten by the animal. Unfortunately, it is not easy to calculate this in a way that makes comparison between different conditions and breeds. The following formula gives some measure of efficiency:

Efficiency (E) = (Produkt (P) : Food (F)) x 100

Where E is the efficiency, expressed as a percentage, P is the produce and F is the food intake.

Efficiency of Meat Production

Within species, efficiency of weight gain falls gradually as an animal grows. However, if animals of the same species, but of different mature size are compared at the same stage of physiological development, they appear to have similar efficiencies of weight gain. Thus faster growing larger breeds may not be more efficient than slower smaller breeds. It is possible to make adjustments for differences in mature size, so that percentage growth rates can give and indirect assessment of the efficiency of meat production rather than absolute growth rates.

The efficiency of growth can be affected by seasonal fluctuations of feed supply. Usually if an animal eats more it is likely to grow faster. Fluctuations in feed supply may cause liveweight loss followed by compensatory live weight gain such as is often found when goats are grazed. Compensatory growth in goats has not been adequately studied, but it is not necessarily inefficient and farmers can take advantage of it. Faster growing goats are more efficient in energy storage but may be no better in protein storage than slower growing goats.

The food eaten by the dairy doe will include allowances for maintenance, pregnancy and lactation. In East Africa large litters are only feasible if the food supply is adequate. Extensive systems of grazing or conditions where the nutrient requirements of twin or triplen births cannot be met are, therefore, disadvantegous. Most intensive rearing systems can meet the extra feed requirements.

Efficiency of Milk Production

The efficiency of milk production relates to the question of the efficiency of goats as compared to other lactating ruminants such as the dairy cow. It is known that dairy cattle produce more food energy than beef cattle. A high yielding cow will generally appear to be more efficient than a low yielding goat. Alternatively, a high yielding goat will be more efficient than a low yielding cow. Efficiency of milk production in goats is affected by persistency, feed utilisation and feed conversion efficiency. Goats have a flatter lactation curve and peak yields are reached between 8 - 12 weeks of lactation. Alternatively cows hae a maximum milk yield between 4 - 6 weeks. This suggests that goats are more persistent milkers.

Goats also produce a relatively higher milk yield per unit of live weight compared to a cow. The relatively higher milk yield in the goat is due to the relatively larger mammary gland and volume of secretory tissue comprising a greater proportion of the total body weight.
A high yielding animal converts feed to human food efficiently. Animals that yield more milk or grow more rapidly will be more efficient, largely because the maintenance overheads are spread over a great volume of producton. This is true of any kind of feed but the farmer will wish to establish which feed gives the best performance.
With goats the large daily intake of feed and larger production of milk per unit of body weight are functions of a higher metabolic rate related to body size.

Yield of Proteins from Meat and Milk

The most important criteria for successful goat production are the efficiency and yield of protein produced from meat and milk. It is well known that in cattle the yield of milk protein is superior to that of meat protein. This is because the efficiency compares the relative yield of protein in various meat and milk animals. The yield of proteins from indigenous goats is approximately 7 times and for exotic goats about 39 times that from meat goats. On a per hectare basis the results are high and even more striking.

The yield of protein from goats compares with similar yields from indigenous dairy cattle. This implies that the dairy goat rather than the diary cow may become more useful for milk protein production.

Milk products from dairy goats is more advantageous by the availability of offspring (mainly males that are not required for breeding) for meat production. These considerations clearly indicate that milk protein producton is an important contribution.

Products from Goats

Meat

Goat meat is the most important product from goats in East Africa. It is widely consumed. The colour of goat meat is usually dark and it is somewhat coarse in texture. The fat content is usually sparse and fat is yellow in colour. The sparse covering of fat on the meat and the tendency for the fat to be concentrated more on the viscera is one of the characteristics of the species. There is often a strong odour especially in the meat of uncastrated male goats. There is little or no processing of goat meat in East Africa. The meat is, generally, consumed where it is produced or sold in markets by butchers for immediate consumption.

Milk

Goat milk is widely consumed throughout East Africa. The daily yield of milk per doe varies between breeds and locations due to various environmental effects, but even a small supply is

important in many regions where there is both continued under nutrition and malnutrition. The chemical composition of goat milk varies with the individual, breed, stage and order of laction, season and nutrition. Whilst the size of fat globules in goat's milk is of the same order as in cow's (1-10 iu m diameter) the content of small globules is greater.

Goat milk also has relatively higher contents of fatty acid. Goat milk is a valuable source of aminoacids, is rich in histidine, aspartic and acid and tyrosine compared with cow's milk and has a larger amount of non protein nitrogen. The nitrogen content of colostrum is higher than that of whole milk.
The sodium, iron and copper contents of goat milk are relatively high. Goat milk has a higher content of Vitamin A, nicotinic acid, choline and inositol compared with cow's milk but lower amounts of Vit B6 and ascorbic acid (Vit C). An important feature of goat milk is that, unlike cow's milk, it contains no precursors of Vitamin A, the vitamin being present intact.

Composition of goat milk compared to indigenous cow milk:

Constituent (%)	Goat milk	Cow milk
Total solids	13.9	13.5
Fat	4.8	4.8
Protein	3.7	2.8
Non fat solids	9.1	8.1
Ash	0.85	0.74
Lactose	5.0	4.6

Vitamin content of goat milk compared to milk of indigenous cow:

Vitamin	Goat milk	Cow milk

(mg per litre)		
Vitamin A	2 074	1 560
Vitamin D	23.7	
Thiamin	0.40	0.44
Riboflavin	1.84	1.75
Nicotinic Acid	1.87	0.94
Vitamin B6	0.07	0.64
Pantothenic Acid	3.44	3.46
Biotin	0.039	0.031
Folic Acid	0.0024	0.0028
Vitamin B1	0.006	0.004 3
Ascorbic acid	15	21.1
Choline	150	121
Inositol	210	110

There is limited processing of goat milk in East Africa. Individual goats or small groups of goats are milked by hand, usually by small farmers and the milk is used for domestic consumption or distributed for sale locally. Cheese making is conducted on a small scale. Occasionally butter and ghee (rendered butter) are produced from goat milk.

Skins

Goat skins are a valuable by product, and in countries with high goat populations, these can earn valuable foreign exchange. The commercial value of skins is, generally, approximately 5 -

10% of the total value of the animal. The skins must be removed with care to preserve their quality for further processing. In organized abattoirs, this is some times achieved but skinning is likely to be less efficient in rural areas. If the skns can be transferred to the tannery with 24 hours no special treatment is necessary. However, some for of curing is necessary at the abattoir to preserve the skins for storage and transport.

- **Air drying. This is the simplest and cheapest method i.e., by stretching the hide on upright frames in open, well ventilated sheds where they are protected against sun and rain. The hides must be suspended so that they can dry on all sides. Occasionally arsenical solutions are used as a preservative and the hides and skins are soaked in the solution before air drying.**
- **Use of Salt. This procedure requires more labour and care and is also relatively more expensive. The salt is applied to the flesh side of the skins. The skins are then stacked closely to allow for impregnation of the tissue. The stack is allowed to stand for about 10 days and is then rearranged with the topmost hide placed at the bottom. A slatted foor is helpful because this allows the brine to run off. Stagnant brine tends to spoil hides.**

Wet salting should be done in rooms where the temperature does not exceed 15.6° C. With higher temperatures deterioration sets in. The alternative to wet salting is dry salting which is a combination of air drying and wet salting. In this sytem, the hides are allowed to dry after wet salting for a few days to remove the moisture. If the hides are marketed after wet salting the moisture content is high and this increases the cost of handling and transport.

Hair

Commom Goat Hair: This type of hair varies with the breed. The fibres are usually milti coloured, very coarse and mostly medullated. They are sometimes straight, non elastic and of variable length. This type of hair is used in the manufacture of carpets, underfelts, ropes and coarse blankets and bags.

Abattoir by-products

A number of important abattoir by-products are produced during the organized slaughter of goats besides the skins. These are tallow (fat), meat, bone and blood meal. Tallow has a wide variety of industrial uses, perhaps the most important being the manufacture of soap. More recently it is used extensively as a valuable high energy animal feed.
Meat, bone and blood meal is a valuable protein feed and is used extensively for non ruminants such as pigs and poultry. Such protein feeds are in short supply and in intensive animal producton these by products are very useful. Additionally, rumen contents can be used as an animal feed. This is particularly rich in the B vitamins.

Other by-products include glue from horn and hooves, various handicrafts from horns, gelatin from bones, heamoglobin from blood. In some parts of Africa the guts from goats are preserved in salt and exported for use as casings for sausage manufacture.

Many parts of the offal of goats are potentially useful by-products and these are the following: Bladder, Kidneys, Blood, Lips, Bones, Liver, Brain, Lungs, Bristles, Meat Scraps, Condemned carcass and parts, reproductive organs, endocrine glands, Skin, Fat *, Spinal cord, Feet, Spleen, Gall bladder, gall and gall stones, Stomach, Hair, Sweet Breads, Head and Head trimmings, Tail, Heart, Tongue, Hide, Trachea, Hooves, Trimmings, Horns, Udder, Intestines and Wool. (*Highly contaminated or partially rancid fat unfit for human consumption) A number of the by-products listed above are edible and their extent and range are determined by such factors as affluence, preference, taste and customs. This is reflected in geographical differences in total edible percentage and total saleable percentage of slaughtered goats. In Africa the estimated total edible and saleable proportions are approximately 50%. Usually livers, kidneys, hearts, tongues, brains and head are sought after in urban areas.

Cheese

Cheese made from goat milk is a much sought after product. However, it must be made properly from milk that is not tainted with the odour associated with goats. This odour comes through in

the cheese very strongly and many people find it offensive. If you are planning on making cheese you will need a good recipe book and access to a supplier of starters and cultures, as most cheeses cannot be made without these. It is also essential to have a clean, dry room in which to make the cheese, where it will not be contaminated by dust and flies. A very simple but tasty and nutritious cheese is made in many cultures by leaving the milk to stand until it has 'turned'. This process can be speeded up by warming the milk a little (to blood temperature) and adding a little lemon juice. When the curds have separated from the whey, the cheese should be hung in a muslin bag, over a basin, and allowed to drain overnight. The curds should then be flavoured with salt and pepper and, if you have them, chives. This makes a delicious 'cottage or cream' cheese. If not eaten the same day it will need refrigeration.

Manure

Goat manure is a useful product with commercial value and is used in many parts of East Africa. The manure has a higher content of nitrogen and phosphoric acid than that of cows. The urine is rich in nitrogen and potassium. The manure is an excellent fertilizer and has the potential to increase crop yields.

Compost

A very efficient method of making compost is to stack the manure in a neat square pile (manure from other livestock can be added to make an even more valuable by product, i.e., cow, sheep, donkey, chicken and camel dung). Where possible the pile should be kept moist by watering. After two weeks the whole pile should be turned over and left to mature. Whilst this pile is maturing a second pile can be started. In this way the farmer has a continuous supply of compost for his farm or for sale.

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Information Source Links

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Pigs

status: under construction

Introduction

Feeding pigs

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Introduction

Origin of pigs

The pig is one of the oldest domesticated animals. It is found throughout the world especially in regions where there are no social or religious objections to pork consumption.
Majority of the breeds we now know are descended from the Eurasian Wild Boar (*Sus scrofa*). Archaeological evidence from the Middle East indicates domestication of the pig occurs as early as 9,000 years ago, with some evidence for domestication even earlier in China. Figurines, as well as bones, dating to the sixth and seventh millennia BC have been found at sites in the Middle East. Pigs were also a popular subject for statuettes in ancient Persia.
From here, the pig spread across Asia, Europe and Africa. One interesting point, while most livestock were utilized initially by nomadic peoples, swine are more indicative of a settled farming community. The reason for this is simply that pigs are difficult to herd and move for long distances. Pigs have become vital to the economy in parts of the world. For example, there exists a "pig culture" in New Guinea as strong and complex as any African culture based on cattle.

Background of pig production in Kenya

Pig production in Kenya has a long history dating back to 1904 when the first pigs were imported into the country from Seychelles. The production of surplus cereals and skim milk provided the basis for pigs as a subsidiary for the British settlers who operated large-scale commercial farms during the colonial period (1900-1963) but since then pig rearing has been in the hands of small scale farmers who now constitute up to 70% of the total pig farmers.

The industry has been in the hands of the private sector for many years, apart from the time when Uplands Bacon factory under the Pig Industry Board had the monopoly. The factory collapsed and was wound up in 1987. After the collapse, pig processing has mainly remained with the Farmers Choice Ltd processing well over 70% of the pork produced in the country. Other players include Chefs' Choice, Hurlingham Butcheries, Oscar foods (Kikuyu), and many local pork butcheries in urban centres across the country.
The Government has continued to encourage pig production as it plays a major role in the tourism sector. The latest intervention by the Government was the introduction of the ADB/GOK sponsored pig project which ended in year 2000 and was providing much needed credit and technical information in the industry. This industry has since withstood periodic fluctuations, common in the pig industry to become one of the East African countries with a well established pig industry.

Pig production is mostly based on commercial concentrates whose quantity and quality of feeds fed varies from region to region and farm to farm. Keeping of scavenging pigs, which requires a minimum amount of inputs, is also common. However, in order to control pig diseases pig farmers are mandated to provide pig-proof paddocking to prevent wild-domestic pig contact (Legal notice number 71 of 1966-The Animal Diseases Act, Cap364.). Free loitering pigs scavenging in dumping sites and market places is prohibited by law.
About 65% pig farming is practiced in Central Province, Rift Valley and Western Provinces. The production cycle in the pig Industry is influenced to a large extent by the tourism sector. During peak tourism periods (June to August) and (December to January), pork demand is highest hence the players target this period. When tourism is off peak, the market suffers a glut (more pigs than the market can consume) leading to low pig producer prices.

Products present in the market: bacon, ham, pies, rolls, sausages, pork cuts, tallow & lard. Pig manure is used on farms as fertilizer.

Population growth, urbanization and improved living standards have fuelled demand for meat

and pork being cheap to produce compared to beef, has a bright future in the country.

The pig industry is characterized by farms having 2 - 5 sows weaning 1-2 small litters yearly. This low productivity may be attributed to any of the following:

- **A short sow productive life (sow culled early due to poor productivity).**
- **Generally, poor sow nutrition especially during the gestation and lactation periods.**
- **Poor housing that predispose the sows to stress**
- **Poor quality boars or mating system**
- **Poor feed quality, high feed prices leading to inadequate feeding**
- **Presence of sub-clinical reproductive diseases leading to low litter size and high pre-weaning mortality**
- **Long fattening period leading to low returns**
- **Market demand fluctuation: during periods of high demand the country has had to import pork products to fill the gap**

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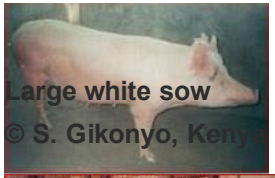
Breeds and Breeding

The main breeds in Kenya

Large White

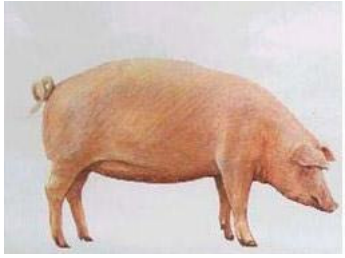
They distinguished by their erect ears and slightly dished faces. They are long bodied with excellent hams and fine white hair. Very prolific, late maturing with good mothering ability and can be used for pork and bacon



production. Fairly hardy animal.
Large white are found practically in all crossbreeding and rotational breeding programmes. Sows have an enviable reputation as dams and form the foundation of the classic F1 hybrid gilt. They are the favourite breed in the country and the world over.

Large white boar
© S. Gikonyo, Kenya

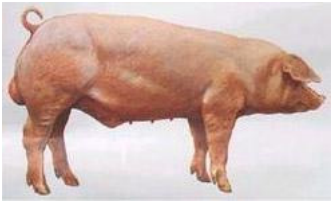
Landrace



It is a very versatile breed performing well under good management. They are white in colour, have dropping ears and a straight snout. Sows produce and rear large litters of piglets with very good daily gain (ADG) and high lean meat content ideal for either pork or bacon production.

Landrace sow

© S. Gikonyo, Kenya



Landrace boar

© S. Gikonyo, Kenya

Duroc - (Duroc-Jersey)

Duroc sow

© S. Gikonyo, Kenya

Durocs are golden brown to black in colour with a thick auburn coat and hard skin. They have small, slightly drooping ears. Traditionally, Durocs have been use as terminal sires (traits associated with it are quick growth, deep body, broad ham and shoulder). Its tenacity in looking after its young, combined with its docility between times, makes it an ideal candidate for an out door pig either as a sire or as a dam. Its succulent carcass and heavy muscling makes it a very suitable pig for anything from light pork to heavy hog production.

Duroc boar

© S. Gikonyo, Kenya

Hampshire

The breed has been developed in the United Stares of America and is now one of the world?s most important breeds. It is used extensively as the sire of cross bred pigs for pork and bacon production. The Hampshire is very prolific. It produces an abundance of lean meat and has more meat than the large white or landrace.

Hampshire sow

© S. Gikonyo, Kenya

Hampshire boar

© S. Gikonyo, Kenya

Pietrain

This is a Belgium breed of medium size, it is white in colour with black spots. Around the black spots there are characteristic rings of light pigmentation that carries white hair. The ears are erect. The Pietrain is famous for its very high yield of lean meat but this is often associated with

Pietrain sow

© S. Gikonyo, Kenya

the presence of the halothane gene responsible for Porcine stress syndrome. It is therefore not desirable as a pure bred but used in cross bred synthetic terminal sire line.

Pietrain boar

© S. Gikonyo, Kenya

Other pig breeds not reared in the country: Large black, Middle white, Tamworth, Welsh, Berkshire, Wessex Saddleback.

Source of breeds

- **Mainly from Farmers Choice Ltd (a leading pork processor)**
- **Replacement from own herd**
- **Other small-scale breeder farmers**

Choice of Breed

Large white is robust, adaptable and of higher performance than most other breeds. It is

preferred by most pig farmers in the tropics. The breed is known worldwide and there are no problems obtaining breeding stock from a variety of sources. It is used for the improvement of other breeds e.g. Landrace.

Duroc - Jersey also has good attributes for both rearing and growth in the tropics. Traditionally Durocs have been use as terminal sires.

Landrace pigs have been widely used for crossbreeding purposes in the tropics. They do well under close confinement feeding but must be well managed and fed.

Selection of Breeding Gilts

- **Gilts selected to have at least 12 teats so as to accommodate a large litter**
- **Gilts to be selected from sows, which wean 9 -10 or more piglets per litter and are known to be good mothers.**
- **Select breeding gilts at weaning period, further selection should be done at 5 - 6 months of age.**
- **Select fast growing weaners. These will likely consume less feed per unit live weight gain and are thus less costly to keep.**
- **Select gilts which have well developed hams and comparatively light heads.**
- **The selected gilts should have good body conformation i.e. strong legs, sound feet etc.**

Selection of Breeding Boars

It is extremely important to select a good boar since it contributes half the quality of the herd. Areas to consider:

- **Boar to have sound feet with good, full hams, uniform curve at the back and of good length.**
- **Boar to have at least 12 nicely placed rudimentary teats so as to pass on this characteristic.**

- **Selection to be done before castration i.e. at 4 weeks.**

Breeding Programs - Breeding models

Pure-breeding: mating purebred individuals of the same breed. The progeny has the same genetic makeup. The major objective of pure-breeding is to identify and propagate superior genes for use in commercial production primarily in crossbreeding programs as well as to propagate and identify superior females for maintaining valuable genetic material. Furthermore crossbreeding will not be worthwhile unless superior pure bred individuals are used.

Cross breeding: mating two individuals from different breeds thus introducing into the progeny a gene combination that is different from that existing in either parent or in the breed of either parent. Cross breeding can involve two or more breeds, depending on the desired result. The sole purpose of cross breeding is to take advantage of the observed improvement in performance of the progeny above that of either parent. This is known as hybrid vigour or heterosis.

Out breeding: mating individuals of the same breed but which are less closely related than the average of the breed. There should not be a common ancestor for at least four generation back in the pedigree of the boar and the females with which he is mated. It is a useful mating system in purebred individuals.

In breeding: mating individuals of the same breed but which are more closely related than the average of the breed. This could be between such close individuals as those from the same litter or a boar and his daughter. Inbreeding is rarely practiced because it can cause problems such as a decrease in litter size and increases mortality. Inbred sows are inferior in milking and mothering ability. It delays sexual maturity in gilts and boars. Inbred boars have less sexual

libido. Inbred gilts have fewer eggs during oestrus and farrow smaller litters than those out bred.

Breeding Strategy

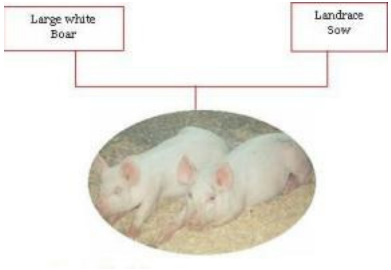
Breeding is a complex science that requires skill and knowledge. It also requires thorough record keeping. To achieve genetic improvement the following methods can be used:

- **Selection: select the best individuals in the herd for breeding, looking at their performance in various characteristics e.g. litter size, growth rate, feed conversion ratio, disease resistance etc.**
- **Culling: remove the individuals that do not perform well.**

Practical cross breeding

As mentioned above crossbreeding has two advantages:

- **It exploits heterosis, this occurs when two breeds which are genetically different are crossed.**
- **Ability to combine two or more individuals that have desirable characteristics.**



A classic TWO way cross. The two ways cross produces F1 Parent gilt of high quality.

Classic two way cross

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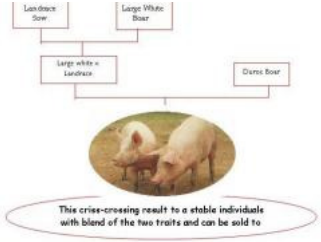


A THREE way cross. This criss-crossing leads to stable individuals with a blend of the three traits

Three way cross breeding

© S. Gikonyo, Kenya

Artificial Insemination (A.I)

Artificial insemination is becoming popular in pig breeding. It is not a difficult procedure and, provided the basic guidelines are followed, it can be highly successful. The principles of oestrus detection, timing and frequency of insemination do not differ from those employed when using natural mating. However it is important to ensure that:

- **Suitable equipment is used**
- **Suitable insemination environment**
- **Proper insemination techniques.**
- **Well stored and viable semen.**

Management of Breeding Stock

a) Boars

A boar can start serving when it is above 8 months of age. During the first two months of service, the boar should serve only twice per week. After this it can be used up to six services per week. The boar should be kept in its own pen to avoid fighting. When mating transfer the sow to the boar.

- **One boar can serve up to 15 sows**
- **Considerable exercise is necessary to prevent the development of leg weaknesses.**
- **The boar's feet should be trimmed regularly as deemed necessary.**
- **Boars should be washed with soap and water every 4 months and sprayed for the lice and mange.**
- **The pen walls should be white washed with a wash containing Gamma BHC at the same time.**

b) Gilts/sows

- **Provide enough exercise as some sows will tend to fatten if not exercised. A fat sow takes longer to come on heat. It is also more likely to crush her young piglets.**
- **First service for gilts should not be until the age of 7 - 8 months and the weight to be 100 -**

130 kg. Sexual maturity occurs as early as 4 - 5 months. Reproductive life of a sow is 4 - 5 years.

- **Keep about 3-4 gilts/sows per pen of 9-10 square metres which should be kept clean (change bedding regularly). The pens of sows/gilts should be next to the boars to stimulate them to come on heat.**

Breeding Cycle. The normal heat period lasts for 3 - 5 days

Heat signs:

1st stage: Early heat signs

- **General restlessness**
- **Vulva turns red and is swollen**
- **White mucus discharge**

2nd stage: Service period signs

- **Real Oestrus lasts for 40 - 60 hours**
- **Vulva becomes less red and swollen**
- **Slimy mucus discharge**
- **Tendency to mount and be mounted by others.**
- **The sow or gilt will stand still when pressure is applied to her back (can accept a man's weight sitting on her. Thus the right stage to send her to the boar).**

3rd stage: *Post Oestrus*-period signs

- **The sow/gilt will not stand still when pressure is applied to her back.**
- **The swelling of the vulva disappears.**

The usual length of oestrus cycle is 3 weeks (21 days) but shorter or longer periods may be seen in the range of 18-24 days.

Moment of serving / Insemination

The length of heat period is very variable among sows/ gilts. Ovulation always takes place when 70% of the length of a heat period has passed. Knowledge of the specific heat period of a particular sow is necessary so as to optimize the moment of insemination/service.
ADVICE: Serve or Inseminate 24 hours before ovulation.

