



Guide

to Improved Cattle, Sheep, Goat and Poultry
Husbandry Practices for Smallholder Farmers
in South Sudan

Foreword

Food and nutrition security and poverty reduction are a priority of our government. The Ministry of Agriculture and Food Security, and the Ministry of Livestock and Fisheries are mandated to ensure that the people of South Sudan produce sufficient food to feed themselves and for export. We have developed the National Agriculture Livestock Extension Policy (NALEP) and launched the process of developing the Comprehensive Agriculture Master Plan (CAMP) through which many projects will be implemented.

The Ministries at national and state levels are challenged by limited resources and weak capacity of community based extension workers, particularly at the County and Payam levels yet these are the staff that meet and advise our farmers. Increased production and productivity issues are crucial if we are going to ensure that crop farming and livestock rearing that our smallholder farmers and families depend on is improved.

We highly value and appreciate the support and efforts made by our development partners and the UN agencies, and in particular the support from the European Union to develop this extension guide to be used by our community based extension workers at both county and payam levels.

The process was rigorous. I am assured that the three guides (crops, livestock and the general guidelines) are written in the language that will be understood by our extensions staff in different agricultural zones of the country.

I am delighted that these guides in the form of booklets will now be used across the country.

Hon. Dr Lam Akol Ajawin
Minister of Agriculture and Food Security
The Republic of South Sudan

Preface

This extension guide for farmers and extension practitioners in South Sudan was compiled over a period of a year. The process brought together staff of both states and national ministries of agriculture and ministry of livestock and Fisheries including technical from the Non-Governmental Organizations and two UN Agencies. The technical information in this booklet is from the experience of South Sudanese farmers, extension staff and development partners implementing food security projects. Additional information was sourced from materials developed by the government, the NGOs, FAO, UNIDO, academic, research and agricultural training institutions across Africa but most especially from the East African sub region. The European Union through the South Sudan Rural Development Programme (SORUDEV) funded and facilitated the process.

The technical information on crop production and animal husbandry techniques that exist in South Sudan were scattered in many documents, places and in the forms that could not be readily accessed or understood by farmers. Above this, there were issues relating to the accuracy of information in them. This booklet therefore provide verified and validated technical information on production techniques that can be used by community based extension workers, County and Payam field extension staff and farmers across agro ecologies of South Sudan. The process of collating the information for the booklet began in June 2014 in the Greater Bahr el Gazal states and was validated twice in the equatorial states of Yei and recently in Juba Juba in May 2016. Throughout this period, the material were pre tested in many communities and at each review stages gaps, clarity, accuracy and relevance were checked and improved on.

Specifically, the guide on crop production covers agronomic and cultural practices for eleven selected crops namely Sorghum, Maize, Rice, Sesame, Cowpeas, Groundnut, Beans, Cassava, Sweet Potatoes, Tomatoes and Kale. In each of the guides you will find information on seed varieties, cropping seasons, land preparation, spacing, pest and diseases management, harvesting techniques and marketing. The second guide on animal production covers husbandry techniques for Cattle, Goats, Sheep and poultry. The guide provides technical information on selection, housing, feed types and feeding, diseases (including disease management) and marketing. The third guide contains a set of guidelines on Ox Ploughing, Agricultural Marketing, Agrodealership, Village Savings and Loans Association, Community Mobilization and Farmer Field School.

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Facilitator

CONTENTS

Foreword	2
Preface	3
Introduction	4
A Cattle Husbandry	
Characteristics of cattle breeds	5
Management of dairy	6
Feeding dairy animals	7
Making pit silage	7
Routine practices in cattle management	10
Cattle Breeding	11
Selection of cattle for meat production	12
Milking Cows in South Sudan	13
Post Milking Practices	14
Common Diseases and their control	14
Notifiable diseases	15
Marketing Cattle	18
Hides and Skin	20
Range Management	21
B Keeping Sheep and Goats	
Introduction	23
Common breed of sheep and goats in South Sudan	24
General management practices	25
Feeding	25
Goat Milk	26
Common Diseases of sheep and goats	27
General diseases control measures	28
Marketing of sheep and goats	29
C Poultry Keeping	
Introduction	32
Selection Criteria for breeding	32
Improving local poultry breeds	33
Management and production systems	33
Poultry housing	34
Poultry feeding	34
Equipment	35
Composition of poultry feeds	36
How to formulate a ration	37
Other routine practices	38
Intensive management practices for improved layers	39
General health care management	40
Vaccination against common diseases of poultry	41
Common Poultry diseases	41
Marketing	44



Introduction

Traditionally, South Sudan is a livestock-rearing country. It is estimated that there are about 11.7 million heads of cattle nationally. Cattle are a very important source of livelihoods and an important asset to households and to the cultures of most tribes. They could also make an important contribution to the country's GDP. Many households rear cattle as an important source of income, food (both beef and milk), social security (a safety net), social status, manure (for soil fertility) and draught power for tillage and transportation. Horns can be used to make glue and bones used to make animal feed and buttons. Cattle are also a good source of biogas.

Environmental, social and gender-related factors involved in rearing cattle in South Sudan include:

- **Environmental factors:** Cattle contribute to the build-up of organic matter and soil fertility, which can improve vegetation and help cultivated crops to thrive. However, cattle rearing also causes overgrazing, putting pressure on land that may lead to degradation. Stray animals that do not have herders can cause damage to crops and pollute common water points, especially during migration. This can lead to conflict. In addition, cattle that are

kept together in small spaces can also cause damage to vegetation;

- Social factors include the fact that most cultural practices (including weddings and religious festivities) are densely intertwined with rearing cattle;
- As regards gender, most cattle are owned by men, to the exclusion of women who nonetheless play a very important role in livestock management (including duties such as milking, disease identification, assembly of manure, warming of livestock and cleaning of the kraal).

Common cattle types and breeds in South Sudan

The types of cattle kept by herders in South Sudan are categorised according to use. Broadly, there are four types of cattle: beef, dairy, dual-purpose and draught.

Cattle breeds in South Sudan and East Africa can be either indigenous or exotic. Broadly, the two commonly kept cattle breeds in Greater Bahr-el-Ghazal are the Ankole and the Zebu. The characteristics and geographical spread of the two breeds vary and cattle in South Sudan are more specifically categorised according to 5 types: Nilotic, Toposa, Murle, Mangala and Lugbara.



Characteristics of cattle breeds in South Sudan

Breeds	Live weight	Purpose	Characteristics	Geographical distribution
Ankole (original name)	Cows: 300 to 450 kg Bulls: 450 to 550 kg	Beef Milk Marriage Ceremonies Barter trade	Long horns Mostly white Medium body conformation Humped Resistant to many diseases Tolerant of extreme heat	Lakes State, Jur River, Northern Bahr-el-Ghazal, Warrap
Zebu	Below 250 kg	Beef Milk	Colour varies Late maturing Limited milk Resistant to many diseases	Lakes State (most common) Jur River Northern Bahr-el-Ghazal Warrap

The types of cattle kept by farmers are often determined by the benefits that the farmer hopes to derive from them. Therefore, most cattle are kept for dairy produce, beef and breeding.

Selection criteria for dairy, beef and for breeding cows

The following characteristics should be considered when selecting cattle for various purposes.

Dairy cattle should:

- Have well-developed hindquarters;
- Be of wedged conformation (diagram);
- Have a well-developed udder and evenly placed teats;
- Be docile and easy to handle;
- Have a deep, long body with wide, well-sprung ribs;
- Have a long lactation period;
- Be free of disease.

Beef cattle should:

- Be from a good dam and sire;
- Have dangling testicles;
- Be unrelated to cows in the herd (to avoid inbreeding);
- Have good conformation for beef production (blocked shape);
- Be free of any deformities;
- Be free of disease.

Breeding cattle should:

- Be fertile;
- Be a regular breeder giving birth to live calves;
- Be a good producer of milk;
- Have a well-developed udder;
- Be docile and easy to handle;
- Be free of disease and ecto-parasites.

Management of dairy cattle

Housing

In South Sudan most cattle are kept in cattle camps under an extensive system and the intensive- and semi-intensive systems of rearing cattle are not currently common. This is seen as a drawback by dairy enterprises. In the extensive system of cattle rearing, cattle are commonly kept by each family in a large hut known as a tukul or lwak (often the biggest in a compound).

It is equally common to keep the animals in camps (often called “Cattle Camps”) in which they are tethered (by a rope around their necks) to a peg. It is not unusual to combine herds belonging to various owners where a set of youths secure them. Under this system, food and water are provided regularly (animals are often led in one group and grazed together) and since many small herds are kept together, it is easier for veterinary extension officers to provide advice and treat animals as requested. However, no buildings are constructed to protect the cattle from the sun or rain.

After a while, the camp (which will have become littered with heavy layers of dung) is rotated to enable the owner of the land to cultivate crops on it. For the well-to-do who also own a herd, the rotation of fields meant for crop cultivation (for use as cattle camps for a few weeks at a time) to allow for the build-up of manure is one of the benefits of collaboration. It is also common to keep a number of dogs in the camp to scare away wild animals and thieves.

Factors to consider when constructing shelter for cattle under the two other systems are as follows:

1. Intensive system:

- a. Should be built on well-drained ground and easy to clean;
- b. Should face the direction of the wind;
- c. Should be located near a water point;

- d. Should have a concrete surface;
- e. Should use locally available materials;
- f. Should include access to pasture;
- g. Should offer protection from thieves and raiders.

2. Semi-intensive system:

- a. Should be built on well-drained ground;
- b. Should be located near a water point;
- c. Should include access to pasture;
- d. Should offer protection from thieves and raiders.

Feeds and feeding

Cattle are ruminants who feed mainly on roughage (grasses and legumes). Cattle feed should be sufficient in both quantity and quality. Cattle feeds should contain a good mixture of carbohydrates, proteins, vitamins and minerals and roughage. Cattle will naturally graze on green pasture, but will also do very well on supplementary concentrate feeds. Dairy cattle require more concentrate than beef cattle.

The commonly available animal feeds are as follows:

- a. Green forage: These include established natural pastures (toch), fodder crops (sorghum), legumes and vegetables (such as pumpkins and sweet potato). Moringa is increasingly becoming popular;
- b. Farm by-products: These includes stalk and dry grasses, as well as vegetables such as okra, pumpkins, sweet potato and moringa;
- c. Preserved animal feeds; These include hay (dry grass) and silage;
- d. Agro-industrial by-products: These include brewers' waste, blood meal for increased protein and bone meal for minerals. Cattle are also given
- e. Mineral (or salt) licks that provide important minerals such as calcium and phosphorus.

The most common method of feeding cattle in South Sudan is free-range grazing, with many of the owning communities being nomadic or agro-pastoralist. This method is relatively cheap where green grass is available, but it can create conflict between crop farmers and livestock keepers. It also places a lot of stress on the cattle, thereby reducing their milk production capacity. Milk production in cows can be improved through:

- a. Use of cereal crop remains and stalks as feed;
- b. Feeding of hay during the dry season;
- c. Silage;
- d. Improving feeds with additives such as molasses and mineral licks;
- e. Supplementary feeding with concentrates, minerals etc.

Commonly used grasses and legumes on which cattle graze are:

- Appach grasses in swampy areas;
- Sorghum;
- Sudanese Grass;
- Hyparrhenea (jaragua);
- Legume plants such as centrosema and calopogonium.

Feeding dairy animals

- Local dairy animals should naturally adapt to feeding on natural pasture;
- The pasture should be free of any larvae which may eventually cause an infestation of worms (such as liver fluke and a number of other internal parasites);
- Feeding troughs must be cleaned on a regular basis;

- Supplementary feeding is recommended in the form of concentrates;
- Mineral licks should be provided,

The improvement of dairy cattle feeding systems should start with a reduction in the distance over which dairy cattle are walked. Stall feeding should be introduced by confining the cattle in feeding paddocks where grazing is controlled. Other methods of improvement are:

- a. Rotational grazing (cows are moved from one field to another in rotation);
- b. Strip grazing (animals are confined to one area, fed sufficient grass for one day then moved to another section);
- c. Set stocking (cows are kept in a single paddock using a semi-intensive system). A one-hectare plot on a large farm is preferred. Animals should be rotated (different cattle in the paddock each week) to avoid the build-up or infestation of worms. 0.25-1.3 acres of good pasture should be provided per cow.

Feeding regime

Recommended ratios are as follows:

Green grass

- Dry cows: 25-30kg/day
- Milking cows: 30kg/day
- Pregnant cows: 25-30kg/day

Making pit silage for cattle

Silage is made from high-quality pasture or crops, preserved through tightly controlled fermentation and fed to cattle along with good management. A grade cow may eat up to 30kg of silage per day. To make good-quality silage which can be fed to cattle during the dry season, it is important to plan far ahead and to pay attention to detail. The steps involved in making silage are set out below:

Steps involved in making pit silage

1. Dig a shallow pit on slightly sloping ground. The depth of the pit should decrease from the higher end of the slope to the lower end, giving a wedge-like shape. The dimensions of the pit depend on the amount of forage to be stored. In order to store 20 bags of fresh forage, you need to dig a pit of about 2 cubic metres, buy 10 metres of polythene and about 30 litres of molasses;
2. Using a chaff cutter, chop the forage to be preserved into pieces of about 1 inch in length;
3. Place polythene sheeting over the sides and floor of the pit so that the forage won't make contact with the soil;
4. Empty the chopped forage into the plastic-lined pit and spread it into a thin layer. Repeat this until the pit is filled to a third of its capacity (6 bags);
5. Dilute 1 litre of molasses with 3 litres of water. Sprinkle this mixture over the layer of chopped forage. Use a garden sprayer to distribute the solution evenly. This helps to feed the micro-organisms that will make the silage ferment quickly, thus preventing rotting;
6. Press the forage down with your feet to force out as much air as possible. This will prevent fungi from attacking and destroying the forage;
7. Add more bags of the chopped feed, sprinkle diluted molasses and compact the forage again. Repeat this process of adding forage, diluted molasses and compacting until the pit is filled in a dome shape;
8. Cover the pit (after a final pressing) with polythene sheeting to keep water from seeping into the silage and dig a small trench around the edges of the pit;
9. Then, cover the pit with soil. A layer



of 24 inches is required for wet, fresh fodder and a layer of up to 36 inches is needed for drier forage. This should keep the air out and prevent damage to the polythene by rain, birds and rodents;

10. Conservation through fermentation takes several weeks. Wait until there is a shortage of feed to start using the silage. When prepared well with good sheeting and sufficient soil cover, silage can last up to 2 years;
11. To remove feed, open the pit at the lower end of the slope. Remove enough silage for a day's feeding and put the cover back.

Watering

Water should be constantly available to cattle to quench their thirst and improve their digestion. When using a free-range system access to water can often be a challenge, especially during the dry season in most parts of Greater Bahr-el-Ghazal. This is one of the reasons why cattle are herded to areas that are rich in rivers and fresh grasses. It is important to ensure that the water given to cattle is clean and fit for animal consumption. Water in troughs must be changed on a daily basis and the trough itself kept clean to avoid contamination.

Routine practices in cattle management

Treatment: Treat sick animals promptly and without delay. It is a good practice to conduct regular de-worming to control internal parasites and to spray the bodies of cattle to control external pests. Timely vaccination is a pre-requisite. Sanitation is required to control pests and diseases and to ensure that milk is safe for human consumption. Therefore, general cleaning and maintenance of animal housing is important.

This can be difficult to enforce due to current husbandry practices in South Sudan and to the nomadic nature of herders. It is however important that the person who tends the

animals be neat, clean and in full working attire (overalls, gumboots, gloves, etc.).

Other routine practices include the following:

Flushing: This is a management term for the provision of high-quality feed in sufficient quantities prior to the start of breeding (in order to improve reproduction) and immediately after gestation. The rule of thumb is to flush for 30 days before and 30 days immediately after parturition. The purpose of flushing in cows is to obtain an optimal ovulation rate and better implantation, leading to an increase in calving percentage (percentage of multiples).

Flushing also improves the condition of the cow to the extent that she should be able to re-conceive within 3 months after calving. During late lactation and early pregnancy the cow's nutritional needs are low and weight may even be lost. Good nutrition is essential at all times during pregnancy and early lactation since it will lead to the birth of a strong calf, the production of sufficient milk for the calf, the resumption of regular oestrus (heat) within 3 months of calving and increased chances of re-conception within that period (the ideal being that a cow should calve with a condition count of 3.5 to 4).