Recommended practices:

Usually only a few of the signs will be seen

- **Put the sow with the boar for a short period every day when the heat is expected.**
- **Always take the sow to the boar. This is less upsetting for him.**
- **Put the sow and boar together just before feeding.**
- **Allow the boar to serve twice, with an interval of about 12 hours between services. If the sow doesn't conceive, she will return on heat in about 3-week's time.**
- **10 days before service, give the sow/gilt 1 - 2 kg of extra feed extra per day. Continue this for one week after service.**
- **During the last month of pregnancy, give 0.5 kg extra feed per day but decrease this gradually one week before farrowing. Provide plenty of water to help prevent congested gut during farrowing.**
- **Each boar should be kept in its own pen to avoid fighting.**

Stimulating regular heat

- **Remove the sow from the piglets early (at 4 - 6 weeks of age) and all at once.**
- **Take the sow to a house with dry sows.**
- **Put the sow close to a boar, in a way that makes direct contact (hear , see, smell) possible.**
- **The sow should not be given any feed on the day of weaning.**
- **The next day feed about 4 kg/day. This is called flushing and should be done for a maximum of 10 days or until the service takes place.**

- **Put the sows in groups (stress stimulates heat)**
- **If there are heat problems, change the type of feed for a few days.**
- **Maintain a good climate; see to it that there is sufficient light in the house.**
- **Sows should not be too fat or too thin when they are served. It is important to keep this in mind when determining the ration during the suckling period.**

Sow is in gestation when:

- **after 21 days of serving she does not show heat signs.**
- **Echo scan pregnancy detection (done by a veterinary) 23 - 35 days after service gives positive results.**

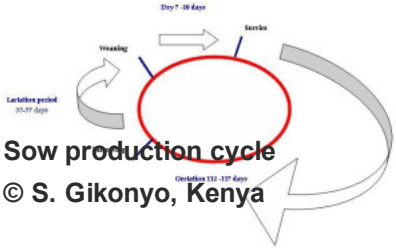
Culling

- **Sows that are difficult to get in-pig (pregnant) or which only manage to rear small litters should be sold off.**
- **Boars which are infertile or moderately infertile should be culled**

Farrowing and birth management

Expected date of birth

On average pregnancy lasts 115 days after conception (3 months, 3 weeks and 3 days). In gilts the udder begins to develop after two months of pregnancy. In the last 14 days of pregnancy the udder will increase in size. It feels firmer, and the nipples stand out more towards the end of the pregnancy.



Sow production cycle
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Farrowing preparation measures and birth of piglets
About a week before the expected delivery date, the sow should be:

- **Washed with soap and water and then rinsed with a mild disinfectant.**
- **Dewormed and treated for lice and mange. Any good acaricide (cattle dip) can be sprayed on the sow or gilt to kill the lice and ticks. An ordinary sprayer can be used for spraying, following manufacturer's instructions for mixing the dip with water.**
- **Immediately after washing she should be put in a pen of her own. The pen should be disinfected before the pregnant sow is put in. Putting the sow in the farrowing pen a week before the birth will also help her get used to the new surroundings. This increases chance of a quiet and smooth farrowing. It makes individual feeding of the sow possible.**
- **2 days before farrowing, the sow and the pen should be washed and disinfected again.**
- **Wash with soap and water and then rinse with a mild disinfectant. Water in which Jik or ordinary bleach has been added can be used as disinfectant.**
- **For large farms a shower area with high pressure sprayer for pigs should be provided.**

A serious pig farmer should have a sow calendar in place to assist him to

- **Plan the daily activities in the pig unit**
- **Plan and control the no. of services**

NOTE: The Weinholt's sow calendar is the most common

Signs of farrowing

- **Udder enlargement during the last 2 days.**
- **The udder will start to look much redder.**
- **A white or clear fluid can now be extracted from some of the teats.**
- **The sow will be livelier, alert, and restless and she may start to bite.**
- **She scrapes the floor with her forefeet and sweeps the straw bedding into a corner with her snout to make a nest.**
- **In group housing the sow may fight other sows.**
- **Just before delivery, the udder will swell and the sow will calm down.**
- **Before the first piglet is born a bloodstained fluid comes out of the vagina. In gilts the fluid may be released earlier.**
- **The sow will usually farrow during the night or evening.**

Feeding before farrowing

Reduce the feed given to the sow by one third in the last 3 days. Give maize bran if available to act as a laxative. A laxative encourages bowel movement. On the day of farrowing the sow should not be given her normal food but only laxative food (green leafy material, or maize bran for example) to prevent constipation. Should the dung be too hard; some Epsom salt should be given.

Birth of piglets

The duration of farrowing may last 1-2 hours and could go up 12 hours. A few piglets are born in a short interval after which there is a longer interval. If this interval lasts more than 1-2 hours or the total birth lasts more than 5 hours, then it is considered abnormal.

Piglets are born head first. A piglet usually appears every 15 to 20 minutes. Very small piglets may be born very quickly, one after another. During the birth the piglets are still enclosed in a membrane which will usually break open as they are born. It is quite common that piglets are still attached to the umbilical cord when they are born. This cord can be left, as it usually soon breaks off on its own. 30 minutes or an hour after the birth of the last piglet the sow pushes out the afterbirth. The sow may suck blood from the afterbirth to build up her strength.

There are times when a piglet may be still born (born dead). Older sows have a higher tendency to have still-born piglets. Although there are normally very few complications at birth it is advisable for someone to be present.

Problems related to the birth

Difficulties during birth

Although there are normally very few complications at birth it is advisable that someone be present. If the whole process of delivery takes longer than 8 to 12 hours then there is something wrong. The birth membrane may suffocate the piglet if they are not taken out. This may happen in particular to the last piglets.

Crushing of piglets Sows do not pay much attention to their offspring until all the litter has been delivered. Piglets that waste no time in searching for milk may easily be crushed if the sow lies down again in the course of the farrowing. A sow will not always accept human company whilst she is farrowing. Remain at a discreet distance and be ready to intervene if it appears really necessary.

Slow Delivery

If the sow seems to be taking a long time before the birth of the first piglet it usually means that the piglet is stuck in the birth canal and may have to be helped out by hand. For this the utmost

hygiene is essential.
The sow's rear end should be thoroughly cleaned and even disinfected.
The hands of the person helping the piglet to come out should also be cleaned and disinfected.
The helping person should then put a lot of vegetable cooking oil or Vaseline on the hand and the vagina to make both the hand and the vagina slippery. Do not use soap.
The prepared hand should then be worked slowly into the vagina with a forward and sideways turning or gentle rotating movement.
Simply by doing this it is possible that the sow will start her contractions and push the piglet out.

The sow can be injected with 2 cc of Oxytocin (not more). If this has no effect after an hour the piglet will have to be released manually, preferably by someone with a small hand which is clean and using cooking oil or Vaseline. If still no progress is made, give another injection. If the piglet is really too big a caesarean operation will have to be done where the womb of the sow is cut open to release the piglets. If there is no veterinarian who can be called easily and quickly, the sow will have to be slaughtered. It is very important to try to prepare for any problems which are expected before this happen.

Weak piglets
Some piglets may be born with weak breathing or may even appear dead. Piglets that have difficulty in breathing can be helped by holding their hind legs up in the air. By pressing their chest in and out their breathing can be stimulated. Pouring a little cold water over the head and chest can help, but the piglet should be dried off immediately afterwards.

Piglets born prematurely
Piglets that are born premature (at 110 days or earlier) have parchment-like skin, which is often very red with no hair or only very short bristles. They may have badly shaped claws, screwed up eyes and difficulty in breathing. They wander around the pen trying to find the udder. Most of them will not survive.

Accidental killing of the piglets by the sow
It is quite normal for sows to eat the afterbirth and any still-born piglets. Some people claim that it is by eating the afterbirth that the mother is encouraged to start on her piglets too. Some sows, especially young gilts, can be aggressive towards their litters. The reason for this is not clear. During farrowing, an inexperienced mother may become frightened by the new-born piglets. She may try to avoid them and start biting. One way of avoiding violent mothers is to choose or select young breeding gilts whose mother and grandmother weaned all their piglets every time they gave birth.

Protecting piglets from being killed by their mother
If the piglets are in danger of being killed by their mother they should be put in a box or covered creep area and kept warm (possibly with a heating lamp). A clean cloth or litter should be put in the box or on the floor to make the piglets comfortable. The mother will usually quieten down. A tranquillizer (or sedative) such as 'Stresnil' (2 mg/kg) can be injected if she does not calm down.

The sow becomes ill after farrowing
The most common problems affecting sows after farrowing are inflammation of the uterus (metritis) or of the udder (mastitis). The sow appears dazed, refuses to get up and to eat, and is feverish. The main causes of these problems are lack of proper hygiene and care of the sow and the pen, before, during and after farrowing. Poor health management allows organisms that cause diseases to enter the uterus or udder. Constipation and uterine prolapse are also some of conditions that may arise. Treatment and prevention of these conditions are discussed under common pig diseases.

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Piglet management

Care of the newborn piglets

A few minutes after the birth the umbilical cord may be pulled gently away or cut if necessary (to about 5 cm length). After birth, the navel of each piglet should be soaked in a cup of iodine solution to prevent inflammation and tetanus. Each piglet should be rubbed carefully, dry with a cloth.

The navel of a piglet being dipped in iodine solution

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Make sure the piglets are able to suck from the udder as soon as possible after birth. Their sucking will encourage the sow to let down her milk. Weak piglets may need to be assisted .It is important that the piglets immediately take advantage of the first milk called colostrum. Colostrum should be taken by all the piglets on the same day they are born. If taken at this time the colostrum is able to protect the piglets against diseases.

Newly born piglets being assisted to suckle

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A sow with her two-day-old litter of piglets resting after suckling

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After the first one or two days, the digestive system of the piglets breaks down the colostrum and its ability to protect from diseases is lost.
The piglets can be given additional feed of goat or cow's milk, or a mashed bean porridge to which a little sugar has been added. If the milk produced by the sow is too little to meet the needs of the piglets, or the sow completely neglects the piglets, they should be put on another sow or reared on cow or goat's milk.

Feeding piglets whose mother does not produce enough milk
If the sow does not produce enough milk the piglets should be given to another sow which farrowed or gave birth up to three days before. This sow should have fewer piglets than the number of teats on her udder. This is because the teats which are not being used by piglets dry off after three days. Piglets normally take control of one teat at birth and continue to feed from it until they are weaned. Transfer extra piglets to the sow with less piglets after disguising them with a spray which has a strong smell e.g. engine oil/kerol diluted with water to last at least 1 or 2 days.
All piglets should be sprayed as soon as introduction is done so that the foster mother doesn't

recognize its own as foreigners. If there is no sow to take over feeding the piglets, they will have to be given extra food by hand. Goat or cow's milk can be given to the piglets in the same way as for motherless or orphaned piglets.

Teeth Trimming

It is usually necessary to trim the piglets' teeth to prevent them biting the udder. The piglets are born with needle sharp teeth which may injure the sow's udder and prevent the sow from letting the piglets suckle. The piglets would then be left to starve. Only the points of the teeth should be removed. If any more is removed there is a risk of damaging the mouth. When trimming the teeth the tongue of the piglets should be rolled back to avoid injuring it.

The needle-sharp teeth of piglets being trimmed

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A teeth trimmer

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Anaemia or Iron deficiency

Anaemia is caused by iron deficiency. This iron is needed for the formation of haemoglobin. This is an important problem, especially for young piglets kept indoors. At birth the piglets have about 50mg of iron in their body. They receive additional 1-2 mg/day from milk while they need 7mg during the first week. It is obvious that the quantity of iron decreases rapidly and, if not supplemented the piglets become very pale a few weeks after birth and their growth slows down.

Iron injection solution

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This can be prevented by:

- **Giving the piglet (0-3 days after birth) iron injection 1cc intra-muscular, preferably at neck muscles, of 200mg/cc iron dextran or 2cc for 100mg concentration**
- **Oral iron- paste containing iron is put in the mouth within 24 hours of birth**
- **Wood ash can also be put into the pen. This will not provide iron, but it does contain other important minerals.**

Tail Cutting

Cut the tip of the tail within 4-7 days. This prevents tail chewing, which can lead to infections. A piece of chain can be hung down from the ceiling for the piglets to chew.

Heating for Piglets

In cold weather, a small area can be heated with an infrared lamp. This keeps the young pigs warm. It helps prevent pneumonia and crushing as the piglets tend to stay under the lamp when

not feeding.

Creep feeding
Young piglets from 7 days onwards should have high protein feed available to them. This has to be fed in a small area where the mother cannot eat the feed. The feed conversion rate of young piglets is very high and thus creep feeding is particularly economic. Creep feeding helps the piglets to get used to feeding at an early age.
NB: The sow's milk yield also begins to decrease just as the growing piglets require feed.

Piglets in creep area warmed by an infra red bulb

© S. Gikonyo, Kenya

Rearing motherless piglets
It is very important that newly-born piglets receive colostrum straight after birth to build up their natural resistance. Colostrum is the first milk that the sow produces after farrowing. If the sow dies whilst farrowing, the colostrum will have to be taken from another farrowing sow for the piglets. If they get no colostrum, their chance of survival is very small.
Cow's or goat's milk can be given to the piglets. This is after the piglets have taken colostrum. The milk should not be diluted, as sow's milk is very concentrated. It should be warmed up to slightly above body temperature (37° - 40°C) in a pan lowered into a larger pan containing boiling water.

Feeding programme

For the first two days the piglets should be fed at regular intervals 5 times a day, for about 10 minutes each time. On the third and on the fourth day they should be fed four times a day, and after that 3 times a day. After 14 days, increase the quantity of milk at each feed, but gradually decrease the number of feeds per day. Gradually change over to more solid feed, so that by the age of about three weeks they should be able to take regular feed. If no nutritious feed is available they should continue on milk for a while longer. The weaker ones can be fed four times a day for a longer time. The figures in the table are maximum quantities - it is better to give too little rather than too much feed. There should be a continuous supply of water, which should be boiled to avoid any contamination.

Feeding programme for orphan piglets

Day	No. of feeding times	Quantity each time (ml)
1	5	30
2	5	40-45
3	4	60
4	4	70
5-7	3	80-100
8-9	3	120
10-11	3	140
12-14	3	160

As soon as possible, the orphan piglets should move onto regular food. This should be of good quality, protein-rich, and easily digestible. Note-despite the amount of care they receive, hand-reared piglets will never grow as fast as those reared by a mother sow.

Castration

A pig is held securely between the legs of the assistant with the scrotum exposed and testicles rounded out

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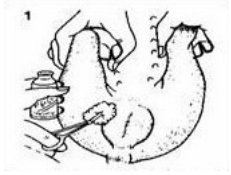
Male piglets are castrated to prevent their meat from boar taint. Castration also makes them more manageable when they become sexually mature. Castration should be done in the first two weeks of a piglet's life. The animals should be fit and healthy. If this is not the case it is better to postpone the operation. Two people are needed when castrating a piglet.

One person will carry out the small operation and the other person will hold the piglet. The pen should be dry and very clean to prevent infection to the wound. The knife should be thoroughly cleaned with a disinfectant. One person takes the pig by the hind legs and holds it firmly between his or her legs. The piglet's head should point towards the ground.

Castration, step by step:



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Step 1: Wash and wip the scrotum with a disinfectant.

Step 2: Press one testicle against the scrotal skin to tighten the skin over the testicle. Make a cut, large enough to allow the testicle to be pushed out. Uses a very sharp and clean knife for the operation.

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Step 3: Pull the testicle out, so that the attached cord is also pulled to the outside.

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Step 4: Hold the exposed testicle with the left hand while the cord is twisted twice.

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Step 5: Cut the cord attached to the testicle by scraping away with the edge of the knife. There is more bleeding if the cord is cut in one stroke or sweep of the blade.

Step 6:Afterwards wash the wounds thoroughly with a disinfectant like iodine


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to prevent infection.

The other testicle is removed in the same way.

Weaning piglets

The piglets should already have started getting used to eating from a trough alongside their mother, and now they should just continue doing so. They will need protein-rich feed as they will be growing fast. There should also be plenty of clean water for the piglets to drink. It is important for the piglets to learn to drink water early in preparation for weaning.

Weaning age

Somewhere during the first 2 months after birth, the mother should be separated from the piglets in order to stop the suckling period.

Early weaning gives more piglets per sow per year (higher litter index). Early weaning however may increase fertility problems (smaller litters) thus necessitating early culling. Good housing, good creep feeding and high levels of piglet care must be observed.

Under very good conditions wean at 3 to 4 weeks . Under poor conditions (back yard, local breeds, no concentrate) piglets can be weaned at 2 to 3 months Earlier weaned piglets are hardier during fattening than those weaned late. Piglets should be weaned when at least 6kgs.

Steps taken at weaning

Sow

- **Determine whether the sow is to be culled or served again**
- **On the day of weaning don't feed the sow, in the days following farrowing flush the sow until serving (flush for max of 10 days)**
- **Move the sow to another pen (near a boar)**
- **Sometimes vitamin/mineral is given just after weaning**

Piglets

- **Give piglets identification (tagging, notching, tattooing).**
- **Weigh the piglets to judge their average weight gain and uniformity**
- **Feed piglets with care to prevent digestive problems after weaning. The type of feed should not be changed during and just after weaning**
  - **Weaning (3-5 wks) do not feed more than 100-200g/piglet/day during 1st 4 days**
  - **Weaning (6-7 wks) start by feeding about 50% of the ration piglets receive during the last few days of suckling, then increase gradually.**
- **Check health of the piglets carefully (especially first 4-12 days after weaning).**
- **Prevent stress, pay attention to hygiene and climate of the pen.**

Problems at weaning

- **Post weaning diarrhoea common after weaning**

Symptoms: Piglets may have a rough coat, depressed appetite, sometimes diarrhoea, swelling around the eyes, hoarse squeaky voice, and sudden death

Prevention

- **Reduce feed after weaning**
- **Make no sudden feed changes**
- **Include crude fibre (bran) in the feed**
- **Prevent stress**
- **Use of medicated feed/water (prophylaxis)**

Treatment

Reduce amount of feed or do not feed at all for 1-2 days, give some bran or skim milk powder in the ration, antibiotics can be mixed with feed/ water.

- **White diarrhoea**

This disease affects piglet of 2-4 weeks old. E. coli bacteria and factors like first creep feed or

changes in sow milk are the major causes.
Symptoms: faeces become more liquid, piglets become pale. Lasts 2-5 days
Prevention:

- **Good feeding of the sow**
- **Hygiene**
- **Fresh and clean drinking water**
- **Prevent anaemia and stress**
- **Feeding of piglets as from 7 days after farrowing.**

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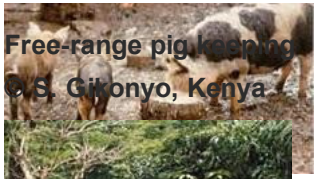
Housing

Good, efficient housing makes management easier and helps the farmer to successfully rear 85 % or more of all the live born piglets to market weight in the shortest possible time. Pigs at different stages of growth need different environments (temperatures). If they are to produce and grow to their maximum potential piglets need special protection against very low temperatures. Growing and reproducing pigs must be protected against high temperatures. The houses must therefore be built in such a way that the pigs are protected against extreme temperatures and other bad weather conditions such as cold winds and continuous rain.

Types of housing

Pig housing will depend on the rearing system. In free-range system, no housing is provided apart from night shelters, which come in different forms. In improved free range pigs are confined within a fenced area using strong wire netting or local materials such as bamboo. Shade is essential and is usually provided by simple roofs



constructed or use of tree shades.

Improved free-range system
© S. Gikonyo, Kenya

- **Semi-intensive: Pigs are kept in houses confined to a limited space. Feed mainly fresh water and fodder have to be brought to the pigs. A roof is provided, the walls commonly made of timber off cuts or old iron sheets.**

Semi intensive system
© S. Gikonyo, Kenya

- **Intensive pig keeping: Pigs are kept in complete confinement; fatteners, boars and sows with their litters in separate units. Management is usually high and higher numbers of pigs are reared.**

Intensive pig keeping system
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Advantages of keeping pigs inside a house and yard

- **The animals spend their energy putting on body weight rather than on looking for food and shelter.**
- **The number of piglets surviving will increase if they are born in secure and healthy surroundings.**
- **Controlling the health of the pigs is easier if they are housed, since it is easier to maintain good hygiene.**
- **Feeding routines can be more carefully controlled.**
- **Manure can easily be collected and used for fertilizing land.**
- **Protection from climate extremes**
- **Protection against theft**

The following are basic requirements that a pig house should meet to ensure increased productivity and profitability of a pig enterprise:

- **House should be warm and free from draughts**
- **Floor should be kept dry and not too smooth to avoid pigs from falling and therefore being unable to move in the pen freely**
- **The floor should be cemented since pigs have the tendency to dig into the ground thus making it difficult to clean and increasing the rate of parasitic infestation to pigs.**
- **The house should have dunging area at the rear and feed trough and water trough in front. It should have a slope to allow free drainage.**
- **The pens should not be near the dwelling houses because of smells and flies.**
- **Cheap, readily available and durable materials should be used for house construction to reduce cost. The house however should have all the essential parts.**
- **To minimize transfer of disease animals of the same age should be housed as close as possible next to each other and the wind flow should be from the direction of the youngest to the older animals.**

Location of the Pig House

- **A pig house should be sited away from walls of other buildings to allow air circulation and where possible about 100m away from the residential house.**
- **The area should be well drained.**
- **The building should face east - west to avoid direct sun rays.**
- **The pig house should be located such that the wind flow is away from the residential premises.**

In hot climates buildings should be of the open type (half walls) which facilitates surveillance, promotes excellent ventilation and are inexpensive. It is difficult to control heat stress in fully enclosed buildings in the tropics.

There are a number of designs according to their use:
1. Farms considering only weaner pig production

2. Farms concerned only with fattening bought-in pigs
3. Farms with both breeding and fattening enterprises
4. Farms with breeding operations and fattening facilities for only some of the animals

The decision as to which option to follow is based on the general organization of the local pig industry.

Recommended Materials

Floors. Floors must be impermeable, and easily cleaned with a shovel and brush as well as with pressure washers. This allows eggs of parasites to be removed and prevents spread of infection. Floors of hardened soil (murram) are not appropriate because pigs grub the soil. Special care should be taken to make the surface of floors non-slippery where concrete floors are made. Wooden floors are warm but have specific problems such as decay, insect attack and chewing by pigs. Hardwood must therefore be used, making them very expensive. Concrete floors are tough and long lasting if well made; easy to clean and reasonably priced. They are also cool, which is beneficial in hot climates. Floors need to have a sufficient slope of about 3% or slightly steeper which allows adequate drainage.

Piglets on saw dust bedding

© S. Gikonyo, Kenya

Bedding. The coldness of the concrete can be reduced by placing bedding material in the pen such as rice straw, sawdust, dry leaves etc. As a precaution it is better not to use plants or seeds as these may be poisonous. Pigs have a habit of finely chewing their bedding litter and will swallow part of it. The leaves of the Wonder Oil Plant (Castor Bean - *Ricinus communis*) for example should not be used. Bedding material should be changed regularly to keep the pen clean and to avoid any parasite build-up. NB. The mixture of bedding with dung and urine makes an excellent fertiliser for the fields, and is especially valuable if converted into compost.

Walls. Walls should be erected over a foundation of sufficient strength. They can be constructed of brick, stone, mud or bamboo or any other material suitable for the locality and climate. Stone or brick walls are costly but durable and hygienic. Bamboo and mud walls are economical and useful but are temporary and hard to keep hygienic. Walls supporting the roof and wall partitions with which the pigs come in direct contact must be strong and materials such as brick, stone, or cement concrete may be best at least for the lower parts of the walls.

Vertical barriers. Partitions within piggeries (90cm, except for boars, which should be 110cm), which allow different categories of animal to be separated, should be provided with gaps to allow good circulation of air at pig height. In order to prevent pigs from escaping, spaces between planks must be small at the bottom.
In order to avoid damage from pushing, posts must be solid and planks nailed from inside. Partitions of reinforced concrete 10cm thick are also possible but these are more expensive. These solid partitions should be limited to transverse sections separating different areas of the building but should not be for longitudinal partitions as this would limit air flow at ground level. For the outer wall special wire netting or gates are used effectively. For the inner walls, if the piggery is two-rowed, a system of rails or flexible wire above the trough is preferable. This allows pigs in pens opposite to see each other. Older gilts and dry sows come on heat faster when they see the boar.

Gates. These should consist of 200mm planks, built with reinforcement in the shape of a 'Z' on the inside. A width of 60cm is sufficient even for the biggest animals. They should be attached

with particularly strong fittings to withstand pigs rubbing against them. The latches should be of the locking type that is not opened if the door is shaken. A latch is moved much more easily than a bolt.