Steaming up: This is the practice of providing extra rations of carbohydrates, proteins and minerals to cows in the late stages of pregnancy in an attempt to promote maximum production of milk from the very beginning of lactation. Feeding usually begins about four weeks before the due date.

Vaccination: This is the practice of using vaccines to prevent disease. Vaccines are inactive organisms that are introduced into the body of an organism to build its resistance to specific diseases. Timely vaccination of cattle (both dairy and beef) is very important. Any sick animals should undergo close daily monitoring. Examples

of common diseases that can be controlled by vaccination are:

- a. Haemorrhagic Septicaemia (HS);
- b. Black Quarter (BQ);
- c. Anthrax;
- d. Contagious Bovine Pleuro-Pneumonia (CBPP).

De-worming: This is a routine practice implemented to reduce the build-up of internal parasites. It is commonly carried out in the rainy season due to the high numbers of insect eggs in the pasture. De-worming medication can be administered in both solid (Bolus) and liquid (drench) form. The simple equipment used is a Bolus gun or drenching gun/syringe. Bottles can also be used for improvisation.

Hoof trimming: This is the practice of cutting the overgrown hooves of cattle. Overgrown hooves make it hard for the animals to walk and are likely to lead to infections such as foot and mouth disease. The commonly used tool is called a hoof trimmer.

Dipping and spraying: This is the practice of controlling ecto-parasites. It can be done by direct application of a diluted acaricide chemical to the skin of the animal or by immersing the animal in a pool (dip).

Identification: This is the practice of marking animals using different methods for easier identification. Methods include branding and ear notching, cutting and tagging. It is commonly done to animals who are at least a year old.

Culling: This is the practice of removing old or non-productive stock from the herd for slaughter.

De-horning/de-budding: This is the removal of the horns of young male calves. Large horns are removed by cutting using surgical or de-horning wire. De-horning is done to reduce the risk of injury to human beings and other animals and is usually carried out 1-2 months after calving. De-budding is the removal of the horn tissues of young male calves to stop the horns from growing. This is done using a de-horning rod.

Castration: This is the removal or destruction of the testicles of a male animal. It is carried out to prevent inbreeding and achieve better distribution of fats, resulting to better-quality beef. The commonly used tool for castration is the burdizzo. Castration is best done sooner rather than later (i.e. when bulls are young).

Cattle breeding

This is the selection of stocks of cattle with desirable characteristics for the improvement of a herd. A superior breed is used to upgrade the herd's performance. Most traditional herds in South Sudan are purebred (even those kept by smallholder farmers). There is very limited artificial insemination and crossbreeding of cattle at this level and the capacity to ensure proper artificial insemination is also limited. All crossbreeding is therefore done through natural means.

Selection of cattle for breeding

Since most cattle kept are of pure stock, breeding occurs naturally within the herd. Selection is done through the observation of qualities exhibited by the cattle and based on the experience of herders. The choice of cattle to breed depends very much on whether the cattle are used for meat or for milk production.

Heifers

A heifer is a young female cow who has not yet calved. It is important to select heifers on the basis of the dam's milk production and the potential of your sires (bulls kept for breeding). The heifer should be properly grown and free of genetic abnormalities. Those that conceive before 24 months of age should be retained. If the aim is to use the heifer as dowry in future, it is important to consider her colour (e.g. in Warrap State, black-and-white heifers are usually preferred).

Cows

The most important economic trait to look for in a cow is her milk production rate. The current average daily milk production of a cross-bred cow is around 5.5 litres, but among the pure traditional breeds commonly kept by agro-pastoralists in South Sudan, farmers rarely get more than 2 litres per day.

A good milk-producing cow should:

1. Have well-developed hindquarters;
2. Be of a wedged conformation;
3. Have a well-developed udder;
4. Be docile and easy to handle;
5. Have deep, long body with wide, well-sprung ribs;
6. Be from a known ancestral line.

Signs of oestrus (heat) in cows

A cow is in oestrus (heat) when she shows signs that she is ready to be mated. During this period it is important that herders are observant since oestrus is short in cows (lasting only 16-20 hours). Cows are most likely to show they are in heat between 6pm and 12 midday. It is thus important that cows and bulls be left together overnight.

Usually, the main sign of oestrus is that the cow will stand and allow herself to be

mounted by another animal (rather than moving away). Other signs include eating when other cows are resting, urinating more frequently and moving around more than other cattle. The vulva of the cow will turn reddish. Appetite may be reduced and milk production will drop significantly. Bloody mucus may leak from the vulva for 1-3 days after heat.

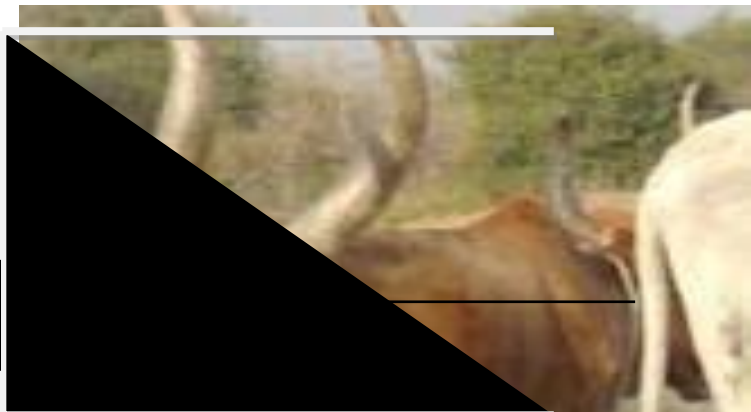
Selection of cattle for meat production

Both in South Sudan and across the sub-region, one of the primary reasons for keeping cattle is that of meat production. While the slaughtering of cattle for household consumption is not a common practice in Northern Bahr-el-Ghazal or some other regions of South Sudan, cattle meat is very well accepted by all religions, customs and cultures.

A good meat-producing bull should:

- i. Be from a good dam and sire;
- ii. Have dangling testicles;
- iii. Be unrelated to cows in the herd to avoid inbreeding;
- iv. Have good conformation for beef production (blocked shape).

Please note that the selection of bulls should be based on the objective of the farmer. If the aim of selection is beef production, the bulls selected should be from a relevant ancestral line. If the aim is milk production, the farmer should select bulls from a milk-producing line.



Milking and milk hygiene

Milk is the main output of the dairy enterprise that is produced for human consumption. Farmers must ensure that milk is produced in clean and hygienic conditions as it is an ideal medium for the development of bacteria and other microorganisms. Milk contamination may occur as a result of:

- Cow faeces coming into direct contact with the milk;
- Infection of the cow's udder (mastitis);
- Bovine diseases (e.g. bovine tuberculosis);
- Bacteria that live on the skin of cows;
- Environment (e.g. faeces, dirt and processing equipment);
- Insects, rodents and other animal vectors;
- Human activity (e.g. via cross-contamination from soiled clothing and boots).

As a result, diseases can easily be transmitted during the production, handling and marketing of milk, leading to serious public health issues. The milking herd should therefore be free of diseases such as mastitis, brucellosis etc. The commonly used milking method in South Sudan is the stripping/pulling of teats. In other cases (when the herd is mainly cross-bred), the preferred method is squeezing. The farmer needs to check for mastitis using a strip cup or another improvised container with a black

surface. If a cow is affected by mastitis, she should be milked last and the milk disposed of.

The following practices should be observed during milking:

- Milking containers must be sterilised before and after use;
- All milking containers must be made of aluminium or steel;
- The udder must be washed before milking;
- Milking salve (ointment/oil) must be applied to the udder if it is too dry.

Milking cows in a South Sudan cattle camp

Pre-milking preparation

The following steps should be taken in preparation for milking:

1. Ensure the milking utensils are clean. They should be washed with warm, clean water and detergent. The use of seamless/stainless steel utensils is encouraged. Where steel materials are unavailable, clean traditional containers can be used such as guards and calabashes;
2. The milk handler should wear protective clothes (preferably white) and maintain good personal hygiene;
3. The milking area should be clean and the floor concrete or rough;
4. The cow should be calmly prepared for the milking process at a fixed/regular time. The udders should be cleaned using a warm, clean towel to stimulate the descent of the milk. The cow should also have been well fed and watered prior to milking;



5. The cow should be given special feed to stimulate milk descent (e.g. concentrates, licks, fresh sorghum or maize stalks or Moringa leaves).

Post-milking practices

1. Weigh the milk immediately after milking;
2. Check for foreign materials in the milk and sieve;
3. Pour the milk into a special container. The container should be lidded and made of seamless or stainless steel or aluminium. The milk can be preserved using a cold system (refrigeration), can be fermented (to make yoghurt) or can be processed into other end products. Milk should be boiled and pasteurised before consumption.

Pasteurisation of fresh cow's milk

Consuming raw milk is dangerous and may cause diseases in humans such as brucellosis, etc. This is because it is likely to contain harmful bacteria such as Brucella, Campylobacter, Listeria, Mycobacterium bovis, Salmonella, E.coli, Shigella, Streptococcus pyogenes and Yersinia enterocolitica. It is therefore essential to pasteurise milk to make it safe for human consumption. This involves heating the milk to a particular degree over a certain period. The change and variation in temperature kills most of the disease-causing pathogens.

The following steps are common among cattle herders:

- Collect the milk in the morning in a clean, preferably steel container;
- Strain the milk with a sieve to remove all large particles;
- Place the milk in a clean pot and heat in a water bath until the milk is hot (75%) but not boiled;
- Set the pot to cool (40%);
- Store the milk in a cool, dry place in a clean bottle or container that is securely covered or sealed;
- Drink or refrigerate the milk on the same day.

Healthcare management

Wherever the incidence of disease is reduced, productivity and profitability in both beef and dairy farming will improve. For the control of all diseases and pests affecting cattle, it is vital to contact your local veterinary officer. Drugs should never be administered without the advice of a vet.

Common diseases and their control

Common animal diseases in South Sudan include Anthrax, Black Quarter (BQ), Haemorrhagic Septicaemia (HS), Contagious Bovine Pleuro-pneumonia (CBPP), Contagious Caprine Pleuro-pneumonia (CCPP), Trypanosomiasis (sleeping sickness), East Coast Fever (ECF), Brucellosis

and Foot and Mouth Disease (FMD), to mention a few.

Diseases are broadly classified as either notifiable or non-notifiable. Notifiable diseases are diseases that must be reported immediately to the authorities in case of an outbreak. Non-notifiable diseases are those that can be dealt with by community animal health workers (CAHWs) if they pose no threat.



Notifiable Diseases

Name of Disease	Signs and Symptoms	Treatment/Control	Prevention
Contagious bovine pleuro-pneumonia (About Hok)*	In milking cows, there will be a drop in milk yield. Sick cattle tend to isolate themselves from the herd and to stop eating. Pregnant cows and heifers may abort. Sufferers will experience diarrhoea, difficulty breathing and a cough. They will stand with their front legs apart facing the wind	Use of Tylosine or Oxytetracycline (OTC) antibiotics, vaccination	Isolation and treatment of sick animals, culling of the animals if CBPP is chronic
Anthrax (Jok Nhial)	Sufferers will experience difficulty breathing, extreme weakness and oedema of the tongue and throat. Death is rapid and clotted blood can be observed after death. The carcass will be very bloated	Antibiotics in early stages, vaccination, burial or burning of carcasses, avoidance of grazing in anthrax-prone areas	One month before the disease period
Haemorrhagic Septicaemia (Marool)	Sufferers will experience a high fever (40-42.5), depression and hot, painful swelling of the throat. There may be bloody faeces, diarrhoea, lack of appetite and excess salivation with the tongue lolling out and dark red. Death occurs suddenly after 24 hours	Broad-spectrum antibiotic (OTC long-acting), streptomycin	Isolation of sick animals, vaccination (one month before the disease period)
Black Quarter (Machac)	Sufferers will experience high fever, depression, lack of appetite and severe lameness and swelling of the upper leg. Breathing may be accelerated and the skin of the affected becomes dry, hard and dark. Death occurs within 24 to 36 hours	Antibiotics during early diagnosis (OTC or penicillin), destruction of carcasses	Annual vaccination, D (6 months to 3 years of age)
Foot and Mouth Disease (Dat)	Sufferers will experience fever and lack of appetite. The coat may be rough and the forefeet lame. There will be blisters on the tongue and above the hooves that break and ulcerate. Cows may experience abortion and reduced milk production	Provision of plenty of water, shading of the animal, cleaning of wounds, provision of broad antibiotics	Vaccination
East Coast Fever	Sufferers may experience fever, lethargy, swollen lymph nodes (neck area), difficulty breathing, a cough and a clear discharge. Death occurs in 12 days	Parvaquone	Tick control, prohibition of movement to ECF-prevalent areas

Name of Disease	Signs and Symptoms	Treatment/Control	Prevention
Trypanosomiasis (sleeping sickness)	Sufferers experience high fever, loss of appetite, generally poor physical condition (emaciation) and an aversion to the sun. They may have sunken, watery eyes and swollen lymph nodes, strange-smelling urine and diarrhoea	Homidium chloride (Novidium and Ethidium), Samarine	Control of animal movement, burning or composting of cow dung to keep tsetse flies away
Foot Rot Disease	Sufferers experience lesions in the centre of their hooves, lameness and swollen joints	Washing and removal of dead tissue from around the affected area, avoidance of walking cattle in muddy areas	No effective form of prevention
Brucellosis	Signs and symptoms are late-term abortion, infertility, retention of the placenta and enlarged arthritic joints	It is advisable to cull the animal	No effective form of prevention

General disease control measures

- National quarantine procedures must be followed in order to avoid disease transmission;
- Animals must be vaccinated regularly (i.e. a vaccination calendar and treatment procedures must be clearly followed);
- A proper feeding regime is very important since it boosts the immunity of an animal;
- Pasture should be well managed in order to avoid infection by disease-causing organisms/agents;
- Regular and timely dipping/spraying is recommended;
- Animals should not be grazed in tsetse fly-infested areas.

Common communicable diseases from cattle to humans (Zoonosis)

1. Brucellosis (Ringworm):

- Ringworm is a skin infection caused by fungi. Animals catch ringworm through direct contact with an infected animal or through being in an infected environment;
- Ringworm is a contagious disease of cattle, goat, sheep and wild animals and can also affect human.
- Humans become infected by eating or drinking contaminated, unpasteurised milk products. The milk of infected sheep, goats and cows is contaminated with ringworm bacteria. If the milk is not pasteurised, the bacteria can be transmitted to people who drink it or eat cheese or other dairy products made from it. Humans can also contract the disease when slaughtering infected animals or during the processing of contaminated organs from freshly killed, brucellosis-infected livestock or wildlife.

2. Anthrax:

- Anthrax is a bacterial disease. The bacteria form spores that can survive for years in the environment. Cattle, sheep and goats are at particular risk;
- People develop anthrax when the organism enters a wound in the skin, is inhaled via contaminated dust or is consumed through eating the undercooked meat of infected animals;
- The disease can be prevented in humans by making sure not to open the carcass of an animal that is suspected to have died from anthrax. It is recommended that the carcass be disposed of by deep burial.

3. Tuberculosis

- In cattle, bovine tuberculosis is caused by the bacterium *Mycobacterium bovis* which is present in the respiratory secretions, faeces and milk of infected animals.

Humans may acquire tuberculosis from unpasteurised dairy products.