Roofs. The roof should be light, strong, durable, weather-proof, a bad conductor of heat and free from tendencies to condense moisture inside. They must ensure maximum shade and should extend down almost to ground level to reduce penetration of oblique sun rays and entry of rain when blown by the wind. Roofs can be made of thatch, aluminum, galvanized iron, tiles, wood or bamboo. Thatch, bamboo and galvanised iron roofs are the most recommended. Recycled sheets certainly are still of use for makeshift piggeries.

Dry feeder
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Feeders. A considerable amount of care must be taken with feeders to avoid all feed wastage. In the first place, whatever the type of piggery, they must be fixed. A mobile feeder is always up-ended and the food soiled, trampled and wasted. As a consequence, experience has shown that feeding on the ground is not appropriate. In hot climates pigs occupy most of the pen area and tend to soil the entire floor area, particularly at high stocking densities. Wastage of food seems to be higher.

Feeding troughs must be easily cleaned, even if pigs themselves do this to an extent. The internal surface must be smooth and without sharp angles. The depth must be sufficient (20cm) such that the food only occupies the bottom and cannot be flicked out.
Finally, they should not be used as a wallow: pigs have the habit of lying in feed troughs. Therefore, subdividing the trough transversely with metal rods (10mm preferably) every 40cm, if it is to be used by many animals, is recommended. This has the advantage of allocating places from the moment of feeding.

The trough may be wooden and fixed to walls with removable bolts. However, if it is to be used

by more than two animals it must be replaced by one made from cement, which meets all necessary requirements. It should be placed along the service wall to aid distribution of food. Cement troughs should have a round hole in the bottom with a bung placed from the outside; this will allow them to be cleaned with water.

If a basal diet is fed ad libitum, this may be offered effectively from wooden hoppers which may contain maize, dry cassava chips, etc. This ensures that animals do not go without food, and makes distribution easier. These hoppers may be made readily from wood. There are advantages in surrounding the bottom corners of the base with iron to prevent its rapid decay. The animals must be able to reach the feed easily. The feed level must be kept as low as possible to avoid feed wastage.

Watering

A water section in between two feeding sections in a concrete trough

Pigs in hot climates, particularly lactating sows, must be given plenty of water, which should be continuous. When feeding under restricted conditions, the troughs may be used as drinkers between meals.

For large piggeries where a running water supply is available, automatic drinkers should be used. Water within bowl/drinkers is soiled regularly and pigs themselves often compound the situation. Nipple or valve drinkers are preferable. These are placed at a height of 60cm with an additional step of 30cm placed beneath them if they are to be used by piglets. These drinkers have several advantages; the water drunk is always clean; spillage is minimized and costs are reduced. Their use is governed to an extent, however, by stability of water pressure. Their control is not standard and becomes impossible under situations where pressure is subject to wide variations. However, low pressure can be maintained by using a reducing valve or a water storage tank.

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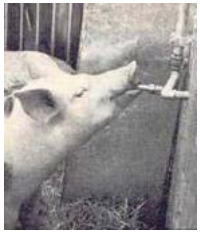

Automatic drinking nipple

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Space Requirements:

	Sows	Fatteners	Weaners	Boar
Trough Length	40cm	35	20	-
Floor Space	1.2m2	1m2	0.5m2	2.5 x 3
Dung area (length)	1-1.5m	-	-	-

Lactating sows will require a creep area (1 square metre) or special pens fitted with guardrails /hurdles or supplied with a farrowing crate.

Standard pen measuring 3m x 2.5m is ideal for:

- **3 dry sows**
- **8 fatteners**
- **1 boar**

Sow in a farrowing crate

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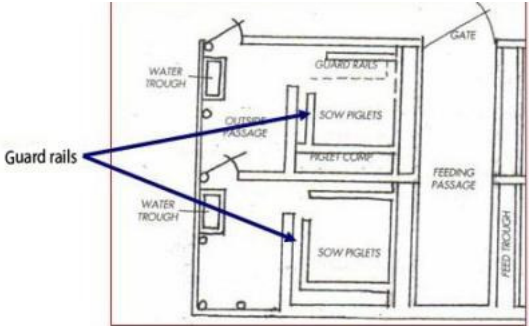
- **8 - 12 weaners**

NB

- **The above dimensions might need adjustments to meet local conditions e.g. for hot areas enlarge the area by 10%.**
- **Provide wood shaving in the nest especially in the first week**
- **Creep area must have an area of at least 1square metre**
- **Lying space behind the trough must be at least 2m long and dung area up to 1.5 square metres**
- **The lowest bar of the rails in the farrowing area must be 23cm above the floor**
- **Trough depth 20cm**

Special Housing Requirements Pens for Sows with Piglets

Special accommodation for the sow with piglets is essential to avoid high mortality among the piglets. Separate areas for both the sow and piglets are necessary. Not all sows are naturally attentive (good mothers), so special management is needed to avoid crushing of piglets.



Using guard rails and hurdles and providing a creep area where the piglets have a warm nest away from the sow can reduce mortality. At the same time, it's important to have good access to the pen and be able to feed and handle the animals. Several designs have been developed to meet these basic requirements.

Guard rails at 23cm from floor and 75cm from the walls
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Constructing a creep for the piglets

You may provide the piglets with a special safe place called a 'creep area' in the sow's pen where the piglets can creep in for warmth and safety. The sow's pen can be divided into two parts, the bigger area for the sow and the smaller area (1 square metre) for the piglets. The opening to the creep area should be small enough to only allow piglets inside. A heating lamp or charcoal burner raised on a firmly placed block should be put in the creep area to provide extra warmth. In very cold weather, the creep area can also be covered with empty grain bags in order to trap heat inside the creep area. The piglets will need the extra heat until they are 2-3 weeks old in the hot months of October and November or until they are 4 weeks old in the cold months of June and July. When the piglets are cold they will tend to bundle together. The piglets nearly always prefer the protective 'creep' rather than lying against the sow. The creep area can be used for introduction of a little feed for the piglets as early as the 7th day of age. This helps the piglets to get used to eating other feed in readiness for the time of weaning. (see figure 16 Piglets in creep area warmed by an infra red bulb)

Farrowing/rearing pen with sow confined

A farrowing rearing pen with the sow confined
A combination of a farrowing and rearing pen, the sow is confined in the sow area (0.7 x 2.5 metres) leaving two creep areas on either side (0.8x2.5 metres). A run of 1.5 metres is provided at the back.

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Modern farrowing / rearing pen

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Modern Farrowing /Rearing pens

Modern farrowing rearing pens are also available but cost is prohibitive. The sow is confined in a space of 65cm by the two sets of hurdles. A creep area in front (50 cm by 80 cm) is provided with heating source to provide warmth to the piglets. The floor is made up of plastic slates for easy manure handling.

The pens should meet the following conditions

- **Both sow and piglets must have a comfortable lying area (avail litter).**
- **Maintaining good hygiene.**
- **Piglets must be able to reach the sow's udder easily**
- **Making the pen adjustable is an advantage (young or older sows can be accommodated easily).**

Housing of Dry Sows/Pregnant Sows

Dry and pregnant sows can be housed in different ways. The choice can be group housing or individual housing. For group housing, a maximum of 3-4 sows should be kept in each pen of 9-10 suare metres.

Sows in group housing

On small farms it is difficult to form uniform groups in terms of age, pregnancy stage, size etc. However, effort should be made to group pigs that are being fed on similar rations. If this is not possible then the possibility of individual feeding should be explored.This can be expensive.

At weaning, sows have to be moved from the farrowing pen to another pen (preferably another compartment or building). To stimulate them to coming on heat, sow contact with the boar is

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essential. This could be achieved by keeping the sow in a pen next to the boars' pen. Where land is available, sows can also be kept partly or completely out doors. Sows kept in paddocks should be rotated regularly to avoid parasite problems and to keep the pasture in good shape.

Housing of Weaners

At weaning, the sow should always be taken away from piglets. The weaner after a period can be taken to another pen. Weaners of the same age can be kept together. Pens for weaners can be simple as long as a lot of attention is given to hygienic condition to avoid scour and worm infestation.

Housing of Boars

The basic requirements for environmental comfort of boars and sows are similar. It has been observed that excessively high temperatures affect the fertility of the boar's semen. Thus care should be taken to ensure that the boar is not subjected to extreme hot or cold conditions. A minimum area of 2.50 x 3.00 square metres is required. When a boar has a mate, the pen area should be 8 - 9 square metres. A separate area can be created (4.00 x 4.00 square metres) where the service can take place. The pen or service area must be kept dry and free from obstacles.

Gilts

Gilts from three months till service (8 months) can be kept in pens which are similar to fattener pens. Afterwards they should be kept in a different pen with a different floor space. It is important to have enough spaces available for gilts. 8-10 gilts should be kept in one pen of 3 x 3m.

Housing of Fatteners

Housing of fatteners
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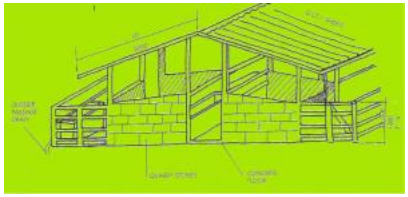
In designing the kind of fattener house, the following must be taken into consideration:

- **Construction which reduces labour requirement**
- **Construction which increases efficiency in operation**
- **Construction which gives good comfort to the pigs, increased feed conversion efficiency (FCR) and hence increase growth rate.**

NOTE:

- **A limited number of fatteners per pen has a positive effect on the productivity (high ADG)**
- **Not more than 8-12 fatteners should be kept in a single pen (3 x 3 m).**

Layout of the piggery



A modest piggery may be composed of adjacent pens in one row with a roof extending over them so that exposure of pigs to sunlight is minimised. The dunging area should be on the side where the door is with the feeder on the other side in the shelter of the roof. Piggeries consisting of more than six pens should be built in two rows to avoid the building being too long. This is to enhance air circulation.

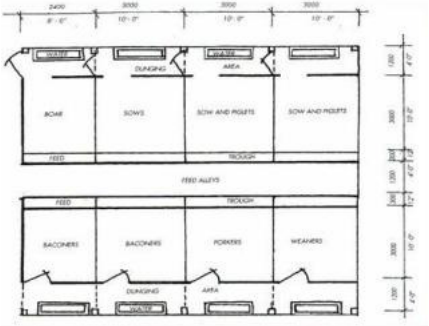
The layout of the building should be arranged to reduce traveling distances to a minimum. Pens should be positioned as in a piggery with only one row and opposite each other with feeders facing each other. The central passage should be 1.5m wide to allow wheelbarrows and feed trolleys/wagons to pass. It should not be too wide otherwise, the cost of covering the area will be high.

Stores must be situated in such a way that feed trolleys/ wheel barrows have good access to

passages and that walking lines are as short as possible.

Pig House Construction Planning

Before building a pig house, one must know the number of places or pens needed for lactating sows, dry and pregnant sows, replacement stock, boars and fatteners. These places can only be calculated after a farmer has decided about the following starting points:



- **The number of sows on the farm.**
- **The expected farrowings per sow per year (litter index).**
- **The weaning age.**
- **What kind of weaner pens the farmer want to use.**
- **Whether the farmer wants to use artificial insemination or natural mating.**
- **Whether he selects his own young breeding stock or wants to buy them from outside and at what age.**
- **What type of housing for dry and pregnant sows (group or individual).**
- **The expected culling rate.**
- **The expected growth of the piglets.**
- **Days needed for disinfections and cleaning.**
- **The expected growth for the fatteners.**
- **The number of animals per pen.**

Construction plan for small scale sow unit

Formulas to Calculate the Number of Places or Pens

The number of places or pens can be calculated as follows: Farrowing rearing pens:

$$\frac{\text{No. of sows x litter index x occupation days}}{365} + 10\%$$

Weaner pens

$$\frac{\text{No. of sows x litter index x occupation}}{365} \times \frac{\text{piglets per litter}}{\text{piglets per pen}} + 10\%$$

An allowance of 10% is given for longer gestation periods, lower growth of piglets and other irregularities in the reproduction cycle.

Places for dry and pregnant sows

$$\frac{\text{No. of sows x litter index x occupation}}{365}$$

(1/3 dry sow till 1 month after service; 2/3 pregnant sows)

Places for replacement stock

$$\text{No. of sows x culling rate x selection rate x } \frac{\text{rearing period (month)}}{12 \text{ months}}$$

Number of pens for boars

A teaser boar is necessary when A.I. is used. When natural service is used, one boar for every 15 sows must be considered.

Place for fatteners (closed farm)

$$\text{No. of sows x culling rate x selection rate x } \frac{\text{rearing period (month)}}{\text{12 months}}$$

Examples

On the example farm with 50 sows:

Piglets are weaned at 7 weeks and moved to the weaner pens 5 weeks later weighing 20 kg and housed 8 per pen, 3 days of cleaning weaner pens.

The sows are kept in groups of 5.

Litter index 1.7, while for the occupation days one week is taken for acclimatization the sow before farrowing and 3 days for cleaning and disinfections.

Number of farrowing rearing pens

$$\frac{50 \times 1.7 \times (49 + 10)}{365} + 10\% = 15.1 = 15 \text{ farrowing-rearing pens}$$

Weaner places

$$\frac{50 \times 1.7 \times (35 + 3)}{365} \times 7.5 \text{ Weaners/litter} + 10\% = 73 \text{ places}$$

Number of places for dry and pregnant sows
The number of days from weaning to service is 6 (fixed). After calculation we arrive at 45 lost days.

$$\frac{50 \times 1.7 \times 159}{365} = 37 \text{ places}$$

(Cycle is 365/ 1.7 = 215 days. 215 - 49 - 7 = 159 days occupation)

Places for gilts
The culling percentage is 40% and only 2 from the 3 gilts selected at an age of 3 months will come in production. The gilts stay in the group gilt-pen till service.

$$50 \times 0.4 \times \frac{3}{2} \times \frac{8 - 3}{12} = 12.5 \text{ places}$$

Places for fatteners
The expected daily gain is 500 grams and the growing period is from 23 kg till 93 kg live weight. First the number of rounds has to be calculated: growth (93 - 23kg) is 70kg. Daily gain 500gram so it takes 70 / 0.5 = 140 days to grow to slaughter. An allowance of 10% has to be added (slow growers, extra occupation and cleaning) 140 + 10% total occupation days. This means 365 / 154 = 2.37 rounds per year.

Places needed

$$\frac{50 \times 1.7 \times 7.5 - 30}{2.37} = 256 \text{ places (30 are the replacement gilts)}$$

Category	No of places	No. of pens
Rearing sows	15	15
Weaners	73	10
Dry and pregnant sows	37	8
Gilts(Replacement)	13	4
Boars	4	4
Fatteners	256	32

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Feeding pigs

For pig rearing to be an economical venture special attention should be paid to both quality and quantity of feeds fed. High growth rate and fertility can only be achieved through proper feeding. In pig production, feeds contributes to 60 to 80% of the total rearing cost and it is therefore important to feed recommended quality and quantity for each pig category. Proper troughs are important to minimise feed wastage especially where floor is not cement or where litter is applied on cemented floor.

Pigs are known to eat a wide range of feeds available at farm level including kitchen swill and green farm by-products. However their growth performance will depend on the feed quality. Pigs must therefore be fed the correct quantity of the right feed mixture. The nutrient

requirements, especially digestible energy and protein, of the various production classes differ. These production classes include:

- **boars and pregnant sows**
- **sows with piglets (lactating sows)**
- **young pigs, three to 10 weeks old**
- **growing pigs up to slaughter at a live weight of 60 or 110 kg.**

Feed sources

Feed mixtures can either be bought or the farmer can mix them himself. The latter is less expensive but it is important to consult an expert on how to mix the feedstuffs that have to be included in the mixtures for each of the production classes. The various feedstuffs must be weighed off correctly before mixing.

Feed mixtures for each of the pig classes must contain the right quantities of the following nutrients, namely:

- **digestible energy (DE)**
- **proteins**
- **minerals**
- **vitamins.**

Grains

Grain constitutes between 55 and 70% of the total feed mixture. The grain in a mixture provides mainly energy (between 60 and 80% of the total DE in the mixture) it also contributes substantially (30 to 60%) to the protein content of the mixture.

Grain by-products. Grain by-products such as wheat bran, maize bran, maize leaves, maize-stalks and maize-cobs are used to dilute the DE content of the mixture. Brans have a protein content higher than that of grains and are also relatively inexpensive.

Cane molasses

Has been recommended as an additive to improve the palatability of dry rations, and particularly in cane-producing countries, as an addition to concentrate or swill-based rations at levels up to approximately 30 percent. Higher levels have generally not been recommended due to difficulties in handling and mixing; loose faeces associated with diarrhoea; dirtier animals and floor pens, and most importantly, an increasingly inferior feed conversion as higher levels of molasses were used.

Plant protein sources

- **Oilcake meals**

Soya-bean oilcake meal and sunflower oilcake meal are plant protein feedstuffs usually included in pig feed mixtures. Soya-bean oilcake is of a higher and better quality protein and contains considerably less fibre than sunflower oilcake.

- **Full-fat oilseeds**

Full-fat soya-bean and sunflower seed meals have a high oil content. The oil results in soft fat in pig carcasses. Therefore, the inclusion of these two feedstuffs, if fed in combination with maize, must be limited in rations for finishing pigs.

- **Lucerne**

Lucerne is also used. It has a high fibre and low DE content. Therefore, the inclusion of lucerne in feed mixtures for pigs must be limited.

Animal protein sources

- **By-products of the animal and fishing industry can be used as animal protein sources for pigs.**
- **Fishmeal -Fishmeal is the most frequently used and best protein source to include in feed mixtures. It also has a high DE content.**

- **Blood and carcass meal - Bloodmeal has a very high nutritional value. Do not, however, use more than a maximum of 5% in feed mixtures because it is unpalatable. It becomes burnt easily during processing, which has a detrimental effect on the quality of the proteins.**

Calcium and phosphorus sources

Feed lime is a good calcium source and is not very expensive, but it contains no phosphate. Monocalcium phosphate, dicalciumphosphate and bonemeal are usually included as sources of phosphate. These sources also contain calcium, but in smaller quantities than feed lime.

Waste products in pig feed mixtures

The utilization of kitchen wastes from institutions such as hospitals, schools or hotels, and the use of brewery wastes, processing, slaughter wastes and agricultural residues, if used to feed pigs, would help to reduce feed costs and also reduce environmental pollution. Organic wastes are subject to rapid deterioration and contamination by micro organisms, some of which are extremely pathogenic Waste products must therefore be used with great caution in pig rations. Even hard objects such as pieces of broken glass, which can injure the pigs, are sometimes found in waste products. However, it has been shown that by ensiling, or by thermal treatment (swill should be boiled for 30 minutes and cooled before feeding.), preferably complete sterilization, organic wastes can be completely decontaminated and safely used as alternative feedstuffs.

These products are usually high in moisture (water) content and therefore have a very low nutritional value when fed in a wet form.

- **Only use waste products in an air-dry form.**
- **Use a flat cemented area in the sun for drying the waste.**
- **Remove any undesirable material from the waste when it is spread out on the cemented area.**
- **After drying, grind the waste in a hammer mill. The milled meal can then be used to replace part of the ingredients when mixing pig rations.**

The nutritive value of kitchen waste

Before using the waste-product meal it is advisable to have it analysed for protein, fat, fibre, calcium and phosphate content by an analytical laboratory. Thereafter it is important to get the advice of a pig nutritionist on how much of the dried waste meal must be included in a pig ration.

Analysis of these wastes indicate that the nutritive value for pigs is adequate with respect to protein and energy, however, its low dry matter content tends to affect growth due to a reduction in total dry matter intake, principally in younger animals, fed ad libitum (González et al., 1984).

The digestibility of the nutrients is variable and somewhat related to the source. Kornegay et al. (1970) in reviewing the performance of pigs fed heat-treated garbage residue from different sources concluded that it should be supplemented with a 15 to 18% crude protein concentrate in order to improve the daily live weight gain (to more than 600 g/day) and feed efficiency. No marked difference in carcass quality was observed when garbage residues were fed to pigs.

Nutritional requirements

For good production a pig should be supplied with the nutrients it demands for a particular form of production. This means that an animal should consume what it requires for its production. Nutritional requirements of animals are determined by means of research and summarized in tables, booklets etc. Many countries have manuals of feeding standards. The art/experience of the farmer in the finer adjustments of feed intake to meet the performance of the animal is also important. There are a number of essentials that must be provided through the feed to the pigs. These include fibre, energy, protein, minerals and vitamins.

Pig feed requirement

	Creep	Sow and weaner	Fattener starter	Grower finisher	Lactating Sow feed
Lys (min)%	1.25	0.6	0.95	0.75	0.6
DE Kcal /kg	3350	3050	3300	3200	3200
% DCP (min)	16	15	14	13	13
M+C (min)%	0.7	0.35	0.55	0.45	0.45
EE (max)%	7	7	6	7	7
CF (max)%	4	6	5	6	8
Ca (min-max)%	0.8-1.0	0.8- 1.0	0.7-0.85	0.6 - 0.75	0.9 - 1.1
P (min)%	0.75	0.7	0.6	0.5	0.6

Making Rations

A ration refers to feed. It is a combination of different feedstuffs (ingredients) indicating how much of each feed stuff has been used and the nutritive value it is contributing. A complete ration therefore contains all the nutrients needed in proper proportions. The quality of a ration will depend thus on the quality of the feedstuffs used.

In any ration every feedstuff used makes up a certain % of the mixture. The total mixture will add up to 100%. What determines the contribution of nutrients by a certain feedstuff in a ration is its percentage inclusion and concentration of the nutrients.

Farmer ration

Own farm rations can help to reduce the cost of feeding the pigs considerably, however feed mixing must be done thoroughly and analysis of samples may become necessary from time to time. Comfrey and Velvet Beans can be used to supplement purchased feed as follows:

- **Comfrey 20%**

Velvet bean 20%
Cereals 60%
Preconditioning velvet beans

- **Soak the beans in cold water and leave it overnight**
- **Clean the beans in clean water the following day**
- **Boil the beans for 1 hour**
- **Rinse in cold water**
- **Dry in the sun**
-
- **Pound in mortar or grinding mill**
- **Mix 25% velvet bean powder with 75% cereal. Alternatively prepare feed as follows:**

- **Commercial pig feed 20%**

Grown Fodder/ swill 80%
This reduces up to 20% of feed costs.

Other Alternative Feed Resources to Assist to Reduce Feed Cost

Pigs are non ruminants, hence cannot extract a lot of nutrients from fibrous materials. Feeds with high cellulose content should thus be minimized in pigs diet. When feeding these alternative feeds, commercially compounded feeds should always form the bulk of the pigs' ration.

Sweet Potatoes vines and tubers
Vines and tubers are quite palatable to the pigs. These do not require any cooking and can be chopped, sun-dried, and used as an energy source for pigs. The performance of pigs fed on dried sweet potato chips, although inferior to pigs fed on maize, offers an additional and interesting option for feeding

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pigs in the tropics. Fresh vines can be used to replace 10% of total dry matter, (Mora et al., 1991) found that performance of 6 to 12 kg weaners tended to improve, both from the point of view of average daily gain (186 vs. 202 g/day) and feed conversion (2.80 vs. 2.50).

Lucerne
Lucerne is high in protein, minerals trace elements and vitamins. Pigs readily eat it in green form; it can also be dried and ground to be included in the pigs ration. However, due to the amount of cellulose most of it will be wasted in the digestive tract.

Fodder beet and edible canna
Fodder beets are readily eaten by pigs when chopped and do not require any cooking. Both tuber and tops of edible canna can be fed.

Kales
Pigs readily eat them and due not require any cooking

Russian comfrey
Both the tubers and tops are readily eaten by the pigs. The leaves are richer in crude protein

than the potato vines. The leaves can be dried and included in the pigs ration.

Giant Amaranths (terere)
It is a good source of calcium and iron. The plant is very easy to grow but difficult to eradicate.
Note: Fodder crops and swill can replace half of the compounded feeds. About 6 kg of fodder/swill can replace one and half kg of compounded feeds. For Lucerne due to its high protein content it can be fed to dry sows on alternative days. At no time however should the fodder crops constitute more than 50% of the pigs ration. Even if the farmer intended to replace all is compounded feeds with fodder crops, this is not feasible since a pig will not be able to finish fodder equivalent in kg to daily ration of compounded feeds.

Daily Feed Requirements

- **Dry/pregnant Sows and Gilts:**

Dry sows and gilts give 2.5/kg day of sow and weaner meal
Give extra 1kg/day one week before serving gilts and sows and one week after service.
Give lactating sows 2.5 kg/day of sow and weaner meal for maintenance and 0.25 kg/day extra for each piglet being suckled.

- **Boars**

Give boars 2.0-2.5 kg/day of pig sow and weaner. If the boar is regularly used give it 2.5 Kg.