Common parasites of cattle and their control

Common parasites of livestock in South Sudan can be categorised as internal parasites and external parasites

- Internal parasites (endo-parasites) include liver fluke, ringworm, tapeworms and cysts. Signs of the presence of gastrointestinal worms include emaciation, loss of weight or appetite, blocked or damaged organs, diarrhoea and coughing. Internal parasitic infestation can be controlled by applying de-worming treatments before animals are moved to grazing areas and at the beginning, middle and end of the wet season;
- External parasites (ecto-parasites) include ticks, tsetse flies, mites, mange and fleas, among others

Name of parasite	Symptoms	Prevention	Treatment
Liver fluke (<i>Fasciola hepatica</i>)	The life cycle involves a snail host. After growing inside the animal the fluke invades the liver capsule, reaching the bile duct after 6-8 weeks. In dairy cattle, cows show reduced milk production, poor fertility, chronic diarrhoea and general emaciation	Avoid grazing cattle in swamps, creeks, lakes or streams that harbour snails. Controlled grazing should help prevent the ingestion of snails Avoid areas that might have been frequented by infected animals, including goats and sheep	The most effective method is to kill the fluke when it is young. Triclabendazole is effective at killing flukes of all ages Clorsulon is also effective against adult flukes
Tapeworm	Stomach and intestinal worms cause diarrhoea and a loss of appetite and weight	No known method of prevention	Deworming
Hookworm	Stomach and intestinal worms cause diarrhoea and a loss of appetite and weight	No known method of prevention	Deworming
Roundworm	Stomach and intestinal worms cause diarrhoea and a loss of appetite and weight. Young animals show stunted growth and development, swollen bellies and poor coat condition	Clean pens and ensure animals are well fed and healthy	Deworming

Control of livestock parasites

- National quarantine procedures must be followed in order to avoid disease infestation;
- Animals should be regularly de-wormed and dipped or sprayed according to a strict calendar;
- Livestock housing should be kept clean as this boosts the immunity of animals;
- Pasture should be well managed in order to avoid cysts/pest infestation;
- Animals should not be grazed in tsetse fly-infested areas.

Marketing of cattle and products in South Sudan

Marketing is an important aspect of any livestock system as the mechanism whereby producers exchange their livestock and livestock products for cash. The cash is then used to acquire goods and services which farmers do not produce themselves in order to satisfy a variety of needs ranging

from food items, clothing, medication and schooling to the purchase of breeding stock and other production inputs and supplies.

Marketing of cattle and their products

- Markets for livestock and livestock products should be identified in advance, i.e. before venturing into production;
- A study should be conducted of the local markets to establish the appropriate time to sell livestock (marketing weeks/days) in a particular location;
- Appropriate licences must be obtained from local authorities (meat inspection units, the public health office, the quality control office etc.) for the butchery and sale of livestock and/or the operation of livestock sale points;
- All livestock products being sold on the local market should be clean and properly packaged;
- The sale of milk that is adulterated with water or flour or has a blue band, or of meat products soiled with grass, twigs, leaves etc., is prohibited by law and must be avoided;
- Livestock should be sold in designated holding yards.

Structure of cattle markets in South Sudan

Type of market	Main sellers	Main buyers	Purpose of purchase
1. Primary collection markets (auctions)	Livestock owner, auctioneer	Other livestock keepers, middlemen	Stock replacement, fattening
		Local butchers	Slaughter
		Traders	Collection for resale in larger regional markets
2. Secondary distribution markets	Traders, middlemen	Butchers	Slaughter
		Traders	Resale in terminal markets
3. Terminal markets	Traders	Local slaughterhouses	Slaughter
		Traders	Export

NB/it is important for pastoralists to monitor prices in the surrounding markets in order to secure the best price for their animals.

Formation of Herders' Associations

Herders' Associations can be set up to manage livestock and associated resources such as water and pasture. It is also easier to request veterinary services when in a group.

There are currently no legal policies regulating herders' associations in South Sudan. Functional and effective herders' associations are therefore required do the following:

- Identify and register all cattle camps in the Boma;
- Inform them of the advantages of registering all animal herds in the area;
- Educate them on the importance of formalising their membership as an association and how it brings the following advantages:
 - It makes livestock movement control easier;
 - It facilitates livestock identification (branding);
 - It makes it easier to organise livestock health management activities, e.g. vaccination campaigns;
 - It helps increase power to lobby Government for technical support to the improvement of the livestock industry;
 - It facilitates the resolution of conflicts;
 - It can help introduce savings and credit among herders and even enable them to obtain loans from financial institutions such as rural or commercial banks;

- It can help herders to work like cooperatives;
- It can help organise adult literacy sessions.
- Register all cattle owners in the camp (often they have their own laws);
- Encourage them to write down their laws and agree to abide by them;
- Identify their leaders and encourage members to rotate leadership after one or two terms;
- Allow them to assess their own capacity to manage their herds and ask them in which areas they need more knowledge and information on cattle management;
- Link them to the Department of Cooperatives of the relevant Ministry at which they can be officially recognised certified as a herders' group or association.

Agro-pastoral farming practices

This is a production system whereby livestock farming is practised alongside crop farming. The farmer keeps both livestock and crops concurrently, but in separate geographical locations. The two forms of production can complement each other in that livestock feed on crop residue and crop farming benefits from the application of manure and the use of animal traction.

The majority of farmers in South Sudan are agro-pastoralists, who grow arable crops in the rainy season as well as rearing cattle.

In South Sudan, based on the seasonal calendar, livestock are brought to herders' homesteads to feed on plant residues and provide manure for the farms. They are also allowed to graze in the fields following the harvest. This system provides the household with both crops (cereals and legumes) and milk for protein.

This practice has the following advantages and disadvantages:

Advantages of the agro-pastoralist system

- During the dry season, animals can be moved to the homestead and kept in the crop farm in order to provide manure;
- Livestock can feed on crop residue, which is a good source of dry roughage;
- Local population are provided with access to dairy and meat products;
- It enhances the income of livestock keepers since cash can be generated through the sale of dairy and meat products;
- It provides easy access to livestock herds for vaccination and treatment during the dry season.

Disadvantages of the agro-pastoralist system

- It can contribute to the spread of invasive weed species;
- Cattle can destroy unprotected perennial and ratoon crops such as cassava, fruit trees etc.

Recommendations

- Animals brought to the homestead should be kept in specific areas reserved for the controlled accumulation of animal manure;
- Pits should be dug for the storage of animal manure to reduce ammonia loss through volatilisation;
- Local farmers should be encouraged to use compost manure to fertilise crop farms;
- The use of draught power (ox ploughs) must be encouraged

to ensure effective utilisation of both animal and crop resources at household level.

Hides and skins

These can be a valuable source of income if properly cured. The value of the hide is always equal to a quarter of the value of the animal. Unfortunately the cattle owner never receives the full price due to poor processing and surrogate practices, e.g. poor flaying, curing and drying.

Hides and skins can be of important economic and cultural value to local farmers if well utilised. The following key benefits can be accrued from hides and skins:

Economics

- The sale of raw hides and skins to local processors can be an important source of income for local farmers;
- Improving the quality of hides and skins can enable them to fetch higher prices on both local and national markets as local tanneries can buy them for further processing (into leather products).

Domestic and cultural uses

- Hides and skins are processed to make water storage containers (girba in Arabic);
- Hides and skins are traditionally used as bedding materials;
- Local communities use skins to carry children and household items;
- Hides and skins can be used to make drums;
- Hides and skins can be used as clothing during ritual occasions.

Hide and skin processing in South Sudan

To obtain a good-quality skin or hide, specific slaughtering and flaying procedures must be followed. It should be ensured that:

- a. An appropriate (and appropriately sharp) knife is used;
- b. The knife is held properly;
- c. The carcass is flayed immediately after slaughter (while still warm);
- d. The hide is kept free of blood and manure;
- e. Cutting, gorging and scouring are all avoided;
- f. The skin/hide is pulled or beaten off whenever possible;
- g. Long (not short) cuts are made with the knife.

The following steps should be observed:

Skinning the animal: Skinning is the process of separating the skin from an animal using local knives or blades.

Fleshing the skin/hide: This is the process of scraping off the flesh and fat, which keeps the hide from rotting. The hide should be fleshed immediately after it is cut from the animal's body.

Dry the skin or hide: The hide should be dried out for a few days to prepare it for tanning. Drying depends on the thickness of the hide and the amount of moisture in the air. Natural drying takes about 14 days. Hides that have been trimmed after flaying will also need to be trimmed after drying to give them a good shape.

Trimming and lacing: This involves making holes all around the hide or skin through which strings or ropes made from the hide

can be threaded. A large skin may need up to 34 holes, which can be made using either a knife or a punch. Skins should be hung in the shade with the flesh facing outward. Holes can also be punched along the edge of the hide and twine used to attach it to a drying rack. Alternatively, the hide may be left to dry on the ground.

The following steps should be observed:

- The skin should be stretched tightly on the ground or drying rack;
- Traditionally, ash is applied to the hide or skin in order to remove excess fat;
- In Sudan and South Sudan, the hide or skin is soaked for 3-4 days in a solution made using Garath seeds (*Acacia* spp). The seeds are removed from the pod, the pod is ground and the powder mixed with water;
- After 3-4 days, the skin or hide is removed from the solution. All remnants of hair, meat and fat will remain in the solution;
- The hide/skin is taken out for drying and is ready for use within a few days.

Folding: Hides should always be folded with the hair on the inside to protect the grain (the most valuable part) and avoid cracking. This also reduces contamination by dust, rain etc.

Storage: When hides are not to be dispatched immediately for sale, they should be stored and sprayed or (as an alternative) brined;

Grading: This is the process of judging the quality of hides and skins via thorough inspection of the skin.

Managing conflicts arising from cattle rearing in South Sudan

A conflict is a misunderstanding or disagreement between two or more parties

or persons. In South Sudan, conflict resulting from cattle herding and rearing is a major problem which has been known to spiral into inter-generational, inter-clan conflict and recourse to revenge. Livestock keeping in South Sudan has been highly associated with internal conflict due to theft and cattle raiding. Disputes between crop and livestock keepers, which are largely triggered by inadequate water supply and the need for scarce pasture resources for livestock use, can persist over a very long time.

Most conflict arises from the raiding of livestock and the lack of access to grazing areas and water points. Other factors include limited access to services such as education and health. Due to the high cultural significance of the herd, the resolution of cattle-related issues such as raiding can be much more difficult than that of others.

Resolving livestock-related conflict

To resolve livestock-related conflict issues, the following steps are recommended:

- Government streamlining of livestock management policies;
- Provision of livestock water points in strategic areas;
- Provision of adequate police services and security to reduce cattle theft and raiding;
- Establishment of an Act of Parliament prohibiting cattle rustling;
- Identification of well-mapped stock routes to reduce agro-pastoral conflict;
- Improved the productivity of local animals (through breeding, pasture, fodder development etc.) in order to enable handling of small numbers that can easily be managed;

- Formation and strengthening of herders' associations and capacity building of peace committees.

Range management (pasture/grazing land)

A range is an extensive area of land which contains forage grasses, legumes and other herbage plants on which animals such as cattle, sheep and goats can graze. It is also commonly called grazing land or pasture land.

Range management is a livestock farming system that is concerned with feeding cattle with adequate grasses and legumes in a controlled manner which leads to soil improvement rather than degradation. The character of a range depends on the composition of its crop. Selected grasses and legumes are grown in adequate numbers. A range can regenerate after being fed on by animals and can withstand being trampled by farm animals. It is important to avoid overgrazing and to reseed by replanting forage crops where they begin to show depletion.

There are two types of rangeland: permanent and temporary grassland. Permanent grassland should be fenced and grazed in rotation. The fence should provide protection and should divide the land into sections.

The advantages of a rangeland are that if properly managed, it provides rich grass all through the year, thereby reducing the distance cattle have to walk in order to find food. Rangeland is easy to manage and saves labour, equipment use and power. It is important for water and soil conservation as the grass protects the soil against rain and other forms of erosion. The use of rangeland can also help to mitigate much of the conflict arising from disputes between crop and livestock farmers practising extensive systems of livestock rearing.



Guide

to Sheep and Goat Production for Smallholder
Farmers in South Sudan



SORUDEV
South Sudan Rural Development Programme

Introduction

Since time immemorial, communities in South Sudan have reared sheep and goats (together referred to as shoats) as complementary sources of food alongside cattle rearing and the cultivation of crops. South Sudan has an estimated 12.4 million goats and 12.1 million sheep. Sheep (*Ovis aries*) and goats (*Capra hircus*) are small ruminant animals. They bring many advantages to resource-poor farming communities in South Sudan due to their potentially high returns and ease of rearing.

The advantages and disadvantages of rearing sheep and goats

Advantages

- Both sheep and goats are easier to handle and manage than cattle;
- They feed on many forage plants which makes them cheaper to maintain than cattle, especially during the dry season;
- Goats are hardy and can survive unfavourable environmental conditions;
- They are small-bodied animals that do not require much housing or space;
- They are both a direct source of food (meat and milk) and a source of income when exported as food to the region (goat is popularly eaten in East Africa as Nyama Choma);
- They have shorter gestation periods than cattle (of 145-154 days or 4-5 months);
- They can be used as dowry and bride prices (3-4 goats are accepted as the equivalent of one cow);
- They provide a good source of farm manure;

- Both sheep and goat skins can be used for making leather;
- Goats are browsers while sheep are grazers, which helps balance the effects of their rearing on the local environment;
- Sheep can be used for cultural festivals.

Disadvantages

- Sheep and goats tend to wander and therefore require more labour to look after them (including from children who would otherwise be in school);
- They can be more destructive to perennial crops and fruit trees around the homestead, especially in the case of goats (because of their browsing habit).

Environmental, social and gender issues related to rearing sheep and goats

Environmental factors: Sheep and goats can be kept in nearly all parts of South Sudan regardless of ecological conditions. They do not pose serious environmental risks or threats, although their browsing nature can sometimes become a problem. Overgrazing exposes soils to all forms of erosion.

Social factors: Sheep and goats are a more important social asset than cattle. They are mostly slaughtered for visitors and are consumed during many festivities and ceremonies such as marriages, christenings and burials. Sheep and goats are very important in times of crisis management as they can be given as compensation or as gifts to friends.

Gender issues: In most cases, sheep and goats are managed by women and women are able to make decisions on their use; however, men still maintain substantial control over livestock assets.

Common sheep and goat breeds in South Sudan

- Nilotic sheep
 - Sudan Nilotic
 - Toposa sheep
 - Mangala sheep
 - East African small sheep
- Nilotic goats
 - Dwarf goats (Yei)
 - Saanen
 - East African small goat (Mabenda)
 - Anglo-Nubian

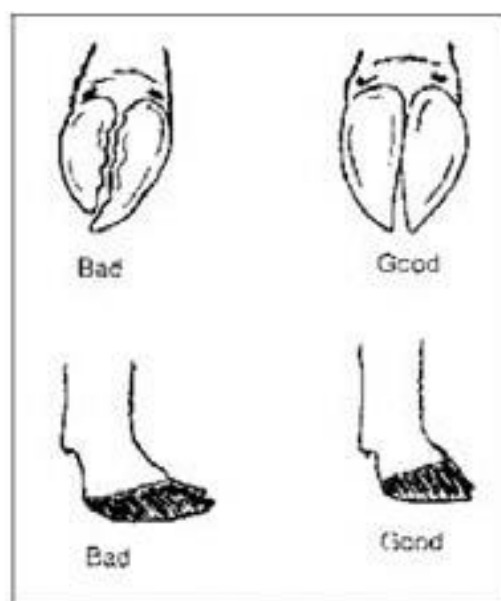
Criteria for selecting sheep and goats for breeding

Selection criteria for a doe (She-goat)

- The doe should be well grown, healthy in appearance and should stand squarely on her feet;
- She must have a high frequency rate of kidding;
- The body should be wedge-shaped (triangular in shape) and sharp at the withers;
- The teats must be disease-free and well-positioned perpendicular to the ground, providing plenty of room for a round, well-attached udder of a fair size;
- The ribs should be deep, denoting the capacity to consume large amounts of feed;
- Good body conformation is essential for milk production;
- The doe should have straight legs.

Selection criteria for a buck (He-goat)

- The buck should have a strong, well developed frame and good body conformation and breeding character;
- Legs should be straight and well-placed under the body, with good hooves;
- The buck should be healthy and free of external and internal parasites;
- The buck should be chosen from a good milking strain;
- He should not be over-aggressive.



Hoof shape - overgrown and normal
(Courtesy FAO "A manual for the primary animal health care worker")

Features to look for when selecting goats or sheep for meat (Chevon or mutton)

- Round and compact shape;
- Well-built body muscles;
- Large body size;
- High feed conversion ratio.

Determining the age of goats

The age of a goat can be judged from the appearance of its front teeth (incisors) on the lower jaw (there are no teeth on the upper

jaw). The kid at birth, or shortly afterwards, has teeth on the lower jaw. These are known as suckling teeth and are small and sharp in kids. When the kid is 12-14 months old the central pair is shed and is replaced by two large permanent teeth. When the kid is 24-26 months old two more small teeth are shed and are replaced by two large teeth, one on each side of the first pair. at 36-38 months old there are six permanent teeth and by the time the goat is 48-50 months old a complete set of four pairs of permanent teeth is present.