- **Piglets**

Give creep pellets i.e. 0.5 - 1.00 kg/day from day 7 up to weaning time per piglet
The feed should be mixed with sow and weaner meal the last one week before weaning.

- **Feeding of Growing and Finishing pigs**

- Pigs weaned at 3 - 5 weeks of 11 - 13 kg body weight should continue being fed on the starter diet until they reach 18 kg live weight. Pigs weaned at 7 weeks or older may be switched gradually to sow and weaner diet.
- For growing or finishing pigs all ration changes should be made gradually. If this is not possible the feeding level of the new diet should be low until the pigs become accustomed to

it.

- Where post-weaning scours are a major problem, restricted feeding during the fist week after weaning may reduce the incidents of scours.

- For treatment in case of an outbreak of scouring, medication through drinking water is preferable since sick pigs go off feed.

Feeding rates by age and expected weight:

Age (wks)	Weight (kg)	Feed/day (kg)	Feed type
8-10	12-15	0.66	Sow and weaner/starter
10-12	15-20	1.0	Sow and weaner
12-16	20-40	2	"
16-18	40-50	2.5	Finnisher
18-24	50-84	3.0	"
24-28	84-105	3	"

NB: When feeding animals any sudden changes can lead to loss of production. Thus feed changes should be as gradual as possible.

Water requirements

Clean and fresh water should be provided ad lib to all categories of pigs. Lactating sows will take 15- 25 litres/day of water depending on litter size. Dry sows and boars will take up to 10 litres/day while pregnant sows will take 12-14 litres/day. Fatteners 4 to 8 litres/day depending on age.

At higher environmental temperatures, the water requirement increases.

Feeding Methods

The methods of feeding to be recommended will depend on the number of pigs to be fed, the rate of gain desired, the type of pig and the amount of labour available. Feed trough use is recommended.

- **Dry feeding. Feeding dry feeds. This is best for pelleted feeds but there is wastage and dusty conditions when the feed is in the form of dry meal or mash.**
- **Wet Feeding. This is the feeding system where water is sprinkled on the feed to minimize the dust. Strict hygiene should be maintained in this method. Less feed wastage unlike the dry feeding and reduced lung irritation caused by dry dusty feeds.**
- **Restricted Feeding. In this feeding regime pigs are fed once or twice per day. Feeding twice per day is recommended.**

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Common pests and diseases in pigs

Diseases can lead to a loss of income, slower growth rates or loss of animals due to death. In these circumstances it is essential to treat the animals, as long as the cost of treatment is not more than the loss of the expected income from the sale of the pigs. If possible, you should seek the advice of a vet when you suspect there is a disease in your piggery.

Pigs are at great risk of falling ill because many animals are kept together in a small space. Infectious diseases spread easily and quickly among the animals. You will also find that commercial breeds tend to be less resistant to diseases.
Sick pigs generally have the following signs:

- **It may not eat or not show interest in feed /water**
- **It may breathe rapidly indicating of a fever**

- **In white skin-coloured pigs the skin may become reddish.**
- **It may have diarrhoea which may sometimes be bloody or blood stained.**
- **Droopy ears or ears pointing downwards.**
- **Dull eyes.**
- **Dull skin and hair.**
- **Its tail will become limp.**
- **Separates itself from the rest**

Parasitic diseases

Parasites are divided into external and internal parasites.

Internal parasites (Worms)

Worms are one of the most serious threats to pig keeping. There are more than 30 types affecting the intestines of pigs. The most important are the intestinal roundworm, the lung worm, the whip worm and the tape worm.

1) Roundworm

Roundworms live in the gut and take food from the pig. The pig can therefore become thin.
Symptoms:

- **Anorexia (loss of appetite) in advanced stages.**
- **Anaemia (loss of condition).**
- **Weight loss in later stages.**
- **When the worms die suddenly after treatment, they can block the gut and cause sudden death.**

Prevention:

- **Control with medicine in the food is useful and provide clean and dry pens.**

- **Separation of young ones from adults.**
- **Washing sows before farrowing.**
- **If pigs are allowed outside, rotational grazing and periodic resting of pastures to allow disinfection.**

Treatment:

- **Periodic deworming**
- **Herbal treatment: herbs such as Moringa are considered to be antihelmintic (able to kill intestinal worms)**

2) Whipworm

Symptoms:

- **Anaemia**
- **Haemorrhagic diarrhoea causing anaemia**
- **Weight loss**

Prevention and treatment:

- **Deworming**

3) Lungworm

Symptoms:

- **Coughing**

Prevention

- **Deworming**
- **Clean pens**

Treatment:

- **Riperol (or Levamisole) injections are used in treatment, but are may be difficult to obtain in**

many places.

4) Tapeworm (measles)

Pork measles is caused by tapeworms which live in the muscles of pigs. They do not usually affect the pig, but can lead to pain and the pig may find it difficult to move around. When people eat undercooked measly pork, the worms develop inside the people, and can make them very sick.

Symptoms:

- **Poor growth**
- **Rough grey hair coat**
- **Swollen belly**
- **Emaciation**
- **Anaemia**

Prevention

- **Prevent the pigs from wandering about where they can feed on human faeces**
- **Make sure that people working with pigs use toilets (hygiene and sanitation)**
- **Deworming**

External parasites

External parasites include mange, lies and myiasis (see below).

Mange

It is caused by small parasites called mites that live in the skin. They provoke severe itching and irritation.

Symptoms

- **The pig becomes itchy, and scratches and rubs against the walls of the sty and other objects with the skin between the legs, around the eyes, ears and neck being principally affected.**
- **The coat looks dull, and there are bare patches, heavy crusts, and lines on the body that look like ribs**
- **Restlessness and itching which can be very severe**
- **Red pimples on skin, which turn into crusts and scabs. Later the skin looks very rough, is thickened and covered with flakes scratching. Skin may show red spots or bite wounds**
- **Thick skin and rough hair coat**
- **Anaemia in severe cases especially in piglets**
- **Death in severe cases**

Prevention:

- **Wash the sow before farrowing at least twice at a one week interval.**
- **Boars should be washed at least four times a year.**
- **Treat gilts upon entering the farm and before serving.**
- **Wash all pigs at the beginning of fattening if mange is already a problem.**
- **General cleanliness.**

Crusts seen within the ear of a pig due to mange

Treatment:

- **Remove scales and dirt with soap and water and a stiff brush.**
- **Afterwards the pig should be washed with organophosphate compounds. Repeat this treatment several times**
- **Ivermectin injection is a very effective treatment against mange and all other parasites. Spraying the animals with cattle dip also kills many parasites on the skin**
- **Herbal treatment: Smearing with coconut oil can be an effective control in cases of light contamination**

infestation
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Lice

These are blood suckers that also cause irritation of the skin. Symptoms

- **Itching**
- **Skin may show red spots or bite wounds.**
- **Thick skin and rough hair coat.**
- **Anaemia in severe cases especially in piglets.**

Prevention:

- **General cleanliness**
- **Treat piglets before putting them in fattening house. Fatteners don't need to be treated**
- **Treat gilts before first service**
- **Treat boars twice a year**
- **Treat new stock on arrival and seven days later. Piglets below three weeks should not be treated**

Treatment:

- **The insecticide benzene hexachloride is a very effective remedy (0.1 - 0.25% solution) against lice. Treatment should be repeated after 7 days since the insecticide only kills adults and not eggs.**
- **Lice can be kept away to a certain extent by planting a pole sturdily in the ground at an angle of 45° with an old sack wound around it immersed in crude oil or used motor-oil.**

Myiasis

Disease caused by flies, which lay eggs in the wounds. The eggs hatch into larvae which live

and feed on the flesh and fall off when they mature, creating more wounds.

Symptoms

- **Infected wounds look very wet and dirty and the edges can be covered with a grey mass which are the eggs of flies.**
- **Later on, larva can be seen as screw-shaped pinkish worms crawling through the wound.**
- **The pigs show annoyance and try to find a shady place.**
- **Death may occur.**

Prevention and treatment

- **Clean the wound daily with water and disinfectant then apply insecticide on wound to cover edges too.**
- **Best working insecticides are the long-acting ones e.g. diazinon or supona.**
- **Good mange control program to prevent wounds smooth walls and floors.**
- **Do not use sharp objects.**
- **Avoid overcrowding to reduce fighting.**
- **Tail docking, ears notching and castration should be handled properly and the umbilical cord disinfected.**

General recommendation

1) Deworming

- **Boars - every 6 months**
- **Sows - 2 weeks before farrowing and after weaning**
- **Piglets - 1 week after weaning**
- **Fatteners - 1 week after weaning and 3months latter**
- **Gilts - 1 week after weaning, at 3 months and at 7months of age and at least 2 weeks before service**

2) Control of Lice, Fleas, Mange

- **Scrub sows with Gamma BHC insecticides four days before farrowing.**
- **Clean and scrub the farrowing pens before use.**

Reproductive Disorders and Diseases

These include, Brucellosis, mastitis, leptospirosis, endometritis and agalactia.

Anaphrodisias

When the sow does not come on heat Symptoms:

- **No heat signs**

  This could be caused by low body weight due to poor feeding, overweight, mineral deficiency, intestinal worms, chronic disease, the animal has just given birth, heavy infestation with parasites

Prevention:

- **Improve feeding of mineral-rich feeds.**
- **Regularly deworm your animals.**
- **Allow the female to stay with the boar.**

Treatment:

- **Gilts should not be treated at all because they may show anaphrodisias after every litter**
- **Sows should be treated on the same day as weaning, and in very severe cases, 3 weeks after weaning**
- **Repeating treatment is of no use**

Parvo (smedi) (virus)

Symptoms:

- **Birth of a small litter at the normal time due to Early Embryoric Death (EED) with mummies of different ages together with fresh or macerated dead foetuses and weak living piglets which die in few days.**

Prevention and treatment

- **No therapy**
- **Vaccination of all gilts and sows before pregnancy**

Leptospirosis (Bacteria)

Symptoms:

- **Fever, anorexia, diarrhoea, bloody urine, nervous symptons caused by meningitis.**
- **Abortion in last three months of pregnancy.**
- **In sows which are affected later, weak piglets are born.**
- **Mummified and macerated foetuses are common in the litters.**
- **Infertility associated with venereal spread may be responsible for repeat breeders.**

Prevention and treatment:

- **Elimination of mice and rats and other roddents.**
- **Vaccination and hygienic measures. Vaccines are not available for all types of the diseases and vaccination may not prevent bloody urine.**
- **Treat all sows with injection or streptomycin before serving.**
- **Use antibiotibics especially streptomycin for all ages.**

Brucellosis

Symptoms:

- **Anorexia, fever, stiff legs, occasional lameness, early abortion (returns to oestrus 5 - 8 weeks after service as a result of infection of service)**
- **Infection later in pregnancy gives rise to litter with mummified, still born or weak piglets.**
- **Bloody vulva discharge and endometritis.**
- **Retained placenta.**
- **Boars usually develop orchitis (inflammation of one or both testicles) and epididymitis within seven days of infection.**
- **The testicles are swollen and painful and permanent sterility can be the result.**

Prevention and treatment

- **Prevention is based on hygienic measures and purchase of stock from clean herds only.**
- **Never treat by antibiotics.**
- **No treatment/vaccination is 100% effective**
- **Slaughter all animals and do restocking. Restocking should be after one month.**

Uterine Prolapse

Symptoms:

- **The appearance of the uterus outside the vulva.**

Prevention and treatment:

- **Uterine prolapse reduction is often not possible since it is very traumatic and the best therapy is to amputate the whole uterus. However 50% of sows do not survive this operation, therefore slaughter should be considered.**

Mastitis

Bacteria infection causes an inflammation of the mammary organ and results in changes in milk production. These bacteria enter the wounds in the udder.

Symptoms

- **Swollen, hot and painful udder.**
- **Absence or reduction of milk in the affected udder.**
- **Sow refuses to suckle her piglets. As a result, piglets squeal due to hunger.**
- **Sow has depression and often fever.**

Prevention:

- **Provide adequate bedding**
- **Keep pig pens clean, dry and free of sharp objects, clip milk teeth of baby pigs.**

Treatment:

- **Gently massage the affected udder with lukewarm water.**
- **Do not allow the young to suck milk from the infected sow.**
- **Remove the milk from the infected udder and discard.**
- **Separate sow from piglets and reduce access to teats (allow a few piglets to suckle at a time). If possible, foster piglets to lactating mothers.**
- **Use antibiotics. Inject penicillin-streptomycin into the muscle of hip or neck.**

Endometritis (bacteria)

Symptoms

- **Vulval discharge of vaginal or uterine origin during urination.**
- **In case of metrititis, fever and agalactia may occur.**

Prevention and treatment

- **Antimicrobial by injection or locally by irrigation of the uterus and vagina, oxytocin can be given to stimulate uteric contractions once or twice a day.**
- **Hygiene.**

Diseases and Disorders of Digestive Tract

Scouring

- **Hygienic measures should be taken to avoid or minimize scouring incidence.**
- **Regular deworming should also be done as a control measure to scouring**
- **Feed changes should be gradual and not drastic to avoid scouring**

Diarrhoea/Enteritis

1) Birth diarrhoea

Symptoms

- **Acute diarrhoea in piglets is watery, yellowish grey and within a very short time piglets become thin with sunken eyes due to dehydration.**
- **Death can occur within 2 - 3 days. Death in piglets can occur even within one day before any sign of diarrhoea is observed.**

Prevention

- **Keep pens, feed and watering troughs clean.**
- **Separate affected animals from healthy animals.**
- **Do not change abruptly an animal's ration.**
- **Make sure that piglets have sufficient colostrum within 36 hours of birth**

Treatment

- **Vaccination**
- **Plenty of drinking water with electrolytes**

- **Use of antibiotics.**
- **Herbal medicine: Fresh leaves of guava or star apple (Sapodilla) This will treat the symptoms only.**

2) Red diarrhoea or Clostridial enteritis

Symptoms:

- **Acute haemorrhagic or necrotic inflammation of the gut during the first and second week of birth.**
- **In acute cases the diarrhoea is watery with an orange-red colour due to blood and is often bubbly.**
- **In later stages, shreds of dead tissues can be found.**
- **Piglets are weak and don't suckle. They get pale and die within a few days.**

Prevention and treatment

- **Vaccination**
- **Make sure that piglets have sufficient colostrum within 36 hours of birth**
- **Keep the pigs warm**
- **Cleanliness**
- **Contact the vet**

3) Transmissible Gastroenteritis

Transmissible gastroenteritis is a common viral disease of the small intestine that causes vomiting and profuse diarrhoea in pigs of all ages. It spreads rapidly. Piglets less than one-week old rarely survive the disease. Symptoms:

- **Very high mortality mainly in piglets upto 14 days old.**
- **The piglets often vomit and have severe greenish-yellow watery diarrhoea, dehydration.**
- **In sows the diarrhoea is greyish, they vomit, and abortion may occur.**
- **In fatteners the symptoms are like those in sows.**

Prevention and treatment:

- **Give electrolytes to piglets and keep them warm.**
- **Antibiotics prevent secondary infection but don't provide a cure.**

4) Fat diarrhoea

Symptoms:

- **Faeces are pasty and fatty, white or yellowish**

Prevention and treatment

- **Remove creep feed for a few days.**
- **Use antibiotics as prescribed by a veterinary doctor.**

5) Post diarrhoea

Symptoms:

- **Diarrhoea with no traces of blood.**
- **Death from dehydration or blood poisoning (septicaemia).**

Prevention and treatment:

- **Increase creep feed before weaning.**
- **Avoid stress to piglets by not mixing piglets from different litters.**
- **Good hygienic measures include roughage in diet.**
- **Use antibiotics as prescribed by a veterinary doctor.**

Salmonellosis

Symptoms:

- **High fever, dullness, anorexia, weakness, nervous symptoms.**

- **Bluish-red colouring of the ears, limbs and the centre of the belly.**
- **Bloody spots all over the body.**
- **Wasting and persistent greyish diarrhoea sometimes mixed with blood and shreds or necrotic material from the gut.**

Prevention and treatment:

- **Normal hygienic measures, pelleted feed, thorough cooking of the swill.**
- **Remove feed for two days and provide clean water.**
- **Use antibiotics as prescribed by a veterinary doctor.**

Swine Dysentry

Known by a number of names, including bloody diarrhoea, hemorrhagic enteritis bloody scours and black scours. It affects pigs of all ages, sometimes causing death.

Symptoms:

- **In acute cases wasting and passing of diarrhoea containing varying amounts of mucus, blood and necrotic material.**
- **Fever.**
- **In chronic cases, pigs have greyish or brownish faeces, rough hair coat and low growth rate.**

Prevention

- **Delay reusing the pens of infected animals.**
- **Disinfect pens.**

Treatment:

- **Some herbal medicines (Moringa tree leaves) can be used to relieve the symptoms of diarrhoea and dehydration**
- **Use antibiotics as prescribed by a veterinary doctor**

Post weaning syndrome (oedema disease)

Symptoms:

- **Development of oedema and nervous signs.**
- **Paleness peculiar squeaky voice.**
- **General incoordination and loss of balance.**
- **Sudden death.**

Prevention and treatment

- **Affected piglets should be weaned by removal of sow and placed on low-level diet.**
- **Avoid stress.**
- **Hygiene.**
- **Include roughages in diet.**
- **Use antibiotics as prescribed by a veterinary doctor**

Diseases of the Respiratory Tract

These include, influenza, pseudorabies, pneumonia, atrophic rhinitis and pasteurellosis.

Influenza

Symptoms:

- **Affected animals are apathetic.**
- **Anorexia**
- **High fever, coughing and sneezing, difficulty in breathing**
- **Red eyes with discharge**
- **Loss of condition.**

Prevention and treatment:

- **Good ventilation.**
- **Vaccination.**
- **No specific treatment. To prevent secondary infection, use antibiotics as prescribed by a veterinary doctor .**

Pleural Pneumonia

Symptoms:

- **Acute cases show anorexia, high fever, laboured respiration, red or blue colouring of ear-tips, belly, legs and end of tail.**
- **Death within 4 - 6 hours of onset of clinical symptoms.**
- **Blood stained froth from mouth or nose.**
- **Abortion.**
- **In chronic cases, anorexia, coughing and depressed growth rate.**

Prevention and treatment:

- **Vaccines only prevent mortality.**
- **Use antibiotics as prescribed by a veterinary doctor.**

Atrophic rhinitis (inflammation of the nose)

Symptoms:

- **Sneezing in younger pigs.**
- **Shortening or deviation of upper jaw - poor growth**

Prevention and treatment:

- **Hygiene**
- **Use antibiotics as prescribed by a veterinary doctor**

Pasteurellosis

Symptoms:

- **Coughing**
- **Breathing through the mouth.**

Prevention and treatment:

- **Hygiene.**
- **Use antibiotics as prescribed by a veterinary doctor**

Porcine Respiratory and Reproductive Syndrome (PRRS)

Symptoms:

- **Blue ears and forced breathing**
- **Lactating sows have rough hair coat.**
- **Gilts have problem getting on heat and early abortion.**
- **High mortality in weaners**
- **In boars, high percentage of defective sperm and less libido**

Prevention and treatment:

- **Use of antibiotics as prescribed by a veterinary doctor.**
- **Vaccination helps but it is so expensive that it may not be cost effective.**

Disease Causing Problems in Walking

Arthritis

Symptoms:

- **Inflammation of joints. Thick soft joints.**

Prevention and treatment:

- **Use antibiotics as prescribed by a veterinary doctor.**

Streptococcal infections

Symptoms:

- **Septicaemia (blood poisoning) which may cause immediate death.**
- **Young pigs rarely recover**
- **Sudden death in older pigs.**
- **Fever, nervous signs and arthritis mostly in weaners and fatteners.**

Prevention and treatment:

- **Proper hygiene. Wash sow before it enters the farrowing pen.**
- **Use antibiotics as prescribed by a veterinary doctor.**

Greasy Pig Disease

Symptoms:

- **Thin, pale brown flakes on the skin surface.**
- **Wet skin covered with crusts.**
- **Rough wet and reddish skin below the crusts, no itching**
- **Death may occur**

Prevention and treatment:

- **Avoid fighting among pigs by mixing pigs from different pens.**
- **Teeth clipping, soft bedding**
- **Hygiene. Wash sows before entering farrowing pen.**
- **Use antibiotics as prescribed by a veterinary doctor.**

Nutritional Disorders

Anaemia

Symptoms:

- **Pale skin, weak piglets with high respiratory rate.**
- **Jaundice**
- **Blood stained faeces.**
- **Early death**

Control and treatment:

- **Provide iron injection or oral iron- paste containing iron**
- **Feeding compost- must be of good quality and supplied daily. Compost of poor quality may contain bacteria.**
- **Wood ash can also be put into the pen. This will not provide iron, but it does contain other important minerals.**

Other Diseases

Foot and mouth disease (FMD)

Foot-and-mouth disease is an acute, highly contagious, viral disease of animals with hooves, such as cattle, water buffalo, goats and pigs.

Symptoms:

- **Sudden onset of severe lameness, fever, formation of vesicles on coronary bands.**
- **Blisters can be found on thin-skinned areas like udder, teats, anal area and eyelids. These blisters rupture within one day.**
- **There may be frothy saliva, anorexia, sometimes hooves become loose and fall off.**
- **Sows may abort.**

Prevention and treatment:

- **Vaccination**
- **Quarantine**
- **Proper cooking of swill.**
- **Slaughter and burial.**

African Swine Fever (viral)

Symptoms:

- **Lesions on the body**
- **Fall in temperature before onset of clinical signs.**
- **Reddening of skin and ears.**
- **Incordination of hind limbs.**
- **Constipation diarrhoea, anorexia.**
- **The animal dies the next day after the attack. 95 - 100% mortality.**

Prevention and treatment:

- **Quarantine.**
- **Boiling of swill.**
- **Restriction of movement of meat from infected areas**

A pig with African Swine Fever, showing a bluish-purple colour and bleeding under the skin.

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- **Vaccination**
- **Disinfection**
- **No therapy (treatment)**

Anthrax (bacterial)

Rare in pigs and associated with contaminated feed containing meat.
Symptoms:

- **Oedema and swelling of the neck region.**
- **Dysponea (breathing difficulty).**
- **Fever, anorexia and passage of bloody faeces.**
- **Sudden death.**

Prevention and treatment:

- **Use antibiotics (penicillin) as prescribed by a veterinary doctor.**
- **Thorough disinfection of the farm and burning of carcasses.**

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Information Source Links

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Camels
Scientific name: *Camelus dromedarius*
Order/Family: Camelidae

Introduction

All camels in Kenya are dromedaries or one-humped Arabian camels. Without camels, human survival in dry environments would be much less sustainable. Camels are thought to have been introduced into East Africa by Somali speaking communities over 1000 years ago. These early pastoralists also had cattle, sheep and goats, but camels were better adapted to the dry climate and deteriorating rangeland of Northern Kenya. Historically camels arrived in the region only after deserts had been created by overgrazing and the following land degradation. Perhaps had the camels come before the desert would not have followed, as camels do not deteriorate lands at the same rates as other livestock. They have no hoofs to destroy the fragile soils and they are mainly browsers, meaning grasslands do not become depleted where camels have fed. Camels produce milk throughout the lactation period, whereas cows and small stock dry up during droughts and prolonged drys pells.

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Camel breeds in Kenya

The 3 main breeds of camel found in Kenya are Somali, Rendille/Gabbra and Turkana. These are kept by communities who bear the same names as those of the breed. There is a fourth breed of camel called Pakistani which was imported from Pakistani into Laikipia ranches in Kenya in the early 1990s. However, only a few pure Pakistan camels exist while crosses with Somali or Turkana breeds have since moved out of Laikipia to Samburu, East Pokot, Kajiado, Northern Tanzania, Mandera and Marsabit districts. Following is a description of these breeds;

Somali

Purpose:

- **Good for milk production as it can give 3 to 5 litres in a day**
- **Milking the camel three times a day guarantees even more milk**

- **Lactation length is 1 to 1.5 years**

Body color:

- **Cream/brown**

Mature body weight:

- **Ranges from 450 - 850 kg**
- **First calving occurs between 4 - 5 years**
- **Average standing height is 2 metres when mature**

Feed requirements:

- **Heavy feeders requiring 8 to 12 hours of feeding in a day depending on feed availability**
- **Are more comfortable feeding on shrubs because of their height**

Advantages:

- **More milk and meat**
- **Matures early**

Disadvantages:

- **Cannot be reared in areas with rough terrain or rocky hillsides due to large size**
- **Suffer more when feed availability is low**

Within the Somali breed are four sub-types namely hoor, siftarr, Aidimo and Gelab. These differ in physical, production and adaptability characteristics. While hoor is the highest milk producing sub-type, it is the least hardy. Gelab on the other hand is the smallest in body size, least milk producing but most hardy.

Rendille/Gabbra

Milk yield:

- **1 - 3 litres per day**
- **Lactation length of 1 to 1.5 years**

Body color:

- **Cream or brown**

Mature body weight:

- **300 - 550kg**
- **First calving occurs between 5 - 6 years**
- **Average standing height is 1.8 metres**
- **Feed requirements: Less than Somali, requiring 8 - 10 hours of grazing**

Advantages:

- **Does better under poor pasture conditions and rough terrain**
- **Tolerate drought conditions better than Somali**

Disadvantage:

- **Lower milk yield**
- **Late maturity**

Turkana

Milk yield:

- **Lower than Somali and Rendille/Gabbra that is, 1 to 2.5 litres/day**
- **Lactation length of about 1 year**

Body color:

- **Mainly grayish/dark**

Mature body weight:

- **250 - 500kg**

First calving:

- **Occurs between 5 and 6 years of age**
- **Average standing height is 1.7 metres**
- **Feed requirements is less than that of Gabbra/Rendille, requiring about 7 hours of grazing**

Advantages:

- **Most hardy of all the breeds**
- **Very agile and able to climb steep lava hills because of small body size**
- **Least affected under situation of feed scarcity**

Disadvantages:

- **Least milk yield and meat**
- **Matures late**

Pakistani

Purpose:

- **Of all the breeds, this is the best for milk production**
- **Produces 4 - 7 litres of milk daily under ranch conditions**

Body color:

- **Predominantly chocolate**
- **Mature body weight: 400 - 700kg**
- **Invariably drooping lower lip**

Feed requirements:

- **It is a heavy feeder**

Advantages:

- **High milk yield**

Disadvantages:

- **Insufficiently tested on rough terrain**
- **Less hardy**

Note: Across all the breeds, males are generally heavier than females

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Breeding Practices

Characteristics of good breeding bull and female

Bull

- **High milk production capability**
- **Fast growth rate**
- **Good body conformation (tall, large body frame and well built), upright in standing, high ability to chase and mount females and**
- **Adaptable to the environment (feed availability, terrain suitability etc)**

Female

- **History of producing high milk volume**
- **No history of diseases**
- **Good adaptability to the environment**
- **Good body conformation (slender body and large stomach)**
- **Well developed and pronounced milk veins**
- **Large and well set udder with four teats**
- **Good mothering ability and no history of stillbirths, abortions etc**

Recommended bull: female ratio

- **The camel keeper should maintain one dominant bull of between 6 to 12 years with one younger bull as his replacement**
- **However, more than one breeding bull may be required depending on the herd size**
- **A bull: female ratio of 1:50 is appropriate when sufficient forage is available**

Sexual maturity

- **Females become active at 4 to 5 years of age and give birth when about 5 to 6 years old. Although sexual maturity varies with breed, it is very much dependent on management level in terms of nutrition and health**
- **Males attain sexual maturity at around 5 years but begins to serve actively at around 6 years when their canine teeth are sufficiently developed for fighting**

Breeding season

- **Camels are seasonal breeders**
- **The breeding season coincides with the cool rainy period of the year**
- **Release of the egg (ovulation) in females is initiated (induced) by mating. This means conception only take place during the second mating which should take place after 21 - 23 days when the heat cycle returns.**

Mating

- **Mating among camels is a violent affair and can lead to injury in females**
- **A breeding bull should not be allowed to run loose with a small herd of females especially when rutting since it can physically injure the females and the calves,**
- **Sometimes the female does not voluntarily sit and she is forced to do so by the male who often chases her around, biting her neck, back of the hump, and pressing her down. This may result in severe wounds to the female. It is advisable to make the female sit before bringing the male to mate with her,**
- **The mating process takes about 15 minutes**

- **It is also advisable that rutting males are herded by strong, mature and mature people since they can easily hurt children.**

Pregnancy diagnosis

- **A traditional method of telling if a camel is pregnant, is to stand near it and raise your hand, then check for the raising of the tail and passing of some urine. If it does so, this indicates pregnancy,**
- **A pregnant camel will also raise her tail when a bull approaches her,**
- **The camel begins to show this sign 2 - 4 weeks after conception.**

Signs of rut in male

- **Loss of appetite and condition**
- **Unusually aggressive and difficult to handle (Chases away all the other males and even humans)**
- **Frequent urination and splashing urine on the back by flicking the tail,**
- **Prolific secretion from the poll glands situated behind the ears and rubbing the secretion onto plants as a way of marking its territory**
- **Protrusion of a soft palatal flap from the mouth (with air, in form of a pink balloon as shown in the picture below)**
- **Making characteristic noises and continuously grinding their teeth with saliva flowing from the mouth**
- **Rutting bulls should be separated as they may fight to death**

Signs of heat in female camels

- **She may become restless**
- **May show swelling of the vulva and mucous discharge**
- **Frequent urination**
- **Making characteristic noise**
- **May have reduced milk yield**
- **May sniff urine from other females**
- **The heat is repeated after 20 - 25 days for females that fail to conceive**

Recommended breeding practices and their advantages

1. Avoid inbreeding by:

- **Replacing the breeding bull at 12 years when its first daughters becomes sexually mature**
- **Exchanging bulls with neighbors**
- **Use of two or more breeding bulls**

Advantages

- **Minimizes congenital/inherent problems e.g. deformities**
- **Enhance calf growth**
- **Reduce calf mortality**

2. Use young bulls below 13 years

Advantages

- **Young bulls have high ability to follow and mount females**
- **Young bulls come to rut faster after the dry season and serve for a longer period in any given breeding season**
- **Young and active bulls ensures higher conception rates of females**
- **Retired bulls can be castrated and fattened for meat or other uses**

3. Use females of less or equal to 6 calvings
Advantages

- **These are young females who normally have good body condition**
- **Produce more milk for the calf and humans and their calves show higher growth rate**

4. To upgrade your camels through cross breeding, look for a bull with the traits you desire and not a female
Advantage

- **A bull propagates desired traits in a herd very fast as it has capacity to serve 50 dams in a breeding season while a female can only give birth to one calf at a time**

Care of pregnant camels, a month before giving birth

- **Closely monitor the camels as this is the most critical stage**
- **Graze the camels near settlement or boma as they may require some assistance**
- **Avoid grazing such camels in areas with pot holes, gulleys, rocky areas, slippery grounds since such camels may easily fall down and severely injure themself**
- **Do not allow the camels to wallow in the soil**
- **Do not put such camels in sloppy bomas as it is difficult to stand on such a ground**

Signs of labor

- **Enlargement of the udder**

- **Sagging of the ligaments at the root of the tail**
- **Restlessness including lying down and standing up**
- **Loss of appetite**
- **Make characteristic noise**
- **Isolating themselves from other camels**

Calving management

What the herder/helper* should do	Why
• Separate the camel from the rest of the herd and keep it in the boma	
• Be near the camel	
• In case of difficult calving, pull out the calf gently	• This is to avoid damage of the uterus or injuring the calf
• Make the mother lie down to ensure that the calf is not dropped while the mother is standing	• Dropping the calf while the mother is standing can injure the calf
• Remove birth fluids on the calf body particularly around the nose	• Removing fluids from the nose and body is meant to avoid suffocation of the calf and pneumonia due to cold and possible death since camels do not lick

	their calves
• **Treat the cut end of the umbilical cord with some iodine, strong salt solution or just tie it in a knot or with a string that is either boiled or disinfected with dettol or savlon**	• **These measures prevents entry of bacteria or foreign bodies which may cause secondary infection**
• **Put the calf in front of the mother until the mother makes some low groaning noise**	• **Groaning normally indicates her acceptance of the calf**
• **Assist the calf to suckle and if the mother refuses to suckle her calf which is especially common with first calvers, smear the mother with some birth fluids around the nostrils. If she still proves difficult, isolate and scare her so that she only see the calf around her. This helps in forcing her to accept the calf. In case of death of the mother, cover the foster mother with hide of the dead mother to enhance acceptance.**	• **Early suckling (the first 3 to 6 hours) is very important because of colostrum** which gives the calf essential immunity to infections in the first few months of life**
Note: If mother dies before two months post birth, the calf rarely survives. **Must witness dropping of placenta although retention is very rare; can also be removed manually**	**Retained afterbirth in camels may lead to severe post-birth complications**

*** It is advisable to call an experienced herder, community based animal health worker (CBAHW) or veterinarian to assist in complicated birth**

**** The dense milk that animals produce for the first 2 to 3 days after birth**

Additional calving management tips If the calf has breathing difficulties soon after birth, do the following;

- **Cold water poured over the chest and head has the effect of shock and makes the calf raise and shake the head**
- **Massaging with two fingers from the eyes along the nose to the nostrils clears out the mucus**
- **Irritation of the nostrils with a straw makes the calf sneeze and expel the mucus**
- **Turn the calf upside down (for example by putting its rear legs across your shoulder and get someone to hold them there) with its head towards the ground and massage the chest moving down towards the head**

Note: Do not reach into the mouth with your fingers!! This can cause an infection and diarrhea in the calf.

Calf Rearing

Management practice	How it should be done	Why
Colostrum feeding	Allow unlimited access of the calf to the antibodies, vitamins, proteins rich and	• Colostrum gives the calf passive immunity and washes the stomach • The quality of colostrum

	easily digestible colostrum within the 1st 3 to 6 hours. If the dam does not produce milk, induce the let down by palpating the udder and the abdomen. In the absence of milk from the mother, feed the calf on milk from other camels. **Note: Herders sometimes deny or give very little colostrum to the calves, claiming that excess colostrum causes diarrhea, especially among the second calvers . Research has shown that irregular feeding and bacterial infection causes the diarrhea and not the colostrum. Other causes includes worms and ingestion of dirt**	**depreciates with time** • **Antibodies are proteins, and can only pass through the walls of the intestines in the first 24 hours after birth**
Housing	**Camel calves need to be protected against cold especially at night. The pen can be made with thick and strong bushes cut from the**	• **Over-exposure to cold breeze can cause pneumonia and death, a strongly built pen protect calves from predators while regular cleaning helps in control of ticks**

	surrounding. The pen should be swept at least once a week to avoid accumulation of ecto-parasites	
Tick control	**Ticks contribute significantly to the high camel calf mortality reported in previous studies. A camel keeper should thoroughly wash young calves with acaricides e.g. triatix once in two weeks or even shorter interval depending on the tick load**	• **Ticks cause paralysis and eventual death of the calves if not controlled**
Diarrhea management **Note: Different camel keeping communities use different traditional methods to manage diarrhea. However, these methods are largely ineffective as evidenced by high mortality rates. Effective modern and traditional methods of**	**Method 1: Rehydration of the calf using a mixture of water, table salt and sugar/honey** • **Take three table spoonfuls of sugar or honey and one and half table spoonfuls of table salt and mix with three litres of clean water** • **Give a soda bottle (300mls) full of this**	• **Diarrhea contributes significantly to the 12-60% camel calf mortality levels reported among camel herds in Kenya** • **When a calf has diarrhea, it looses a lot of water that leads to death if not replenished. The honey-table salt-water solution has rehydrating and treatment effects**

managing diarrhea as explained under the 'how' column exist.	solution through the mouth on four hourly intervals until the diarrhea stops. Method 2: Traditionally eggs from chickens which interact with camels is used • Give one egg by the mouth daily to a calf with diarrhea until it stops Method 3: Use of conventional drugs • Give sulphur based drugs e.g. S-dime tablets according to manufacturers instructions • Note: The sick calf should continue suckling, be kept in a clean environment and separated from the healthy ones until it recovers	• The eggs of chicken which interacts with camels and feed on ticks and other flies from camels have been observed to have both treatment and preventive effects on the diarrhea • These measures prevents spread of the diarrhea to other calves
Calf management in the first four months of growth	• Let the calf run with its mother during the day for the first three months	• This allows the calf adequate milk. Heavy milking for human consumption at this stage negatively

	• After the third month when the calf is able to graze actively, gradually reduce the milk allowance depending on the quantity and quality of forage available and its growth performance • In case of death of the mother or calf rejection, bottle feeding is advised	affects calf growth rate hence delaying its reproductive and physical maturity • Early separation contribute to calf diarrhea since such a calf stays hungry the whole day and when the mother returns home in the evening, it takes a lot of milk at one suckling. The milk tends to cramp the undeveloped stomach leading to diarrhea. • Letting the calf accompany its mother during the day also triggers early rumination because of early access to forage and water
Management of the non suckling calves (weaners)	• Gradually wean (dry) the calf from suckling • Deworm at weaning • Vaccinate the weaners for trypanosomosis • Feed the weaners on good quality forage • Gradually increase the watering interval • Supplement with minerals • Wash weaners for	• Camel keepers wean the calves at an average age of one year. Under pastoral management, calves before weaning mostly graze around and are watered at home. However, after weaning the calves join the main herd that is normally subjected to long distance foraging and watering. This abrupt change in management contributes to stress which may be disastrous to the calf. The practices outlined here minimize the stress.

	external parasites	

- **Additional methods of managing diarrhea in camel calves (this works in some cases with cattle calves, dose may need to be increased for camel calves)**
- **Drench with Kaolin (about 2 handfuls in a soda bottle mixed with a bit of cud from the mothers mouth and filled with clean (preferably boiled and cooled) water. Drench at least twice per day until symptoms disappear.**
- **Charcoal drench: Crush charcoal very finely. Put about 2 handfuls in a soda bottle, fill clean water and shake. Drench morning and evening.**

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Camel Nutrition

The importance of good nutrition in camels

The importance of good nutrition in camels Nutrition of the camel is fundamental to growth, reproduction and production. Optimum nutrition is essential for it has a profound impact on fertility, foetal growth, birth weight and also the future milk yield. As is the case for humans, good nutrition implies that the camel must get sufficient proteins, energy, roughage, minerals and water.

- **Protein is important for growth and milk production**
- **Energy enables camels to walk around in search of pastures and water**
- **Roughage enhances feed intake and digestion**
- **Minerals are important in reproduction, formation of bones, feed digestion and absorption and milk yield, among others**

- **Water is useful in transportation of food, air and wastes through the body systems**

Comparative studies between camels and other livestock show that the camel has lower food intake in relation to body weight than any other livestock species.

Feeding habits

- **Foraging camels spread over a large area thus minimizing pressure on a particular forage species and area i.e. low trampling and soil disturbance,**
- **The cleft on the upper lip helps camels in diet selection i.e. removing leaves from stems and picking acacia pods from the ground,**
- **On the average, protein content of diets selected by camels is higher than for other livestock,**
- **The long legs and neck enable camels to browse up to 3 m above the ground, a height not reached by other livestock**
- **Due to their specific forage preferences and feeding at higher levels, camels are rarely in direct competition with other animals (notably cattle and sheep) for grazing and therefore a combination of these species results to increased productivity per unit of land**

Suitable camel feeds

Given the opportunity, camels prefer to feed on shrubs and trees (browsing). However, in the absence of browse forages they can comfortably live on herbs and annual grasses. The concept of planted forages is not applicable in the Kenya situation where camels are reared under extensive free range systems. What is practical is to manage the natural forages in a way that promotes growth of palatable and quality shrubs that camels prefer. Keeping a mixture of camels and small stock or cattle where possible helps in maintaining the required forage composition.

- **A camel requires 8-10 hours of grazing daily to be satisfied. This depends on breed, body size and feed availability**
- **In an ideal situation, camels are able to select a high-quality diet that provides all the nutrients required by the body**
- **Camels are also able to survive on low quality fibrous roughages. They adapt well to different diets and dietary conditions**
- **During the dry season, when other forages are scarce, camels can browse on the green tips of trees (e.g. Acacia sp.) that other livestock species do not, enabling them to survive droughts,**
- **It is worth noting that there are some plants that can poison camels e.g. Capparis tomentosa and Solanum spp and areas where such plants are concentrated should be avoided.**

Some important range forage species for camels

	Growth form	Local Names				
Scientific name		**Somali**	**Rendille**	**Turkana**	**Samburu**	**Gabbra**
Acacia tortilis	**Tree**	**Abuk Abak**	**Dahar**	**Etir Ewoi**	**Ltepes**	**Dadacha**
Acacia nilotica	**Tree**	**Bili Madow**	**Gillorit**	**Ekalapelimet**	**Ilkiloriti**	**Burquqe**
Indigofera spinosa	**Dwarf shrub**	**Rufile Maratel**	**Khoro**	**Emakwi**	**Lkitagesi**	**Korategala Kiltipe**
Salsola dendroides	**Dwarf shrub**	**Darran-ad**	**Hadum**	**-**	**Aduung**	**Durte**
Boscia coriacea	**Shrub**	**Ghalangal**	**Yoror**	**Erdung**	**Serichoi**	**Galgacha**

		Dakkiyah				
Balanites aegyptiaca	Tree	Kullen Kidthi	Kulum	Eroronyit	Sarai Ilbulei	Badhan Baddana
Salvadora persica	Shrub	Adde Athei	Hayei	Esekon	Sokotei	Aadhe
Euphorbia tirucalli	Shrub	-	-	Elila	Loile	Anno
Cordia sinensis	Shrub	Mared Mareer	Gaer	Edome	Ilgoita	Madeera
Barleria Spp	Herb	Gamaadiis Odarol	Geidow Sucha	-	Lkurumbule Sucha	Maadek Shiisha
Blepharis linarifolia	Herb	Quarda Yumarook	Lemaruk Harja	-	Emarak	Kutumbule Baraata

Feed digestion

The camel ruminates, chewing cud mostly at night, but though there are similarities in stomach construction, the camel stomach has only 3 chambers with no clear distinction between omasum and abomasum. Studies show that camels digest cellulose better than other ruminants. Further, camels have lower metabolic rates than other livestock, helping them to utilize their feed very efficiently and minimize water intake.

Mineral requirements

- **Mineral deficiencies adverse affect productivity of camels**
- **Camels are known to prefer grazing and browsing on salty plants, suggesting higher**

requirement for salts.

- **Pastoralists are aware that camels require salt and some make efforts to take their camels to naturally occurring salt sources.**
- **Suggested salt allowances under normal dryland conditions range between 30 and 60 g/day. A camel working hard in the hot season may need as much as 140 g of salt daily.**
- **However, research has shown that camels suffer specific mineral deficiencies due to complete lack or inadequate levels in the natural sources, which suggests need for properly formulated and balanced minerals for camels. One option is to buy industrial chemicals especially those containing phosphorus (dicalcium phosphate), calcium (calcium carbonate) copper, zinc, selenium, magnesium (copper sulphate, zinc sulphate, magnesium sulphate) that will supply key and commonly deficient elements and mix them with natural mineral licks or other livestock salt available in the market. The mixing ratio however needs to be guided by an expert as it depends on the difference between what the camels can get from the grazing resources and their daily requirements. Regular moving of camel herds to places with natural salts (water, licks or plant) for supplementation do help to some extent.**

Water requirements

Compared to other livestock, the camel is the most efficient in water utilization in the body by being able to reabsorb most of the water in the intestines and kidney leading to dry feacal pellets and concentrated urine, avoiding water loss through evaporation, among others. Camels also have capacity to utilize metabolic water by recycling urea. Water requirements in camels depends on the water content of the forage and accessibility to water but is lower in relation to body weight than other livestock species . During wet periods, camels get sufficient water from the feed and may not require direct watering. However, during dry seasons and drought periods, camels require regular watering, the recommended interval being 5 to 8 days. Watering intervals longer than this leads to dehydration which interferes with the functioning of the body systems and may reduce productivity. Watering intervals during drought of up to 14 days have

however been reported. Dehydration in camels could be tested by the skin elasticity. This is done by grabbing and pulling out the loose skin e.g. the neck or lower part of the abdomen and then you release. If the skin reverts back to it normal position quickly, it suggests that the animal may not require water. However, if the skin takes long to revert to its normal position, this suggests significant degree of dehydration.

Supplementary feeding in camels

Under normal circumstances camels, can get enough and quality diet from natural vegetation. This implies that in traditional extensive systems with enough browse and water, extra feeding may not be beneficial. However during periods of feed scarcity or under peri-urban production systems, supplementary feeding would certainly be beneficial to camels particularly the pregnant, lactating and calves.

- **Supplementation can be achieved through harvesting and storage of some feed material e.g. acacia pods especially for the settled households.**
- **The nutritional quality of natural vegetation is highest at the time when vegetation is beginning to dry up and this would be the most appropriate harvesting time.**
- **Grass hay, minerals supplements and concentrates like dairy cubes could be bought from the market and fed to camels. However, this may prove expensive and only affordable for a few high yielding breeds like Pakistani.**

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Herd Management

Management differ among different camel keeping societies, but all try to keep a predominantly female herd. The camels are usually kept in thorny enclosures over night, where they can be inspected, milked and generally looked after and kept safe from predators.

Where camels are kept as part of a mixed herd, the watering intervals follow the other animals, but where camels are kept separately, watering intervals may be increased gradually up to 2 weeks, enabling camel herds look for browse from a very large distance from water sources.

Well fed camels, which are kept away from areas with biting flies and tsetse flies rarely become sick, but droughts, excessive rains, lack of browse and other debilitating factors can lead to diseases in camels.

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Camel Diseases

Symptoms and Treatment

Trypanosomiasis

Not all trypanosomiasis parasites are transmitted by the tsetse fly. *Trypanosoma evansi* (thryps) is a very serious camel parasite mostly spread by biting flies. The parasite replicates in camels, horses, dogs, cattle, water-buffaloes and elephants. Equines and dogs are susceptible and usually die from the infection. Cattle sheep, goats and antelopes often become infected and act as asymptomatic carriers.
Symptoms: Thryps affects camels of all ages, with a higher incidence of disease in sub-adult camels shortly after weaning. Many environmental and host factors have impact on the course of the disease such as other infections, nutritional status, age, pregnancy, previous exposure,

etc. If the several of the following symptoms are present in an animal, it is wise to get it tested and if positive, get it treated:

- **Visible weight loss, the hump starts drooping**
- **Lack of appetite**
- **Swellings (oedema) may appear on feet, brisket, underbelly and eyelids**
- **Fluctuating body temperature with initial peaks of fever up to 41°C**
- **Shivering**
- **Mild diarrhea**
- **Different smell of urine**
- **Abortion**

Diagnosis: The best tool for diagnosing thryps in the field is a battery-operated mini centrifuge for testing the camels blood. Such equipment should be operated by a vet or other trained animal health officers.

Treatment: The best drug to combat thryps currently is Triquin. In order to calculate the correct dose the approximate weight of the sick camel must be known (see Bodyweight estimation). NOTE: Triquin is only meant to treat camels. Do not use on any other animal. Examples are known of goats being injected with this drug and dying immediately.

Other important camel diseases are:

Skin Diseases of Camels

- **Camel Pox**
- **Sarcoptic Mange**
- **Ringworm**
- **Ticks**
- **Flies**

- **Bacteriological skin infections**
- **Abscesses of the skin and external lymph nodes**

Gastrointestinal helminthes of camels

- **Roundworms**
- **Tapeworms**
- **Liver Flukes**

List of Laboratories for analysis of camel diseases

- **Kenya Agricultural Research Institute (KARI), Marsabit; P.O Box 147-60500; Tel.+254 069 210 2040; Fax +254 069 210 2220**
- **KARI, Trypanosomosis Research Centre; P.O. Box 362 - 00902 Kikuyu; Tel. +254 66 32960/4; Fax +254 66 32397; E-mail trccd@kari-trc.org, ketri2@bidii.com**
- **KARI, National Veterinary Research Centre; P. O. Box 32 - 00902 Kikuyu; Tel. +254 066 32106/2, 32000, 32703; Fax +254 066 32450; E-mail vrckari@yahoo.com**
- **Analabs, Kenya Limited; P. O. Box Nairobi**

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Jan 26, 2010 - Disclaimer

Donkeys
status: under construction

more Images

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Introduction

The donkey or ass, *Equus africanus asinus*, is a domesticated member of the Equidae or horse family. The wild ancestor of the donkey is the African Wild Ass, *E. africanus*. Traditionally, the scientific name for the donkey is *Equus asinus asinus* based on the principle of priority used for scientific names of animals. However, the International Commission on Zoological Nomenclature has ruled in 2003 that if the domestic species and the wild species are considered subspecies of each other, the scientific name of the wild species has priority, even when that subspecies has been described after the domestic subspecies. This means that the proper scientific name for the donkey is *Equus africanus asinus* when it is considered a subspecies and *Equus asinus* when it is considered a species.
In the western United States, a small donkey is sometimes called a *burro* (from the Spanish word for the animal).