General management

Housing: Most sheep and goats are kept outside and are tied to a stake with a long rope (tether). 3 common types of shelter for sheep and goats are also provided across South Sudan. These are: i) walled and roofed; ii) raised floor with wooden walls; and iii) built of poles with a roof. Their attributes are as follows:

Walled and roofed	Raised floor with wooden walls	Poles with a roof
<ul style="list-style-type: none"> - Wall of up to 1.5m high - Well ventilated - Keeps animals dry during the rainy season - Easy to clean - Warm - Provides protection against predators and thieves 	<ul style="list-style-type: none"> - Warm and easy to clean - Animals can be fed at the fence - The floor is well drained, resulting in reduced incidence of foot rot 	<ul style="list-style-type: none"> - Well ventilated - The floor can get wet and increase susceptibility to foot rot disease - Cheap to construct - Exposes animals to rain, heat, cold and draughts

Feeding

The quality of feed consumed by a goat/sheep depends on: age, breed, sex, size and physiological status (e.g. pregnant/lactating).

- Goats will consume about 3-5% of their body weight in dry matter daily;
- Young goats will consume relatively more than mature goats;

- Pregnant and lactating shoats need more feed to produce milk and help the foetus to grow;
- Minerals and proteins (such as salt licks) are useful to their diet.

Example of a Supplementary Ration for Goats

Ingredient	Kilo-grams
A source of energy, e.g. sorghum, millet or maize bran	6.9kg
A higher protein e.g. groundnut meal or Leucaena leaves	3.0kg
Table salt (NaCl)	0.1kg
Total	10kg
<i>0.75-1.0kg of this ration should be fed to each adult goat per day</i>	



Watering

- An unlimited supply of water must be available to shoats at all times;
- Water must be clean and fit for consumption by shoats;
- Water used in troughs must be changed on a daily basis and the trough itself kept clean to avoid contamination.

Other routine practices

- Timely vaccination of sheep and Goats is essential to the prevention of diseases such as contagious caprine pleuropneumonia (CCPP) and peste des petits ruminants (PPR):
- Sick animals must be identified, isolated and treated as soon as possible to avoid spreading disease to other animals within the flock;
- Animals should be regularly dewormed using a deworming agent (e.g. Dexamethasone);
- Shoats should be sprayed or dipped to remove ticks and other ecto-parasites;
- The condition of any sick animals should be closely monitored on a daily basis;
- General hygiene, including the cleaning and maintenance of animal housing, is important;
- Any humans who tend the animals must be clean and wear full working attire;
- Each animal in the flock should be observed and checked for changes in behaviour or composure;
- Shoats should be debudded, dehorned and their hooves trimmed when necessary;

- Males that show undesirable genetic characteristics should be castrated in order to prevent the inheritance of such genes by the next generation.

Breeding

Breeding is an important aspect of rearing sheep and goats for milk and meat production. Across South Sudan, breeding occurs naturally under the extensive system. In a controlled situation, a breeding objective must be clearly set out whether one is breeding for increased milk production or seeking to fatten the herd for meat production. Most livestock keepers in South Sudan use natural selection based on the observation of desired characteristics or traits.

Others are:

Pure breeding: In this system, purebred females (does) are run with purebred males (bucks) in order to maintain the desired traits (colour, size, meat, and milk qualities) of that particular breed;

Crossbreeding: This involves the mating of different breeds in order to combine positive characteristics found in the different breeds and develop a flock that includes hybrids.

It is important to give colostrum (the creamy, yellowish first milk produced after birth) to the newborn animal immediately after birth. Young sheep and goats that take colostrum develop better immunity against common diseases as well as improved muscular strength.

Breeding in goats: Both female and male goats reach maturity by the age of 6 months, but they should not be allowed to start breeding until they are 8 months old. Female goats are readiest for mating at about a year old. This is found to be difficult to control in South Sudan because most goats are kept under the traditional system with limited supervision.

The heat period in does is signified by a swollen, reddish vulva that secretes a discharge of colourless liquid. The goats will be restless, will cry much more frequently and will try to mount each other. The heat period will last 1-2 days and if the goat does not become pregnant, the heat period will reoccur within 18-21 days. The average gestation period (pregnancy) in goats is 150 days. It is common for goats to deliver 1-3 kids. Like all livestock, goats must be very well fed during gestation and the kids should be well fed to enable them to develop quickly.

Goat's milk

Goat's milk is regarded as more nutritious than cow's milk as it is naturally homogenised and the fat globules contained in the milk are much smaller than those in cow's milk. Goat's milk is therefore more easily digestible when consumed. Goat's milk contains 12 milligrams of cholesterol per 100 grams milk while cow milk contains 15 milligrams per 100 grams milk. Raw goat's milk is also sweeter in taste since it contains more butterfat than pasteurised cow's milk.

Keeping milk safe for human consumption

In most communities in South Sudan goat's milk is part of the staple diet of children and the elderly. It is vital (and a requirement in most countries) to make milk safe for human consumption through pasteurisation. Milk is pasteurised by heating it to at least 62.8°C for 30 minutes, followed by rapid cooling to below 50°C. Following pasteurisation, natural lactic acid bacteria remain in the milk. They are harmless, but if the milk is not kept cold, the bacteria multiply rapidly and cause it to turn sour.

Milking containers must be sterilised before and after milking using warm water and must remain covered. All milking containers must be made of aluminium. Milk must be sieved and boiled (pasteurised) before drinking. In preparation for milking, the udder must be washed before milking and milking salve (ointment/oil) applied to the udder when it is too dry.

Common diseases and their control

There are numerous diseases that affect sheep and goats in South Sudan. These include Contagious Caprine Pleuro-Pneumonia (CCPP), Sheep pox, Peste des Petits Ruminants (PPR), Orf; Anthrax, Rinderpest and Foot and Mouth Disease.

	Diseases	Symptoms	Control	Treatment
1	Contagious Caprine Pleuro-pneumonia (CCPP)	Clinical signs include fever (40-42°C), coughing, dyspnoea, high morbidity (about 100%) and high mortality (about 70%)	CCPP vaccination	Antibiotic injection (long-acting OTC)
2	Sheep and goat pox	Clinical signs include high fever and symptoms of pneumonia and acute enteritis. Skin lesions appear, particularly in areas free of wool	Vaccination of sheep	
3	Peste des Petits Ruminants (PPR) – also known as goat plague	Clinical signs include abnormal breathing with coughing, discharge from the eyes, nose and mouth, oral sores, diarrhoea and death The faeces is initially soft before becoming watery, foul-smelling and bloody. It may also contain pieces of dead gut tissue	Quarantine is essential to avoid spread. A PPR vaccination is available for both goats and sheep	
4	Orf (contagious ecthyma)	Clinical signs include pustular and scabby lesions on the lips, muzzle and udder, emaciation and pneumonia in lambs	The lesions should be treated with antiseptic drugs. A vaccine may be used in outbreaks. Affected animals should be isolated and unaffected animals vaccinated to reduce the number of new cases and shorten the course of infection	
5	Anthrax	A clear symptom is when animals that appear to be in good condition die suddenly without showing overt signs of ill health. Also common are fever, staggering, agitation, depression, incoordination, trembling and difficulty breathing, followed by rapid collapse, terminal convulsions and death. Bloody discharges from orifices such as the nose, mouth, ears, penis and rectum are sometimes observed	Annual vaccination is recommended. This should be done 2-4 weeks before the onset of a known period of outbreaks	
	Heart water	This is the literal presence of water around the heart. The animals will become nervous and afraid of things. Clinical signs include hyperaesthesia (increased sensitivity), a high-stepping stiff gait, excessive blinking and chewing. Affected animals will isolate themselves. In the acute form of heart water, animals often show signs of anorexia and depression along with congested and friable mucous membranes	Vaccination can help with the control of heart water. Control of tick infestation is a useful preventative measure in some instances but may be difficult and expensive to maintain in others	OTC at 10 mg per kg per day, IM, or doxycycline at 2 mg per kg per day will usually produce a cure if administered early in the course of heart water infection

General disease control measures

- National quarantine procedures must be followed in order to avoid disease transmission;
- Animals must be vaccinated regularly (i.e. a vaccination calendar and treatment procedures have to be clearly followed);
- A proper feeding regime is very important since it boosts the immunity of an animal;
- Pasture should be well managed in order to avoid infection by disease-causing organisms/agents;

Common parasites and pests and their control

Common parasites

The parasites of shoats in South Sudan can be categorised as either endo-parasites (internal) or ecto-parasites (external). Some common parasites are:

- Internal parasites (endo-parasites): Ringworm, tapeworm and cysts, among others;
- External parasites (ecto-parasites): Ticks (achak in Dinka language), Tsetse flies, mites and fleas among others. Ecto-parasites are mostly vectors that carry disease-causing germs.