A male donkey or ass is called a jack, a female a jenny, and offspring less than one year old, a foal (male: colt, female filly). While different species of the Equidae family can interbreed, offspring are almost always sterile. Nonetheless, horse/donkey hybrids are popular for their durability and vigor. A mule is the offspring of a jack (male donkey) and a mare (female horse). The much rarer successful mating of a ma
le horse and a female donkey produces a hinny. Asses were first domesticated around 3000 BC, approximately the same time as the horse, and have spread around the world. They continue to fill important roles in many places today and domesticated species are increasing in numbers, but the African wild ass and another relative, the Onager, are endangered. As "beasts of burden" and companions, asses and donkeys have worked together with humans for millennia.

With domestication of almost all donkeys, few species now exist in the wild. Some of them are the African Wild Ass (*Equus africanus*) and its subspecies Somalian Wild Ass (*Equus africanus somaliensis*). The Asiatic wild ass or Onager (*Equus hemionus*), and its relative the Kiang (Equus kiang), are closely related wild species.

Donkeys are tolerant of hot, arid environments, and, in general, is more likely to be found in hot, dry environments where the agriculture is subsistence and they are popular among pastoralists as well. Despite the increase in mechanisation throughout the world, donkeys are still well deserving of the name 'beasts of burden'. They have an important role to play in the transport of people and goods in rural, arid and semi-arid areas and where roads are poor or non-existent.

A notable increase in the use of donkeys for tillage is evident in East Africa as the number of draft cattle on small farms have declined. This has resulted in changing perceptions of the value of the donkey in many rural communities that rely on animal power for crop production. Other than for labour, donkeys are the only alternative to oxen on many smallholder farms in East Africa. They are the cheapest form of farm power other than human labour, and therefore within reach of the "poorest of the poor"; they are available to women in cultures where men usually manage the draft animals and are therefore able to alleviate the drudgery of women's household activities, such as water and firewood carrying.

These two situations have resulted in an extraordinary increase in interest in the donkey since 1990 by both farmers and aid agencies as well as a realisation that little is understood of donkeys' requirements, potential for improvement and contribution to rural livelihoods. The challenge facing farmers is to make the best use of the resources that they have available, while the challenge to livestock researchers and extension officers is to provide information that will help farmers do this. Donkeys have developed very loud vocalizations, which help them to keep in contact with other donkeys over the wide spaces of the desert. The best-known call is referred to a "bray," which can be heard for over three kilometers.

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Breeds and Breeding

Some examples of domestic donkey breeds includes the:

Domestic donkey breeds

An incomplete list of domestic donkey breeds includes the:

- **Abyssinian Donkey**
- **American Spotted Donkey**
- **Cypriot Donkey**
- **Mammoth Donkey**
- **Mammoth Jack**
- **Miniature Mediterranean Donkey**
- **Poitou Donkey: The Poitou Donkey breed was developed in France for the sole purpose of producing mules. It is a large donkey breed with a very long shaggy coat and no dorsal stripe.**
- **Spotted Ass**
- **Standard Donkey**
- **Burro - adopted wild Burro**
- **Wild Ass, Onager and Kiang**
- **East African Donkey**

The donkeys found in East Africa are generally quite small (1 m - 1.50m). They are greyish in colour and have the black stripe across the withers. It is probable that, due to unplanned and indiscriminate breeding, as well as poor management, the donkeys in EA, especially in rural areas, are smaller and appear to be weak behind. In contrast, the donkeys from Northern Kenya

East African donkey

© Val Corr, Naivasha, Kenya

generally appear to be bigger, stronger and a more biscuit brown in colour. They are also, generally, in better condition that the rural donkey despite the poor pasture. This has to be attributed to the better management practices used by the rural communities of this area. This, presumably, could be as a result of more experience with donkeys in this area.

Breeding

While different species of the Equidae family can interbreed, offspring are almost always sterile. Nonetheless, horse/donkey hybrids are popular for their durability and vigor. A mule is the offspring of a jack (male donkey) and a mare (female horse). The much rarer successful mating of a male horse and a female donkey produces a hinny. Mules were common in East Africa until the 70's since when they are hardly ever seen. They were used widely as pack animals during the war and on safari. The mule is, generally, a much bigger animal than the East Africa donkey. They are usually a dark brown and their ears are much longer than a donkey's. Their size makes them stronger than a donkey, but they are not as obliging as a donkey

Jennies are pregnant for approximately 11 months, and usually give birth to one foal. Twins are very rare and, where this occurs, one of the twins would more than likely be very small and would not survive. Horse-donkey hybrids are almost always sterile because horses have 64 chromosomes whereas donkeys have 62, producing offspring with 63 chromosomes.

The offspring of a zebra-donkey cross is called a, zebroid. Occasionally zebroids are seen in areas of East Africa where donkeys and zebras graze in close proximity. They are easily

identified by stripes on their legs, quarters and, sometimes, their sides. This cross is often found to be very difficult to train as zebra are known for their unfriendly nature and it seems that this trait is passed on to the young.

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General characteristic of donkeys

- **Donkeys' ears are much longer in proportion to their size than a horse's.**
- **Donkeys are extremely intelligent (much more intelligent than a horse) and very tough.**
- **Donkeys feel pain in the same way as any other mammal.**
- **Donkeys do not have a true forelock (at the front of the head between the ears), although sometimes the mane grows long enough to comb down between the ears toward the eyes.**
- **Many donkeys are the familiar gray-dun color, but there are many other coat shades.**

1) Pull carts

2) Pack

3) Riding

4) Ploughing

A donkey carrying pack goods
© KENDAT, Kenya

A boy riding on his donkey
© Kendat, Kenya

A farmer tilling donkeys
© KENDAT, Ken

5) Donkeys can also make wonderful guard animals - the right donkey gelding (male) or jennet will take care of an entire herd of cattle, sheep or goats - the natural aversion to predators will inspire the donkey to severely discourage any canine attacks on the herd.

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Care and Management of working Donkeys

All animals are sensitive to how we treat them, including donkeys. If we treat them better, they will be healthier, live longer and we will be able to get more out of them. With humane, considerate care and treatment, a donkey becomes the most co-operative and productive work animal. Below are some practices you should consider in your relationship with your donkey.

Treat your donkey humanely

Donkeys should always be treated gently. If you are harsh to your donkey, she will not be friendly to you. When a donkey is working, and during the dry season she needs balanced, diet and mineral salts. If using your donkey to carry on her back, ensure that the load is balanced, the backbone is protected and there is enough padding to prevent sores from developing. For pulling carts use comfortable breast straps or collar harnessing with breaching. Always ensure that the draw pole does not rub against the donkey's body, causing injuries and sores.

Keep your donkey healthy

If your donkey is not eating well and looks dull or sick, seek veterinary advice. De-worm your donkey twice a year. De-worming is most effective at the end of dry season, or before seasonal rains. The most common disease in donkeys include: tetanus, tick, fever. African horse sickness, pneumonia and rabies. All these illnesses need veterinary attention

Train your donkey

Good harnessing and training are important in order to easily handle and work better with your donkey. Training should precede working sessions and donkeys usually learn very fats. Keep harnesses and equipment around where your donkey rests so that she becomes familiar with them.

Some good practices that will make your donkeys serve you better and more productively
DO's

- **Allow your donkey to rest and graze before work. Make sue she gets enough to eat and enough water to drink.**
- **Use suitable harnesses and carts that do not cause pain, injuries or sores.**
- **Give your donkey one day rest at least once per week.**
- **Shelter your donkey at night and especially during hot and wet/rainy weather.**
- **Allow only adults who will take good care of your donkey to use her.**
- **Ensure that your donkey pulls only a load that she is comfort able with. It is better to make two journeys if the load is heavy.**

Some Bad Practice That will make Your Donkeys Serve you Less Effectively

DON'TS

- **Don't injure your donkey by whipping, cutting or caning.**
- **Don't allow harnesses e.g. timber or metal bars to come over the donkey's back as this may cause wounds.**
- **Don't keep beating or caning your donkey when she is struggling to pull a heavy load up a slope. Help by pushing the cart from behind instead.**
- **Don't leave your donkey to roam around especially at night; she may cause a road accident.**
- **Don't overload your donkey or work her when sick, as this is against the law.**
- **Don't tie your donkey by the leg. This may cause her to break her leg. Instead, use a head collar and tie the rope to it or if not available, tie the rope around her neck.**
- **Don't approach your donkey from the side. She cannot see you very well from the side, as she will be surprised and may react defensively.**
- **Don't allow your donkeys to feed on garbage, its dangerous for their health.**

Daily care of working donkeys

At the beginning of the working day a halter has to be placed around a donkey's head, for instance by using a rope that passes behind the ears and around the nose. Lead the animal to a tree or post to groom and prepare it. Donkeys like routine so use the same place each day. This is a good moment to give some concentrates or by-products. Otherwise give something like fruit peelings, a banana or a handful of maize. This will encourage the donkey to come and enjoy human attention. Observe the donkey. If its behaviour is different from previous days then something may be wrong. Alertness and interest will indicate that the donkey is healthy. Feel the legs to be sure they are not swollen or hot. Any damage to the legs caused on the previous day will show up in a stiff and obviously uncomfortable gait. Any temporary stiffness should be quickly .walked off. If this does not happen the donkey should be put to rest for as long as necessary. If the stiffness persists a veterinarian needs to be consulted.

Care of the coat

Grooming means taking care of the hair and skin of the animal. Daily grooming is important for the health of working donkeys. Donkeys enjoy being groomed and will become tamer by this daily routine. Grooming keeps the donkey's skin healthy and prevents dirt from causing harness sores. Give special attention to those parts of the skin that are in contact with the harness and/or back pad.

Grooming should be done after work and can be done with a wad of dry grass or a piece of old sack. This will massage tired muscles, loosen dirt and dust and dead hair.

If a donkey gets very dirty or sweaty, it may be helpful to wash it all over with clean water. Take a damp cloth and wipe out the nostrils and around the eyes. Any secretions that may have occurred during the night should not be left on the face during the day, as these will attract flies.

Check the coat for external parasites such as ticks. Ticks do not only create wounds, but also spread many infectious diseases. Check especially under the tail and inside the legs where the donkey cannot easily reach when grooming itself. Remove by hand any ticks that are found.

Care of legs and hooves

Inspect a donkey's hooves daily and take care of them. A donkey.s hoof should be short and upright with an oval bottom. If the toe becomes long and slanted, it should be trimmed. Excess hoof wall, as well as ragged loose pieces of frog, can be removed with a sharp, strong knife. Cracks and chips in the wall can spread, and eventually destroy the entire hoof. Coating them daily with oil or grease may help hooves that are very dry or brittle, badly cracked or broken. This prevents them from further dehydration and assists healing.

A donkey will pick up its foot if the tendon is pinched at the back of the leg, just above the pastern. Pick up and handle the feet of the donkey early and often in its training, calling a clear command like

Hoof in good condition

© Val Corr, Naivasha, Kenya

leg! so that it will not object to this care later on during its working life.

Healthy frog

© Val Corr, Naivasha, Kenya

Clean out the bottom of the hooves with a hoof pick before each use of the donkey, to prevent lameness from stones or other materials penetrating the sole of the foot. Clean from the heel towards the toe, especially in the grooves between the frog and the bars of the hoof.

If the area around the frog becomes black, oozing and very smelly the animal has thrush. This bacterial disease results from prolonged standing in wet areas. Treat it by pouring on a solution of copper sulfate or iodine daily. Take the animal out of wet housing. An untreated hoof will rot and cripple the animal permanently.

Wet frog needing attention

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Foot dangerously long

© Val Corr, Naivasha, Kenya

Rope marks on both legs

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Implements and tillage practices

Most of the implements used in crop production in Africa have been designed for use with oxen. While these implements many prove satisfactory for a team of four donkeys in good condition, they are likely to be too heavy for smaller teams or single animals. Increasing the number of animals in a team is not always the answer.

Teams of more than four donkeys are difficult to use, unless fields are large, and work output per animal drops as the number of animals in a team increases (eg Karim-Sesay, 1993). It is unlikely that farmers would be able to make harnesses for this kind of work, without seriously compromising the well being of the working animals.

A major challenge to the agricultural engineers is to identify, design or modify implements that can be used effectively by donkeys in primary cultivation. This would enable the farmer to

reduce his reliance on oxen for these tasks. The implement has to be technically acceptable by and affordable to farmers in order to be adopted by them.
Secondary cultivation, weeding and carting require lower draft forces than plowing and the low live weight of the donkey is less of a constraint. This is also the case on light sandy soils where conventional plowing is often unnecessary for crop establishment. The development of alternative tillage practices that require less power than conventional plowing in which the donkey can be used provide a further challenge to engineers and soil scientists.

Donkeys are known for their willingness to work for man (they are very slow, but this is why they are so tough) and for their longevity. A donkey that is well cared for is able to work for at least 15 years. From experience of working with donkeys in this country, I would suspect that most of them don't make much past 7 years.

If you are a donkey owner, you have a valuable asset and an obligation of responsibility to your donkey.

- **They eat very little, don't necessarily need shelter, and are able to work long hours. In return the very least you can offer your donkey is somewhere suitable where it can graze when it is not working and water to drink every day.**
- **Do not tie it by the leg, but by the neck.**
- **Make sure that your donkey has a drink of water EVERY DAY. It cannot be stressed enough how important this is for your donkey's well being and could double its life expectancy**
- **Make sure that it is not overloaded and that the harness fits. It is very easy to cover your harness and ropes in sheep skin, with the hair side against the donkeys skin (especially on their shoulders, backs and under their tails).**
- **Donkeys are notoriously lazy but they do not need to be beaten even though it is necessary to carry a stick.**
- **The stick should NEVER be waved at or used on their heads. This only makes them 'head shy' and difficult to deal with.**
- **If you make a friend of your donkey it will be much more willing to work for you.**

- **When a female donkey has a foal, she will need time off. There is a very high mortality rate in donkey foals which is undoubtedly caused by the mother being worked to soon and too hard after birth, resulting in poor or insufficient milk production - the baby donkey will suffer from malnutrition and, in the worst case scenario, will die from starvation.**
- **If your donkey is managed by a 'contractor' make him understand the value of your donkey and, if you are not happy with his treatment of your donkey, find another 'contractor'. If it is understood that you will not tolerate your donkey being mistreated you will have done yourself and the donkey a service.**

Treat your donkey as you would your car - you would not allow anyone to abuse your car continually - you would soon find another driver!

Harnesses

Designs for suitable harnesses for donkeys are available, and consist of two types: collars and breastbands. The problem of harnessing is therefore not a technical one, but more one of acceptance, education and dissemination. This requires the expertise of the extension officer rather than the scientist. The challenge to the extension officer is to develop techniques to teach the farmers the benefits of using harnesses that are comfortable to the animal, and then encourage them to use these harnesses.

The choice of harness depends on availability and cost in an area. In Africa this generally means a breastband harness, although there are a few areas where collar harnesses are available. Collar harnesses, while excellent for the donkey, are expensive for the farmers and require some training of artisans in their construction. Breastband harnesses are a cheaper alternative to collar harnesses, but these can cause bad sores if they are not made correctly or fitted correctly.

Harness pad with cloth underneath to stop rubbing

© Val Corr, Naivasha, Kenya

The bands should be broad and of a material which will not readily rub the donkey, although padding of the harness with softer less abrasive material can overcome the latter problem. The harness straps can easily be covered n sheep skin which will avoid rubbing at very little or no cost to the owner.

Fastenings should not be of a type that will rub the animal and adjustable straps over the back enable the size of the harness to be changed to fit different sizes of donkey. This is important if it is to be used on different animals.

Manufacturers of harnesses often make them too thin, to save on material and without adjustments or padding, in order to keep the price down. Purchase of such harnesses can prove a false economy to donkey users as they usually cause sores on the animals, thus reducing work performance. It is these messages that the extension officers need to get across.

In areas where cattle deaths brought about by drought has meant that many farmers have to use donkeys rather than cattle for land preparation, farmers very often use the yokes they have for the cattle on the donkeys, despite such use being illegal in some areas. This can be the result of ignorance and/or unwillingness to purchase donkeys harness. Again education, of donkey users as well as of artisans producing donkey harnessing, is required, rather than technical developments.

Donkey in well balanced cart

© Val Corr, Naivasha, Kenya

Branding

It is common practice for donkey owners, particular in rural areas and where donkeys live in large herds, to brand their animals. This is often done with hot wire (which is extremely painful) and by cutting patterns in their ears or, in worst case scenarios, to cut the ears off altogether. The first method is acceptable in that it is probably the only way rural donkey owners have of identifying their animals. The second method should be avoided at all costs.

Donkeys ears cut off

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Donkeys have larger ears than horses. Their longer ears may pick up more distant sounds and may help cool the donkey's blood. It is, therefore, important that donkey owners do not cut off the ears as a brand mark.

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Housing

The housing of donkeys can be kept very basic. Depending on the climate and season, a small shelter is sufficient. It should have, at the very least, a roof. It should, preferably also have three closed sides with the open side facing away from the prevailing wind directions.

There must be enough space to lie down and the floor should not be damp or cold. Barbed wire enclosures should not be used for enclosing donkeys. Many donkeys will try to get through or jump over and injure themselves. The shelter should be at least 8 foot x 8 foot (2.4 x 2.4 m) for a single donkey. If the house is smaller than this, the donkey may get 'cast' when it lies down. The floor should be cleaned regularly and never allowed to become muddy with manure and urine as the donkey will almost certainly develop foot problems.

A very simple stable made of off cuts, lined with plastic or sacks, with a door. Simple slip rails could be used instead.

© Val Corr, Naivasha, Kenya

If the donkey is sheltered at night it is likely to be able to work much better as it will not have expended energy trying to keep warm. If the shelter has a door (which can very easily be made of slip rails) it is advisable to put water and hay inside the stable for the donkey to eat during the night. This will ensure that the donkey is rehydrated for work the following morning.

A donkey house can be constructed from 6 poles (one at each corner, one in the centre at the rear of the shelter, two for the door). The sides can be made of off cuts or, if these are not available, sacking can be fixed to the poles to afford shelter from the wind. The door should be at least 6 foot (1.8m) wide. The stable needs to be at least 6 foot (1.8m) high, and the roof should be pitched to allow water to drain. It is advisable to either gutter the roof and harvest the water or dig a ditch at the back of the shelter, in order that any water spillage is drained away from the stable.

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Nutrition - Feeding your donkey

You can help your donkey live a long time healthier life by making some changes on its feeding. Donkeys generally take good care of themselves but perform even better when we take good care of them.

Donkeys that are well fed are generally healthier, more productive and cost less to maintain. Try some of the following suggestion on feeding your donkey and see the different it makes on how

hard your donkey works for you.

The things your donkey needs from food.

Just like beings, donkeys should be fed on a balanced diet. A balanced diet consists of energy foods, fats, vitamins and minerals.

Energy foods

Energy food gives donkey the strength to live, walk and work. The more energy foods your donkey eats the harder it can work and the stronger it will be. Donkeys get energy mainly from feeding on grass and straw.

Protein foods

Protein in foods gives your donkey what it needs to grow, stay healthy and recover from injuries and illness young donkeys need a lot of protein to grow tall and strong. Mother donkey's milk is an important supply of protein for the baby donkey. Donkeys get protein from dark green foods like alfalfa, bean straw and some types of trees like acacia. You can supplement protein with cattle or sheep's food.

However, any of these supplements should NOT contain UREA. Donkeys also need some protein to get more energy from their food.

Fats

Fats in food help to keep your donkey healthy and warm. Fats act as a store of energy when food is in short supply. Most of the donkey's food does not contain much fat in them, but its body can make fat from the extra energy food and protein eaten when food is in plenty. Fatter donkeys get fewer injuries from harnesses than thin donkeys.

Vitamins

Vitamins in food keep your donkey healthy and strong. If it doesn't get vitamins it will become weak and sick. Donkeys get vitamins from fresh green foods like vegetables or grass. Dry, old grass fed contain few vitamins

Minerals

Minerals and salts in food give your donkey strong bones, teeth and a higher blood count. If your donkey doesn't get enough minerals its bones become weak and fragile. If a donkey doesn't get enough salt it will feel weak. On hot days it loses salt from its body through sweat and needs to eat more salt to replace the lost salts.

Water

Water that your donkey drinks is very important to keep it healthy. Allow your donkey to drink at least once a day. On hot days make sure it drinks more.

How to judge the quality of your donkey's food

Colour

green feed in normally higher in all vitamins, particularly vitamin A The green colour indicates the food has not been rained on excessively, it less apt to contain mould, and is easier for the donkey to eat.

Type

Feeds from legumes, like alfalfa and clover are normally higher in proteins, vitamins and minerals (especially calcium) that feeds from grass

Leaf to stem ratio

Feeds which contain higher leaf to stem ratio makes a feed more nutritious and easier to eat. Such feed has greater nutritional value.

Date of cutting

Feed that has been in the shamba for long declines in proteins and minerals, and increases in fibre. The older the feed the harder it will be for the donkey to digest.

Mould

Forage stored food that "smokes" when shaken is mouldy. Abortion, colic, and even death have been attributed to mouldy hay. Avoid feeding your donkey with food that has turned mouldy.

How much to feed your donkey

The amount of fresh food a donkey needs depends on food quality, food freshness and the nature of the donkey's work. The following table shows the recommended feed for donkeys with different needs.

ACTIVITY	FEED REQUIRED
Non working donkey	Napier and fresh grass
Working donkey	Napier, fresh grass and rice straw
Adult males	Napier and fresh grass
Pregnant females	Napier and fresh grass
Grazing donkey	Napier and fresh grass
Milking females	Napier, fresh grass rice straw and Maize husks/cobs.

A nursing jenny needs to eat the equivalent of about 2 - 3% of her body weight a day if she is only fed forage.

A working donkey needs to eat a volume of about 3 - 4% of its body weight a day. Thus an average donkey will need about 4 to 6 kg of fodder a day and more if nursing or working. If a donkey cannot obtain this amount from available grazing, it will need supplements. In any case, if donkeys are fed concentrate each working day, they will require less grazing, and learn that work brings rewards. If a donkey is fed well, but is still thin, it probably has internal parasites which need treating.

Donkeys' tough digestive system is somewhat less prone to colic than that of horses, and is able to break down near-inedible vegetation, extracting moisture from food very efficiently. As a rule, donkeys need smaller amounts of feed than horses of comparable height and weight.

General Guidelines

1. Give plenty of water to drink such that it wants to eat more; give water before you feed.
2. Feed your donkey more on working days and when heavily pregnant
3. Grow some crops or grass that your donkey can routinely feed on in your compound or garden
4. Save some food that you might feed to your other animals for your donkey
5. Feed more crop residues such as maize Stover or rice straw.
6. Feed kitchen waste to you donkey and crop residues from bean and pea crops, which contain lots of protein.
7. Give your donkey a salt lick
8. Give a little fresh green feed every day.

9. Use a running line tether along ditches and fields boundaries so that your donkey has a lot to choose from.
10. Use a nosebag to feed when it is resting during the working day
11. Repair harnesses that are causing sores and do not inure your animal with whips or other objects.
12. If your donkey is over 10 years old, ask the vet or animal health worked to check its teeth, and if necessary file them.
13. Check your donkey for worms and other parasites.
14. A fit donkey will use feed better that one that is injured or has sores.

Storage and Preservation of Feed

1. Store crop residues off the ground and under cover; this reduces pest and weather damage.
2. Feed your donkey in trough not on the ground; this reduces waste.

WARNING: DO NOT feed donkeys with cattle or goat/sheep's feed that contains urea (biuret) or monensin. Check the label and if in doubt don't feed otherwise you'll kill it!

Some donkey users in Southern Africa, recognising the value of their animals, have been feeding supplements throughout the dry season.

Water

Donkeys need clean fresh water every day, especially when working in hot weather. Lack of water can cause colic, a fatal condition. If possible they should have access to fresh water at all times, or at least in the morning and evening. The water trough or buckets should be kept clean. Donkeys should be allowed to drink as much as they want without being rushed. They are often expected to drink from ponds or streams. This is fine as long as they are not exposed

to heavily used, muddy areas as these may contain parasites such as liver fluke.

The importance of water cannot be stressed enough. When deprived of water for extended periods a donkey will suffer muscle fatigue and, in severe cases, death will result. The heart is a muscle and will fail if the donkey is continually deprived of water

.

Feed supplements, alternative feed resources, feeding methods

Provided natural pasture is abundant and donkeys have adequate time to graze, the feeding of donkeys should not be a major problem. Besides forage (or roughage) from grazing, the animals may be fed additional forage and concentrates provided by the farmer, depending on age and workload. In general, feeding strategies should be aimed at maintaining adequate body condition during periods of work stress or reproductive stress. Some preserved forage or concentrates should be stored for such periods. This is particularly important if donkeys have to work at the end of the dry season, when natural pasture is scarce.

The most common forage supplements are crop residues. These include groundnut hay, and maize and sorghum stover. The leaves of legume fodder trees (e.g., Leucaena, Sesbania and some Acacias) are rich in protein and can also be fed to donkeys

Supplements are most important in the following conditions:

- **Local grazing is poor because of drought or over-grazing.**
- **Animals must walk long distances for food.**
- **Donkeys do not get at least six grazing hours each day.**
- **Female donkeys are in the last three months of pregnancy or they are nursing a foal.**
- **Young foals are growing, especially between 6 and 18 months of age.**

Staking donkeys for eating

If donkeys are staked, it is important to move their stake daily, or even twice per day. Never tie a donkey by its leg as this may cause blood restriction which could result in the foot falling off. If they are fenced, it is better to have several small paddocks rather than one large one. This allows donkeys to be moved often (rotational grazing). In this way donkeys gain more nutrients than if they continually and selectively graze one large pasture. A grazing donkey can ingest eggs of internal parasites contained in manure, causing internal infections with these parasites, particularly worms. Therefore donkeys should not be allowed to graze in areas with lots of manure. Never resort to placing a wire ring in the nose of a donkey. The septum is not the same as that of a cow and the wire will nearly always cause serious damage to the donkeys nose. This can result in infection of the nasal/sinus passages.

Damaged Nose

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Clinical Examination and Diagnostic thoughts of equines - VETS AND AHAS

Clinical examination is the primary action that a clinician undertakes whenever s/he is examining an animal.

- **Don't give any drug before carrying out any examination as this will interfere with the findings**
- **Give water for heat stress**
- **Get the history from the owner/user.**
- **Ask about the feeding-appetite and what it ate e.t.c.**
- **Age of the animal**
- **Sex- signalment e.g. female-pregnancy status**
- **Water intake- quantity taken, urine colour**
- **Earlier treatment given.**
- **Behavioural change.**

Regional examination

For easier and wholistic clinical examination, the animal is divided into region/blocks i.e.

1. Head region
2. Neck region
3. Shoulder and breast region
4. Fore limbs
5. Thoracic area
6. Abdominal area
7. Hind quarter/hips area
8. Hind legs are

Clinical examination

a) Vital Parameters

- **Take pulse rate, heart rate, breathing rate, and body temperature**

b) Mouth

- **Check for cuts/wound/lesions inside cheek, smell**
- **Tongue any cut /wound**
- **Teeth irregularity in growth /sharp teeth**
- **Any lesion on the lower and the upper pad /gums, CRT**

c) Nostrils-color of discharge and amount of discharge

d) Eyes- this is conducted in a well lit place, or if in darkened place use torch pen and do routine examination.

- **Presence of any swelling, tears, & wound.**
- **Color of mucous membrane**
  - **i) Pale**
  - **ii) Red mucous membrane**
  - **iii) Presence of any foreign bodies.**
  - **iv) Sight- blindness, cataract**

Others

- **Swollen gut**
- **Genital organs, swelling, wounds, discharges**
- **Limbs and feet, look for conformation, wounds, swelling.**
- **Examine the sole and frog pain abscess, swelling**
- **Skin any abrasion, wounds, papules, swellings, discharge, external parasites.**

Rectal Temperature

i. Put a head collar on the donkey and have an assistant hold the head
ii. Stand besides the donkey just in front of its back leg with your body against its body
iii. Then insert the thermometer- ensuring the bulb is against the wall of the rectum
iv. Keep hold of the end of the thermometer
v. Wait 60 seconds or longer if the instruction on the thermometer tell you that longer is required
vi. Read the thermometer and clean the thermometer thereafter.

Rectal Temperature, Range 36.5- 37.8 (average 37.1)

Pulse Rate

This can be detected at several points of the donkey's body

- **Under the mandible at the side of the face**
- **Or feel for it behind the fetlock joint**
- **Or just above the hoof on the inside of the leg , for laminitis**
- **Auscultate for the heart beat just behind the donkeys elbow**

The normal heart rate for an adult donkey is 44 beats/min.

Respiratory Rate

- **This ranges from 16-20 breaths /min.**
- **Increased respiratory rate accompanied by cyanosis is a sign of a serious disease; while if it is increased with an increased involvement of the abdominal muscles may indicate respiratory**

disease.

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Veterinary care - common diseases and conditions

General signs of disease

Donkeys tend to be quite healthy. When an animal falls ill, give it a rest in a quiet place with food and water. Consult, if possible, the local animal health agent or veterinarian. A farmer should be able to tell in an early stage whether the donkey is sick. Signs of ill health are when a donkey:

- **has a very warm muzzle, pasterns and feet;**
- **has a nervous or depressed expression**
- **hangs its head**
- **has a rough coat with hairs standing up**
- **stands with all four legs close under it**
- **is reluctant to take steps**
- **is sweating before work**
- **does not pass faeces or urine, or if these are abnormal**

The earlier a disease is recognised, the sooner treatment can start. The cost of medicine or loss of work power can thus be minimised.

The common diseases mentioned hereunder are:

1. **Wounds**
2. **Rectal prolapsed**
3. **Hoof Problems- Pedal Sepsis, Laminitis**
4. **Skin conditions and diseases**
   - **Swellings under the skin include- Abscesses, hernia, haematoma, tumour, oedema etc.**
   - **Skin diseases- Bacterial Diseases, Viral Diseases, Parasitic Diseases, Fungal Diseases**
5. **External Parasites- Ticks, Lice and fleas, Mange**
6. **Internal parasites**
   - **Gut worm (intestinal): round worms or tapeworm**
   - **Lungworms**
   - **Flukes (trematodes)- inhabit liver and intestine**
   - **Stomach spirurids worms and larvae causing cutaneous habronemiasis**
7. **Infectious diseases**
   - **Bacterial diseases**
   - **Viral diseases**
   - **Fungal diseases**
8. **Main respiratory diseases**
9. **Colic**
10. **Zoonotic diseases**
11. **Teeth problems**
12. **Horse sickness**
13. **Mud Fever**

1. Equine Wound Management

General wound care

The wound should be cleaned with clean salty water. While a wound is healing the cause of the wound should be removed and the animal rested; if available a mild disinfectant can be used

(dilute iodine 1-2%)

Fresh Wound management

- **Clip the hair around the edge of the wound**
- **Wash using clean water.**
- **Use fly repellant chemicals**

NB. Oxygen is a vital part of the wound repair process; anaerobic conditions may arise if the wound contains both a disrupted blood supply and an enclosed surfaced; puncture wounds are notorious for the development of these conditions and this provides an ideal circumstances for some of the most notorious Clostridial infections eg C. tetani is classic wound contaminant; to which Penicillin is highly effective. A fully vaccinated donkey may contract tetanus when the wounds are highly contaminated with the causative agent.

Wounds with impaired oxygen delivery require careful management to eliminate anaerobic conditions and encourage a good oxygen supply. NB: In case of deep wounds it is important to administer Tetanus toxin currently available:

i. Managing Infected wound

It is paramount to remove all the dead tissues and any foreign bodies in the wound using a scapel blade which may delay the healing of the wound. Ideally after 6-8 hours a wound is considered to be contaminated therefore the need of using prophylactic antibiotic. Any suspected infection should be flushed using diluted hydrogen peroxide should not be used in any healing wound - ensure there is proper drainage for the hydrogen peroxide; this is followed by lavaging and later application of diluted (1-2%) Povidone iodine.

2. Rectal prolapse

This is where the lower or the end part of the gut may turn out/ come out of the body. This is

commonly seen in working donkeys that are suffering from heavy helminthiasis (internal worm parasitism) - Gasterophilus larvae (Bot fly); diarrhea and malnutrition. While feeding of dry feed (bran, maize or rice straws) without adequately providing the donkey with water. Overloading/overworking may also predispose the donkey to the condition.
Other causes include parturition and colic.

a) Manifestation

The owner complains of a mass of reddish (meat) hanging from the rectum. The rectum is oedematous/swollen, reddish or cyanotic (survival rate is low). Ruptured (cracks) due to excessive edema. Necrosis may have set in.

b) Treatment

Identification of the initial cause is paramount for effective management Physical Restraint of the animal may be enhanced chemically (Xylazine or ACP) Gently cleaning of the rectum and the perineum (vulva in female) with mild disinfectant (diluted Savlon or soapy water) ensuring no or minimal damage to the organ and the surrounding tissue. Remove any necrotic tissue.

NB: Apply hygroscopic compounds (sugar) - salt is very irritating and should be avoided where possible to reduce the edema fully (patience is of essence). These should be washed off as they are act as good media for microbial growth.
Lubricate with liquid paraffin or any other water soluble gel. Gently and carefully return/replace the rectum to its normal anatomical position. Patience is required. Do not push against peristalsis.
If necessary, retention with purse string suture is recommended but normal passage of faeces to be ensured (Local anesthesia required). The Suture should not be left in place for more than 12 hours. Antibiotics and anti-inflammatory should be given when there is need. Treat the underlying cause.
The owner should be advised provide water ad lib and to monitor defaecation

3. Hoof care and Management

Donkeys' feet generally require trimming every 6-10 months dependent on the terrain; owners should be encouraged to check/examine all the four feet on a daily basis to remove debris, stones and other foreign bodies.

Common Hoof Problems

Lameness is caused by pain in some part of the leg. Lameness may be in more than one leg. The foot of the lame leg is held pointing to the ground especially in front leg lameness. There is a difference in amount of muscle in the shoulder of lame leg and normal leg.

a) Pedal Sepsis

Is an acute lameness presenting as non-weight bearing lameness; abscesses frequently track proximally from the white line at the bearing surface to eventually rupturing at the coronary band. It is important to first trim the foot back to a normal length and conformation, exposing a clean bearing surface free of all but deeper lesions; the entire weight bearing surface should then be explored, paying attention to the white line area. Black marks, especially those adjacent to the sole axially are suspicious.

NB: Digital pressure at the coronary band may illicit a response from related distal abscess. One may resect the overlying hoof wall to facilitate drainage; however avoid injury and Prolapse of the underlying sensitive corium.

b) Laminitis

A common problem usually not recognized by the owner which may cause damage to the hoof. Causes are varied and include

- **Excessive feeding of carbohydrate rich feed. E.g. bran**
- **Grain overload**
- **Trauma**

- **Generalized septicemia/toxemia.**

Clinical signs

- **Reluctance to move, recumbency**
- **Pain on coronary band**
- **Increased digital artery pressure**
- **Weight shifting**
- **Weight bearing on heals**

Treatment

- **Remove the cause**
- **Analgesia NSAIDS flunixn- IV, then by mouth- Phenylbutazone**
- **ACP**

Hoof Care

The hoof of animal continuously grows throughout its life but wears down as it grows. At times the hoof may overgrow when the animal is rested or injured which will call for trimming; there are instances when the hooves are overgrown/ deformed which will call for trimming them in two sessions with two weeks gap. This ensures the hoof is trimmed to back to its functional state (normal shape and angle).

Steps for Hoof trimming

- **Cut the sole back with a sharp knife. Immediately stop cutting when you see a pink color/blood.**
- **Cut the over grown wall using hoof cutter.**

- **Use a rasp/file to tidy up the hoof wall**
- **Trim the frog using a sharp knife to its normal shape.**

Overgrown donkey hooves

4 Skin Condition and Diseases

a. Swellings under the skin include:

Abscesses, hernia, haematoma, tumour, oedema' etc.

i. Abscess

This is pus accumulation under the skin.
Management of Abscess
Treatment is by lancing, cleaning/flushing using diluted hydrogen peroxide and apply diluted iodine- ensure the created wound will be able to drain.

ii. Haematoma

This is accumulation of blood under the skin due to injury leading to bleeding under the skin. The swelling is soft at first but doesn't pit under pressure. It is less painful than an abscess. An uninfected haematoma should be left alone; as it heals with the blood clots and the serum being absorbed. Infected haematoma is treated in the same way as an abscess.

iii. Tumours

Sarcoid is a viral skin tumour/cancer that resembles a large hairless warts; it is commonly found on the hairless areas, around genitals, eyes and nostrils. If untreated they enlarge and ulcerated with continuous discharges; they are prone to fly strike. Management is through surgical excision - ensuring the whole mass is removed.

b. Skin diseases

Skin disease includes changes of the skin due to bacterial, viral and parasitic as well as fungal infections.

Common skin diseases include:

i. Bacterial Diseases

- **Dermatophilosis**
- **Glanders**
- **Ulcerative lymphangiits**
- **Fistulous withers and poll evil**

ii. Viral Diseases

- **Sarcoids**

iii. Parasitic Diseases

- **Ticks**
- **Lice and flea**
- **Myasis (warbles)**
- **Manges**

iv. Fungal Diseases

- **a. Ring worm**

This is caused by Trichophyton and Microsporum spp. which tends to grow in circular hairless rings, nodules and abscesses on skin. It is spread by close contact with infected animals/equipments.

Prevention

- **Avoid contact of infected and uninfected animals/equipments.**
- **Treatment- severe cases of ring worm are treated with anti-fungal creams such or oral griseofulvin (contraindicated in pregnant mares) otherwise most cases recover naturally.**

b. Epizootic Lymphangitis

Fungus: Histoplasma fasciminosum: causes lumps and abscesses on skin and mucus membranes, in eyes causes discharges which attracts flies leading to irritation and rubbing of the affected areas.

Prevention and Control
This can be done by use of anti-fungal drugs and/or surgical removal of nodules or use of Zinc oxide ointment on skin.

5. External Parasites

i. Ticks:

Are large bloods sucking insects that attach to the soft skin under the tail, inside the fore and hind legs and in ears. They transmit blood parasites that cause blood loss and diseases such as Babesiosis.

ii. Lice and fleas

Lice are found usually in the mane and the tail in poorly fed and young animals. They cause itchiness causing the animal to rub and lick itself. Signs will include patchy losses of hair, excessive rubbing, scratching and biting at skin, restlessness, scabs, exudates formation, head shaking.

iii. Mange

These are parasitic mites that burrow into the skin and cause intense irritation resulting in biting and rubbing by the animal. Mites are characterized by severe irritation, thickened skin

with gray scabs and surface flakes

Prevention and treatment

Mites can be transmitted from one donkey to another by contact or grooming equipment, so avoid contact of animals and using the same grooming material. Mange is treated with Ivermectin (three time each 10 days apart (day o, day 10, day 21).

Control and Prevention of External Parasites

Use of organophosphates such as Stelladone®, Synthetic pyrethroids such as Delete®, Decatix®

NOTE: Amitraz such as Triatix®, Norotraz®, are contraindicated in equines. However there are some farmers who have used amitraz with no side effects reported; this can be achieved if the animal is given adequate water before applying the acaricide. At all times ensure the unit is cleaned and beddings replaced while you control the parasite on the animal.

6. Internal Parasites

These include:

- **Tape worms**
- **Liver flukes**
- **Roundworms.**

These are variations with different kinds of worms

Symptoms of worms:

- **Lethargy**
- **Poor coat**

- **Poor condition**
- **Anaemia**

Prevention/Treatment:

Removal of faeces from pasture every 2-3 months to reduce contamination of grazing resulted in a decrease in worm egg counts, and less clinical disease in horses compared to those treated regularly with anthelmintics (Herd, 1986, Krecek, unpublished data). This is a simple, low cost method of reducing worm egg counts which could be an affordable, effective and therefore acceptable practice to control parasite burdens in donkeys. Keeping animals in fly-proof accommodation for at least part of the day when vector flies are prevalent, can also reduce the incidence

a. Strogylosis

Strongyles are found world wide, the larvae cause colic and death. The larvae migrating in the body tissue causes:

- **Pain and colic**
- **Fever**
- **Loss of appetite**
- **Damage to an artery to the intestine. Adult strongyles are found lining the gut and feed on the animals blood which results in weakness and poor body condition**

Prevention:

In areas where the worm burden is high it is advisable to deworm the donkey after every three or six months intervals. In other instances strategic deworming is the best way of controlling the worms which targets the period when the infective stage of the worm is highest. Treatment: use any of the following: Ivermectin orally or Fenbendazole

b. Ascarid worms

These worms don't cause much problem to the adult donkeys except when they block the gut hence causing colic; but poses problem in foals

Clinical signs

- **Coughing**
- **Weakness and emaciation**
- **Unthriftness**
- **Adult worms are some times seen in dung**

Prevention and treatment

Treat all foals aged eight week and above, by which time the animal would have developed immunity. The drugs of choice are Piperazine or Ivermectin.

c. Tape worms/ Cestodes

These are less harmful to donkeys as compared to round worms. The animal doesn't show overt signs of infection/infestation but in case of large numbers they cause intestinal blockage, colic and caecal perforation.

Note: Diagnosis using the faecal floation method has low sensitivity, due to un-even egg distribution in faeces- though it is highly specific as the tapeworm eggs distinctively angular and readily identified.

Treatment:

Pyrantel or Praziquantel compounds.

d. Liver fluke Disease

The fluke is a leaf-shaped parasite that lives in the bile ducts of the liver. This condition is only

found at PM, in a live animal they asymptomatic.

Clinical sign

- **Tiredness**
- **Loss of appetite**
- **Swelling on the skin**

Prevention and treatment

- **Avoiding animals grazing in swampy areas is effective prevention method.**
- **Oxyclozanide or triclabendazole are used to treat fluke.**

Rectal Prolapse has been associated with heavy endoparasitism. Dewormers/Anthelmintics in the Market

Drug	Animal use	Worms Targeted	Efficacy	Resistance
Levamisole (Readily available in market and cheap)	Cattle, sheep, goats and avians		Good buy narrow spectrum - Toxic to equine	Low
Oxyfendazole	Cattle, sheep, goats and equines	P. equorum -Large and small strongles resistant to other Benzimidazoles	Higher plasma concentration compared to Fenbendazole - Broad spectrum	Very high
Ivermectin* (acts on ectoparasite and endoparasite) - relatively expensive	Dogs, cats, equine, sheep, cattle, goats	Large and small strongles, P. equorum - Arthropods e.g Gasterophilus	High - Broad sspectrum	Medium

Pyrantel	**Equine**	**P.equorum, small strongyles**	**Narrow spectrum**	**Medium**
Fenbendazole*	**Same as Ivermectin**	**P. equorum - Large and small strongles**	**Low efficacy -Broad spectrum**	**Low**
Piperazine (Cheap and readily available)	**Avian, bovine, equine**	**P equorum, small strongyles**	**Very narrow spectrum - Effective on ascarids, poorly effective**	**Low**
Albendazole (Highly misused, readily available)	**Most domestic animals**		**Broad spectrum -Low efficacy**	**Very high**

N.B: Administration of Oxfendazole and Fenbendazole over a number of consecutive days may prove more effective against most resistant parasites than a single administration.

Control and Prevention

- **Strategic deworming**
- **Practice clean pastures/feed management.**
- **Frequent use of anthelmintics and sub-optimal dosing may cause resistance.**
- **Egg counts to be used as a guide to worming e.g. in treatment of tapeworm this is done when there is positive identification of eggs in faeces.**

7. Infectious Diseases

Infectious diseases of equine include viral, bacterial, fungal as well as parasitic disease in broader sense. Here we will consider only certain of these infectious agents.

A. Bacterial Diseases

a. Strangles

This disease looks like flu initially with coughing which disappears later. Clinical signs

Early case - High temperature, watery discharge from the nose, coughing
Later cases - Cough disappears, difficulty of swallowing, thick, creamy, white pus (nasal discharge)

Treatment - Resting the animal, nursing (offering soft, moist food), and antibiotic (preferably Penicillin based) treatment.

b. Tetanus or Lock Jaw

Caused by Clostridium tetani; it is associated with soil contamination of sores and wounds from ill-fitting harnesses and poor hygiene during surgery.

Clinical signs

- **History of deep wound(s) which can already be healed completely.**
- **Muscle stiffness and locked jaw-unable to eat and swallow food**
- **Dilated pupil**
- **The animal has a frightened expression**
- **The ears stickup**
- **Respiratory failure and death**

Treatment - Use of tetanus toxoid, heavy dose of Penicillin and sedatives, keep the animal in a calm place. Open the suspected wound and flush it with hydrogen peroxide.

Prevention and Control

Can be prevented by complete treatment of wounds and cleanliness/ hygiene in surgical procedures.

c. Anthrax

Anthrax in equines has a chronic form and these animals do not die of the disease in most cases.

Clinical signs

- **high temperature (410c)**
- **high pulse rate**
- **large swelling around the belly**

Treatment: - Anthrax easily treated by antibiotics in earlier stages

d. Glanders

The disease affects the skin and lungs. Horses are resistant to glanders but mules and donkeys die within two weeks

Clinical Signs

- **Fever**
- **Watery nasal discharge initial but later on the discharge gets thicker.**
- **Lumps appear in the nostril and break open. After healing the lump leaves a star-shaped scar in the nostril. The burst lump also releases a sickly honey-like discharge.**

Treatment: sulphadiazine.

B. Viral Diseases a. Flu - Is caused by viruses Clinical features

- **High temperature.**
- **Later on there is coughing**
- **Watery discharge from the nostrils which later becomes thicker and yellowish.**
- **As time goes on the cough becomes more severe.**

Prevention - Vaccination

b. Rabies

The disease is a viral disease which comes from a bite of an infected animal or contact of wound with saliva of an infected animal.

Clinical signs

Divided into the furious (encephalitis) and dumb (paralytic) forms; the disease usually is a combination of both- signs will include

- **Change of behaviour, colic, self mutilation especially on the external genitalia, grinding the teeth, foaming at the mouth, paresis or spastic or flaccid paralysis in one or more limbs and convulsion.**
- **Pica**
- **Hydrophobia**

NB: Any rapidly progressing neurological condition should be a case of suspected rabies, especially if accompanied by obvious bite or wounds or history of exposure to rabid animals. Confirmatory Diagnosis: the complete head of the donkey to be submitted to the laboratory for diagnosis Kabete Veterinary Laboratory or any of the Regional Veterinary Investigation Laboratories (VIL).

Prevention: Vaccination.

C. Fungal Diseases a. Epizootic lymphangitis

This disease affects equines especially when they are crowded. The infection gets into the body through damage to skin and can be carried by biting flies.

Clinical signs

- **Development of lumps under the skin along the lymphatic stream.**

- **The lumps burst and yellow pus discharges**
- **Emaciation.**

Prevention

- **Affected animals should be kept away from healthy animals.**
- **Harnesses and grooming equipment should be disinfected.**
- **Control of insects.**
- **Severe cases should be euthanized.**

8. Main Respiratory Diseases

Diseases that affect respiratory system

a) Strangles - This a highly contagious bacterial infection of the equine (as discussed above) b) Pneumonia: is an inflammation of the bronchioles

The most common complaint in donkeys is pneumonia. This is generally brought abut by poor management practices and working undernourished donkeys too hard for too long. The result is exhaustion and the donkey is not able to deal with the challenge presented by exhaustion, dehydration and cold (at night). This will, inevitably, result in pneumonia

Other causes include:

- **Secondary to viral or bacterial upper respiratory disease**
- **Inhalation of foreign material e.g. food, drenched or stomach-tube medicines (aspiration pneumonia)**

Symptoms:

- **Reluctance to move.**
- **Arched back.**
- **Head hanging.**
- **Shallow/fast breathing.**

- **Temperature**

Clinical signs

- **Fever**
- **Increased pulse rate**
- **Increased respiratory rate**
- **Coughing**
- **Nasal discharge**

Prevention/Treatment:

- **Good food.**
- **Plenty water.**
- **At least two weeks complete rest.**
- **Allow animals with respiratory disease to rest and recover properly, before starting heavy work again,**
- **Treat secondary bacterial infections early (antibiotics - see below),**
- **Avoid drenching equines with wormers, liquid paraffin etc. and use extreme care when passing a stomach tube**

Treatment - Penicillin or Trimethoprim-sulphonamides for at least 7 days, NSAIDs, Rest in a clean, dust-free areas,

c) Lung worms

- **Lung worms can cause inflammation of the bronchioles in equines**
- **Infection mainly acquired towards end of wet season**

Clinical signs

- **persistent coughing for several months**
- **may have slightly increased respiratory rate and mildly increased lung sound**
- **non-progressive condition**

Preventions

- **Remove faeces from environment to prevent transmission**
- **Avoid keeping horses with donkeys**
- **If horses are kept with donkeys, treat the donkeys for worms,**
- **Treat regularly for worms(every 3 months)**

Treatment

- **Ivermectin 0.2mg/kg(1ml/50kg) or**
- **Fenbendazole 15mg/kg or**
- **Thiabendazole 440mg/kg and repeat after 2 days**

D. Protozal Diseases a. Trypanosomiasis

A part from the common species of Trypanosoma causing Trypanosomosis in equines; donkeys are also affected by tsetse transmitted Trypanosomosis (T. vivax, T. congolense and T. brucei) commonly referred to as Nagana in cattle. Therefore in tsetse fly endemic areas, donkeys are also at a higher risk and may not the necessary attention as the other domestic livestock. It's usually an acute or chronic disease depending on the species of tsetse fly; these signs are dependent on the nutrition status of the animal, pregnancy status, level of work, level of stress, general health status and any concurrent disease.

Clinical findings

Intermittent fever (comes and goes), weakness and progressive thinness (loss of body weight) tired easily and may stop eating, anaemia/ pale mucus membranes (gums, conjunctiva), swollen lymph nodes, limbs and belly with edema, sensitivity to light, dullness, dragging hind limbs, loss of balance, seizures, head pressing, cycling and paralysis are signs of brain infection.

Diagnosis

Use thin and thick blood smear (blood sample take when there is fever and from peripheral

venous supply preferably the ears vein.

Treatment

The drugs used must be used with a lot of caution and be injected deep intramuscularly due to tissue necrosis and toxicity.
The Preparation in the market include:

1. Homiduim bromide or Homidium Chloride 1mg/kg bwt example Ethidium and Novidium.
2. Diminazene aceturate (Berenil, Norotryp) can cause nervous signs and death if not carefull used. Dose: 3.5mg/kg
3. Isometamidium chloride: for prophylaxis and curative: use separate needle for filling the syringe and jabbing.
4. Quinapyramine sulfate: prior to its use the donkey must be well rested; fatigue can cause curare like reaction.

NOTE: Trypanocidals do not cross the blood-brain barrier hence once nervous signs have commenced it is inadvisable to treat such an animal but it is imperative for it to be euthanized.
Prevention/control
Control the fly on the animal and treat diagnosed cases on time.

b. Babesiosis

Babesiosis is caused by intra-erythrocytic protozoan parasites; Babesia. This is a tick transmitted disease, whose vectors include Hyalomma, Dermacentor and Rhipicephalus ticks; intrauterine infection, particularly with B. equi, is also relatively common.

Clinical findings

The incubation period ranges from 5 - 21 days. The signs include fever (frequently 105.8°F [41°C] or higher), inappetence, increased respiratory rate, muscle tremors, anemia, jaundice,

depression, marked thirst, lacrimation, swelling of the eyelids, weight loss; hemoglobinemia and hemoglobinuria occur in the final stages.

Affected donkeys are constipated, passing small, hard ball of faeces covered with yellow mucus, may loose the health condition. Sometimes donkeys can show colic symptoms viz. looking at flank, pawing, kicking at belly region, lying down and rolling, due to sluggish intestinal peristaltic movements and constipation.

NB: The most characteristic sign is the development of icterus, mucus membranes vary from pale pink to pale yellow to bright yellow in color. Petechiae or ecchymosed haemorrhages are seen on the mucus membranes of nasal passages, vagina or third eyelids. Extremely large spleen in the affected animals is the common symptom.

Untreated or neglected cases become severely anemic, malaise, reluctant to move, down neck, inappetence, disinterest in surroundings and show signs of general weakness. Development of progressive anemia and haemoglobinuria in the last clinical phase of the disease is pathognomonic sign in B. equi infection in horses and also in donkeys. Equines usually have higher threshold for escape of haemoglobin through urine from the circulation, hence haemoglobinuria is observed as last irreversible clinical sign signifying nephrosis and subsequent renal failure.

Chronic cases are more common in donkeys and clinical signs are usually non specific including mild inappetence, poor work performance or poor body weight gain. Mixed infections are not uncommon therefore making diagnosis difficult. Clinically, babesiosis can be confused with other conditions that cause fever, anemia, hemolysis, jaundice, or red urine. Therefore, confirmation of a diagnosis by microscopic examination of Giemsa-stained blood or organ smears is essential. From the live animal, thick and thin blood smears should be prepared, preferably from capillaries in the ear or tail tip.

Hemoglobin concentration, PCV level, red blood cell counts reduces significantly in donkeys infected acutely with B. equi parasite. Acute infection is also characterized by severe

leucocytosis, lymphopenia, high absolute neutrophils count. Post mortem signs from B.equi include: varying degree of emaciation, gross enlargement of the liver and spleen and flabby kidneys. Small pin point petechiae haemorrhages are also present on liver, spleen and cortical surface of the kidney. Lungs are edematous, congested and enlarged lymph nodes.

Treatment

If equine babesiosis is diagnosed and treated early, there is an excellent chance of recovery. . Imidocarb (Imizol®is a babesiacidal drug that is administered at a dosage of 2.2mg /kg. Two treatments are administered at a 24-hour interval. For cases of Babesia equi that are resistant to therapy, a dose of 4mg /kg is administered 4 times at 72-hour intervals. This regimen is often effective in treating the infection.

Prevention

This by control of tick infestations and avoiding iatrogenic transfer of infected blood during routine surgical and medical procedures.

9. Colic

Colic: means abdominal pain (the stomach or intestine), affecting all equine species; however donkeys show fewer behavioural signs to pain

Causes of colic

This is caused by many different conditions affecting the internal organs. Most cases of colic are associated with poor management practices. The common causes include:

Food

- **Sudden changes to what the donkey eats, such as overfeeding and irregular feeding- e.g.**

too much food at once ortoo much grain. It is necessary to feed small quantities of good quality food at regular intervals.

- **Poor quality food, such as mouldy hay, or too much dry straw (indigestible roughage**
- **Long gaps between meals**
- **Fresh highly fermentable green fodder that produce gas**

Water

- **Not enough water**
- **Rapid drinking of too much water**
- **Water not supplied regularly**

Internal parasites - Some internal parasites can cause colic.

Poor Teeth - Will lead to large junk of food passing through hence causing blockage Sand - the animal may swallow sand if it is grazing on the sandy ground where grass is scanty. The swallowed sand can cause inflammation and impaction in the gut. Eating strange things - Equines sometimes eat plastic bags, pieces of ropes and all sorts of rubbish. These accumulates along gut and cause colic

Clinical signs of Colic

- **Kicking or looking at flank**
- **Sweating**
- **Restless**
- **Rolling on the ground**
- **Pawing the ground**

Diagnosis

- **History: to be taken to establish change in management to be noted- change of diet, access to excess feed.**

- **Assessment of pain: donkeys opposed to horses don't show overt signs of pain- so colic may not be identified until the terminal stages of disease. A donkey in pain will stand with its head lowered, lie down or not respond as normal and may be dull. Dullness is the most common sign of impactive colic followed by reduced appetite.**
- **Heart rate: normal is 44/min, donkeys with impaction colic may have heart rate of 60/min or less compared to others with other types of colic which may be 60-100/min.**
- **Respiratory rate: normal 16-20/min. severe abdominal pain may increase the respiratory rate in an apparent attempt to reduce the movement of the diaphragm and chest. Pressure on the diaphragm from grossly distended colon will elevate the respiratory rate. Prognosis is grave if there is elevated respiratory and cyanosis.**
- **Rectal temperature: average is 37.1; increase maybe due to physical exertion or infection.**
- **Mucous membrane and capillary refill time: used to assess the hydration; dehydration will cause blanching of mucus membrane; endotoxin release or congestion will lead to it being brick red and even cyanotic.**
- **Appetite: must be assessed in a dull donkey as it might be the only sign of colic.**

Treatment

Aimed to relieve pain, correct dehydration and restore the normal passage of ingesta.

- **Pain relief: use of nasogastric intubation will help relieve pain, use of NSAIDs e.g. Flunixin meglumine**
- **Correcting dehydration: rapid rehydration IV will restore circulatory blood volume and improve tissue perfusion; will correct shock due to absorption of endotoxin through a compromised intestinal wall**
- **Making an impacted donkey move or eat fresh grass may make the animal pass ingesta. Avoid long fibres such as hay and straw until the normal transit of ingesta is established.**
- **Impaction colic can be managed by use oral laxatives, mild analgesics, IV/oral fluids. Administration of mineral oil to caecal impaction is less effective than in treatment of large colon impaction because the oil can pass straight into colon without penetrating the caecal mass.**

Prevention of colic

- **Feed small quantity of good quality food at regular intervals**
- **Do not prevent the horse from eating for a long period, and then let it eat a lot**
- **Avoid grain overfeeding**
- **Offer water little and frequently**
- **Deworm regularly (every 3 months)**
- **Check teeth regularly and rasp accordingly**

10. Zoonoses

Zoonosis: is any infectious disease that can be transmitted to humans by vertebrate animals e.g. rabies, anthrax, glanders

1. Rabies

- **Rabies is a fatal infection transmitted in saliva.**
- **It is caused by virus**
- **It affect all mammals**
- **Rabies is fatal to humans so extreme care must be taken when handling any suspected case**

Transmission - Equines are infected via a bite from a rabied animal (dog,donkey or other animals)

Message to the owners

- **Any animal showing abnormal behaviour or after being bitten by a dog should be isolated in a secure place**
- **If a donkey is bitten by a suspected rabid dog, it is recommended to immediately wash the wound generously with soap and water without touching the area.gloves required.**

2. Anthrax

- **Anthrax is an infection of blood**
- **Other species suddenly die of the disease, but horses and donkeys may be ill for a long time and not always die.**
- **Anthrax is caused by bacteria**

Transmission - Animals can get the disease when they eat a bit of contaminated soil with grass.

Prevention

- **Vaccination**
- **Stop vultures, dogs, etc. from opening the body (avoid the blood from contact of air).**
- **Bury it deeply, at least four meters deep**

Treatment - Give injections of antibiotics such as penicillin

Principle of Vaccination

- **Vaccine is a harm less form of microorganisms (virus, bacteria) administered to the animals orally or parentally.**
- **Due to vaccine/ antigen introduced into the bodies, the animal produces antibodies to protect the animal against the same disease.**
- **Vaccines are either live or dead requiring their own handling methods**
- **Antibody formation requires at least two to three weeks**

Vaccination Protocol

- **When a vaccine is introduced in to the body, it forms immunity in the body of the animal**
- **Vaccination is a preventive method from different contagious and infectious diseases and not curative**
- **Vaccination plays a roll in the eradication of infectious diseases.**

- **Vaccinate only healthy animals as well as those presented to vet clinic for treatment.**
- **Vaccinate all equines starting from 6 weeks old including pregnant mare**

Handling of vaccines

Storage: great care should be taken in case of storage Live vaccine should be stored in the refrigerator at -20 degree centigrade; while the killed vaccine can be stored at +4 degree centigrade for two years & at room temp. 20 - 21degree centigrade for 6 months

Some equine diseases that need vaccination & the doses of vaccine to be given

- **A.H.S ----------1cc for adult animals and 1.5 cc for young**
- **Anthrax---------- 1cc for adult animal and 1.5 cc for young**
- **Tetanus---------- 1cc for adult animal and 1.5 cc for young**

11. Teeth Problems

Due to a combination of factors such as limited angle of opening the mouth, rostral positioning of the lip corners and the length of the dental arcade it is difficult to fully examine the caudal teeth; hence the need to use a gag (speculum) for this purpose. Conditions affecting the teeth include overgrown teeth which may affect the ability of the donkey to masticate hence the need to even such teeth

Tooth rasping

Animals with no clinical signs may still have sharp or damaged teeth that may cause problem later

Clinical signs of tooth problem include

- **Thin animal**
- **Dropping food**
- **Reluctance to eat**
- **Reluctance to work**
- **Increased salivation**
- **Foul smell from the mouth**
- **Older animals may need rasping every 3-6 month**

A donkey undergoing treatment
© KENDAT, Kenya

How to rasp

1. It is important to use rasping instrument/ equipments and mouth gag for teeth rasping. The mouth gag if available can be used to examine all of the molar teeth , palate ,upper jaw , lower jaw , cheeks tongue etc.

2. Things to examine are sharp edges, hooks, spikes broken or missing teeth.

3. Sharp edged teeth must be rasped until it comes to the level.

Horse Sickness

Donkeys seem to be reasonably immune to this disease and, when it does present itself, it is usually takes a much milder form than in horses. However, it should be treated with respect. If the donkey is allowed to rest for 3 weeks recovery is usually spontaneous. It is prevalent after the rains when mosquitoes are more prevalent.

Symptoms:

- **Swollen eye sockets, under the jaw and, sometimes, in the sheath area**
- **Liquid dripping from nose and mouth**
- **Signs of colic (discomfort)**
- **The donkey may still graze naturally, but it will become weak and show a reluctance to work.**

Prevention/Treatment:

- **3 weeks complete rest.**
- **Provide good grazing with shade available.**

- **Provide plenty of fresh water.**
- **Use 'wet smoke fires' at night. These not only keep livestock free from mosquitoes (including those that are suspected of spreading Rift Valley Fever), they benefit humans too.**
- **Use damp grass/manure as fuel and place in a container (a half drum is excellent). This will create smoke instead of flames. It is very effective against all flying insects.**
- **If the farmer has pyrethrum on his farm, a few dry flowers added to the top of the fire are a huge benefit. If managed sympathetically, recovery is usually spontaneous**

Mud Fever

Mud fever, which is extremely painful, is only seen in the wet weather or when animals are left standing in wet, muddy conditions. In sheep, goats and cattle this will result in foot rot. In donkeys it will result in mud fever. Mud fever is a group of diseases causing irritation and dermatitis in the lower limbs. Often caused by a mixture of bacteria, typically Dermatophilus congolensis, and Staphylococcus spp, mud fever can also be caused by fungal organisms (dermatophytes). Photosensitization, chorioptic mange mites, contact dermatitis and other conditions also contribute to some cases.

Resulting in painful sores and scabs, which in severe cases can make a donkey lame, mud fever most commonly affects the pastern and heel area but can also affect the upper leg, the belly, and in some cases the neck and back (also known as Rain Scald). Non-pigmented skin tends to be more severely affected.

Muddy, wet fields are conditions in which mud fever thrives. As with any bacterial infection, Mud Fever can become a very serious condition very quickly. The legs can become swollen and sore and open sores can become quickly infected. Often, such is the level of damage to the skin that these open sores can become very difficult to heal. The donkey will be very reluctant to move as this is very painful.

Under normal circumstances the skin acts as a protective barrier, preventing microorganisms from entering the donkeys system and doing any damage. However, the integrity of the

epidermis can become compromised through the abrasion of soil grit on cold, wet skin. The continual wetting of the skin causes a breakdown of the protective barrier of the epidermis, allowing the bacterium to enter and cause infection

Symptoms:

- **Swelling of the affected area**
- **Heat and small scabs**
- **Listlessness and fever**
- **Reluctance to move**
- **In severe cases the affected area will ulcerate and the skin will split causing the possibility of secondary infections**

Prevention/Treatment:

- **Keeping the donkey out of the wet and mud is the first step in treatment of mud fever**
- **Initial treatment also consists of clipping of the hair away from the infected area and use of an anti-bacterial lotion on the scabs to soften them and gently remove them.**
- **When the scabs are removed, the skin must be kept clean and dry. Washing the infected area with an antiseptic solution (a hydrogen peroxid solution - never neat as this will cause further damage) is part of the treatment for mud fever.**
- **The legs should be dried thoroughly after washing and then sprayed with Alamycin spray (commonly known as 'dawa blue' in East Africa) which is readily available and affordable in East Africa.**
- **The donkey will need a treatment of 5 days Penstrep antibiotic (readily available in East Africa).**
- **A Veterinary Surgeon should be consulted for further treatment.**

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Donkey's Health and Diseases

Routine Health Care Check

Donkeys are more stoic, therefore detecting ailment/disease becomes more difficult compared to horse as dullness and depression maybe the only apparent sign. Therefore a donkey maybe in an advanced stage before a clinician is called to attend to such.

Daily health checking of the donkeys' condition include:

- **Observing how the donkey responds to your arrival, as well as its food and water**
- **Check the fecal consistency**
- **Check that the eyes are bright and clear; wipe away eye secretions as they attract flies.**
- **Check the hooves- overgrowth, cracks, abnormal smells**
- **Check the skin for external parasites such as ticks**
- **Check for donkeys' gait- for signs of lameness.**

A. Handling and restraint

This is an important aspect in management of donkey diseases/ condition; wrong handling of donkeys while undertaking any examination may lead to the animal being un-friendly and therefore difficult to restrain. In normal situations when appropriate handling procedure are practiced the animal should be calm and be examined without much ado. However in highly strung animals, mistreated donkeys or one experiencing pain; restraining may be a challenge hence the need of chemical restraint.

The following basic rules should be observed when handling the donkey.

- **Use minimum level of restraint; don't use force while restraining the animal.**
- **If the animal becomes difficult don't beat him/her but you need to stop and reassess the situation.**

- **Always impress upon the owner/user on proper restraining of his/her animal; as this will save you valuable time. Advice them on the need of not pulling the ears or applying pressure on the nose as this will make the donkey uncomfortable and it will become wild hence difficulty in restraining as well as altering the vital body parameters such as respiratory and temperature which will otherwise interfere with diagnosis.**
- **To avoid scaring the animal do minimize the number of people around so as not to scare the donkey.**
- **Don't use several types of restraint concurrently.**
- **If the restraint method is not working STOP and reassess the situation.**
- **The safety of the animal, yourself and others depend on you; therefore show the handler appropriate restraining procedure**

Humane and safe Handling of Donkeys

The Best Way to approach a Donkey

Unless the donkey knows you; it will be important for it to be handle by someone it knows and trust, otherwise it will be cautious about allowing you to move closer.

It is important to approach a donkey from the sideway and never directly from the back where a donkey cannot see you clearly (though a donkey can see surprisingly far around the back.) Or directly from the front (donkey feels threatened) as these are the two blind spots for a donkey- the eyes are placed on the side therefore it cannot clearly see directly in front or back. So if one approaches the animal from these blind spots it is bound to be suspicious and kick.

However, at times if it is approached from the side the animal may turn to present its hind limbs a posture favorable for kicking, but the donkey should be encouraged to do the approaching instead, as described below.

Donkeys are flight (wild) animals and thus should not jump to grab them forcefully. When a donkey's ears are pointing backwards and its tail is switching strongly from side to side-this

means it's frightened and preparing to kick. In such a situation it's better to check what is frightening it and remove the threat. If the donkey obviously considers the approaching person to be the threat, then that person must stand still, make soothing noises, use the donkey's name and hold some tidbit to encourage the donkey to make the approach to the person rather than the person approaching the donkey.

It's also advised to approach and work with donkeys, and stand before mounting on them (equines) always from the "near" or left side. The right side is called the "off" side.

Behavioral restraint

- **Make the animal comfortable before attempting to restrain him/her.**
- **Bring the animal closer to other animals; where it will feel comfortable; if it is a mare with a foal ensures it is closer/ can see it, so as to make your examination easier.**

Physical restraints

- **Use a strong, natural rope twice as long as the donkey.**
- **Tying /use halter or head collar.**
- **Use non slip knot on the halter.**
- **Use a quick release knot.**
- **Hold the donkeys chin gently.**
- **If Casting (lateral recumbence) it is necessary to sedate (by veterinarian) the animal so as to avoid fear & distress**

Halter

If the donkey's head is restrained, it can be led or held for any procedure/s such as examination or administering medication. A halter can be made from a piece of sisal rope; but one should

avoid using nylon rope against the skin. A simple slip halter can be made with loops. Ensure that the halter doesn't become too tight across the head and doesn't apply too much pressure on the nose as this will block the animal from breathing hence cause discomfort and the animal will start being wild.

Head collar

Head collars are suitable for donkeys'; they should have buckles to adjust the size of the straps around the nose. This way the head collar can be made big enough to go around a donkey's nose.

Chin hold for donkeys

For most donkeys this is sufficient, however when more restraint is required hold by the chin and the base of the ear. Put the flat of your hand under the animal's chin, the put your thumb across its mouth and grip (do not grab) with your fingers.

Blind folding

Covering a donkey's eyes with your hand, a towel or a similar cloth will often make it stand quietly. This is more useful in the field.

Lifting the front leg

This helps to prevent kicking from a hind leg(s). Pick up the front leg on the same side as the back leg on which you are working. Two people may be required for this technique; one person keeps the head still while the other holds up the front leg. However this method is not suitable for very nervous donkeys/horses. In such situations then light sedation is necessary.

Sedation for examination

Only veterinarians should attempt to sedate donkeys, so directions are not listed here, but for

some types of examination sedation is necessary. Please consult you veterinarian.

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False beliefs and myths about donkeys

Donkey

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Different communities hold different myths and false beliefs about donkeys. Some of them are simply unrealistic. These myths and beliefs should not discourage you from taking good care of your donkey. You will only reap full benefits if your donkey is in good condition.
Below are some examples of false beliefs and myths:

1. If a donkey gets sick it will die no matter what you do to it.
Fact: If a donkey is sick like any other animal it needs medical attention from a qualified Animal Health practitioner- either a vet or animal health technician. In addition, it needs to be fed well and given plenty of water to replace lost fluid. In a short while, it will be up and about.

2. If a donkey is carried on a vehicle it will laugh itself to death
Fact: Donkeys are themselves used as transport animals. There is no scientific relationship between a donkey being carried on a vehicle and death. The most important thing is to remember to make it as comfortable as possible during transportation on the vehicle.to avoid any stress.

3. A donkey will die not worked hard every day
Fact: A donkey is a very hard working animal. For maximum output, it requires enough rest, adequate feeding and watering. When not working it is important to remove the harness.

4. If you get in contact with a donkey's dung you will contract tetanus.
Fact: Tetanus is caused by bacteria, which is abundant in equine faeces (including donkey dung) and in the soil. Because of their tendency to roll on the ground, donkeys often contract tetanus if they have open wounds which get in contact with the dung or the soil.
We can only get infected if we have open wounds that get in contact with the dung. The good news is that we vaccinate our donkeys and even ourselves against tetanus.

5. A donkey should be buried with a 100shilling note in its mouth as a reward for its hard work when it was alive.
Fact: The best way to reward your donkey is to use the money on it when it is still alive. For instance, buy concentrates or salts for the donkey.

6. A donkey can only feed at night because during the day it is supposed to be working
Fact: Working donkeys use large amounts of energy during the cause of their working day. They therefore need quality, high-energy foods to maintain a body condition suitable to the amount of work that they do. Maximum food intake improves body condition and enables the donkey to work more efficiently. In turn, this means increased earnings for the owner.

7. If you don't work a donkey hard it will become hostile and unfriendly
Fact: A well cared for donkey is friendly and a nice companion at work.

8. Every new donkey has to get wounds before it gets used to the new work it does.
Fact: Donkeys are very courteous and have a high sense of self preservation. It is difficult to force or frighten a donkey to its own best interest. They should therefore be trained to take on

new tasks instead of being forced with beatings and caning

9. If cows are kept in the same enclosure with donkeys the cows will become infertile Fact: There is no scientific truth to this claim. It is just a misplaced fear that donkey's presence contaminates the cows and impacts on their fertility. Animals are social; they live together and blend naturally. Unlike other domestic animals, donkeys get low priority when it comes to allocation of resources. Thus, is cows and donkeys are household together and given feed, chances are that the donkey will access most of the food leaving the cows will less food therefore less productive.

10. If a donkey gets blind grid glass bottle and put the glass powder in the eye. It will clean the cloudy cornea to heal.
Fact: A donkey with an eye problem may lead to the clouding of the eye. This may be caused by dust, pollution or flies. At the earliest sign of discharge, redness or cloudiness, take the animal for treatment. Delay may cause the condition to get worse and the donkey may become blind. Do not home remedies to treat the eyes as they can damage the sensitive structures and cause blindness. Ground glass will puncture the eye leading to blindness.

Donkey

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Do not follow false beliefs and myths which only serve to justify unfair treatment of your donkey.
Treat your donkey well and it will serve you productively.

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Usage

The performance and capabilities of donkeys

The size of a donkey is a limitation to the amount of work that it can do. Most adult African donkeys fall in the weight range of 90-210 kg, which is less than the live weight of most cattle used for draft work (Pearson and Ouassat, 1996; Nengomasha, Jele and Pearson, 1995). However, if donkeys are well managed they can do many of the tasks undertaken by oxen, provided that they are teamed in sufficient numbers to provide the necessary draft force required to complete the task.

It has been shown that well-fed, well-trained donkeys teamed in fours are capable of sustaining a combined draft force of over 1 kN for a 4-hour working period. This power output is sufficient to plow relatively deep soil with a mould board plow, as well as complete most other agricultural tasks associated with crop production, in an acceptable time. However, animals are not always in such good condition, nor is it always possible to use a team of four animals. These problems can be alleviated by improving the management of the animals to improve the power supply or by reducing the demand for power by modifying the implements or tillage practices.

Marketing

Sadly, donkeys have very little market value in East Africa. They are, generally, valued at the same rate as a meat goat (between 3 - 5 thousand shillings). If donkeys had more value attached to them, they would be better cared for and owners would take more interest in their breeding and management methods.

If one considers the value of the produce that a donkey carries in its working lifetime, it is obvious that it is a very undervalued asset to a farmer. If the owners of donkeys realised just how valuable an asset they had, they would pay more attention to whom they 'contracted' this

'car on leg'.

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