Other common predators of shoats in South Sudan are hyenas, foxes, baboons and lions.

General livestock pest control

- National quarantine procedures must be followed in order to avoid pest infestation;
- Animals must be regularly dewormed and sprayed or dipped according to a strict calendar;

- Overstocking should be avoided.

	Type of animal	Time of deworming
1 st deworming	All animals	Late March or early April
2 nd deworming	Animals under one year of age	Middle of July
3 rd deworming	All animals	Late October

- Livestock housing should be regularly cleaned to eliminate vectors of disease-causing organisms
 - Pasture should be well managed and rotational grazing practised in order to avoid infestation by cysts or pests;
 - Regular and timely dipping and deworming is recommended.

Marketing of sheep and goats and their products

Traditionally, sheep and goats are sold at local markets and often in villages. Local markets tend to be auction markets or sales yards at which live animals are sold alive. At the butcheries, sheep and goats are slaughtered and their meat sold in kilograms. Goat meat (chevon) in particular is a delicacy when served in a popular dish called Chaya-be-jamur or Nyama choma while mutton is very popular for religious festivities. When marketing, the following should be considered:

- Identification of markets for shoats and shoat products should be done in advance (before venturing into production);
- A study should be conducted of the local markets to establish the appropriate time to sell livestock (marketing weeks/days) in a particular location;
- Appropriate licences must be obtained from local authorities (meat inspection units, the public health

office, the quality control office etc.) for the butchery and sale of livestock and/or the operation of livestock sale points;

- All livestock products being sold on the local market should be clean and properly packaged;
- All sheep and goats should be sold at designated auction yards.

Annexes:

Annex I: General outline that could be used for training by extension agents

Topic:

Clearly state the topic you intend to cover during this session.

Objectives

Start with “at the end of the topic, the trainees should be able to...” and list what you want them to have learnt by the end of the session.

- i)
- ii)
- iii)

Facilitation method

State here the type of facilitation method you intend to use. There are many methods, so be specific and choose the method that is most effective (this is not limited to lectures, demonstrations, field work or role

play). Remember that you could use a combination of methods.

Duration

State the time required to carry out the training. Remember to be brief and precise and not to waste the participants' time. They may lose interest if the training takes too long and you should not end up rushing your lectures due to limited time. Pick an appropriate time for training. Remember that your trainees will usually be adults who have competing needs for their time so be sure to be creative, get straight to the point and make your points clearly.

Materials for training:

List all the required materials, training aids and possible equipment to be used in the training. Be sure to use illustrations as much as you can, especially if your trainees are without formal education.

Content

List the specific concepts and knowledge that will be part of the training (such as common diseases of sheep and goats, for which you may refer to page 8 of this technical guide).

Resources

State the sources of the information you are delivering. This is useful to provide further reading for the trainees as well as a reference. Resources can include technical guides (such as this one), textbooks and other publications.



Guide

Husbandry Guide to Poultry Production
for Smallholder Farmers
in South Sudan

Poultry Production

Introduction

Poultry is an important source of both income and animal protein for many households in South Sudan and across Africa. Birds (poultry) play a major role in the economic, social and religious lives of rural communities in South Sudan. Local poultry breeds are very well adapted to the local environmental conditions such as heat, cold, heavy rain and periodic shortages of food. Many rural households rear chickens because they thrive in nearly all conditions, require little space, are easy to feed and reproduce quickly. The economic reasons for keeping birds include:

Egg production: Eggs are an important source of food that is high in quality protein and other nutrients;

Meat production: Poultry provides meat which is also a good source of high-quality protein and is well accepted by many people across tribes, cultures and religions;

Poultry manure production: Poultry manure is an excellent organic fertiliser that is used to improve the nutrient content of soil. Poultry droppings are also useful to fish farmers as they provide food for fish and manure for ponds;

Egg shells and feathers: These are used to furnish and decorate houses. Eggshells are also nutritious to animals and are a useful source of calcium in animal feed;

Poultry products and by-products such as eggs and meat: These are a source of income and livelihoods and can complement household income from other sources.

Social and gender-related factors involved in keeping poultry in South Sudan

Chicken rearing in South Sudan is commonly associated with women and

children and chickens are the only essential domestic animals over which women have absolute control. Decisions as to when to eat and/or sell chickens are left entirely in the hands of women, which can empower them economically if the birds are of viable quality. In most cases, women have gained respect in the community due to their contribution to their family herds through the sale of chicken (which enables many women to buy small animals such as goats and sheep). Chickens are often given as gifts or used during traditional ritual ceremonies.

Common chicken breeds in South Sudan

Chicken breeds are classified according to two main categories:

- Local (indigenous); and
- Exotic (foreign).

Local Breeds: These are chickens traditionally raised by local communities. An example is the South Sudanese local chicken which can be broadly grouped into 2 types: frizzled-feather or naked-neck. Local breeds of chicken in South Sudan are often named after different tribes.

Tropical fowls are the most commonly kept birds in South Sudan. They are tough and highly adaptable to the harsh environmental conditions of the tropics and can scavenge on any materials they find; hence they are self-reliant. They are however light in weight (with the male usually bigger) and females produce three clutches of about 15-20 eggs per year. Tropical hens are very broody (inclined to incubate their eggs).

Exotic Breeds: These are chickens from other regions and can be found throughout South Sudan and East Africa. Different types are classified according to their origin.

1. Mediterranean breeds (such as the white leghorn and Egyptian Fayoumi) are known for their high rate of egg production. They have an average weight of 2.7kg (cocks) and 2kg (hens) and can mature very early if well kept;

2. American breeds are well known for their meat and egg production. Examples of American breeds are the Rhode Island and the New Hampshire, both of which are very popular among poultry keepers across the tropics. The New Hampshire has an average live weight of 4kg (cocks) and 3kg (hens). Rhode Island Reds are equally popular due to their high adaptability;
3. English breeds are also known for their meat and egg production. One English breed that has become very popular is the Sussex (which has speckled and red varieties);
4. Asian breeds are well known for their weight and meat production. One Asian breed is the Brahma, which has an average weight of 5.4kg (cocks) and 4.6kg (hens). They lay brown eggs which are generally accepted by consumers.

Improving local poultry breeds

The crossbreeding of exotic and tropical fowls is becoming popular among local fowl keepers in some parts of South Sudan. Local breeds are said to be more flavoursome and therefore fetch higher prices than crossbred broilers; however, it can take a long time to raise the birds and they are often very small and light. In contrast, an advantage of crossbred fowls is that they retain the desirable characteristics of the local breed, but mature more quickly and also tend to be heavier. For this reason they can be sold in larger numbers at a better average price and thus provide higher economic return to the keepers.

The strategy of crossbreeding is promoted by both the Government and development partners. The products of crossbreeding are said to be much improved, bigger and more adaptable to the harsh climatic conditions of the free-range system. Crossbred birds are sometimes called grades. The steps to be taken to improve poultry breeds are given below:

- Identify a flock of chickens that you would like to improve to grade level. In most cases, this is done at household level. In cases where several households keep local breeds of fowl, all households should work together;
- One option is to introduce a number of eggs from improved breeds to a brooding hen by replacing all the local eggs she is incubating. This should be timed to start as soon as she begins to sit on the eggs. The size (and particularly the smell) of the eggs should be similar to those replaced. It is suggested to smear the eggs with milk fat, Shea butter, coconut oil or ash (all these are abundant in South Sudan);
- The other option is to introduce purebred cockerels such as Rhode Island Reds or New Hampshires to the flock of local fowls. For this to be effective, it is important to remove all local cocks from the flock. Usually, one cock should be able to service ten hens.

Please note that a common setback of this cross breeding is the refusal of keepers to eliminate the cocks in their flocks. With this refusal, a mix of local and improved breeds will remain in circulation.

Selection criteria for breeding

Breeding is the practice of selecting poultry birds with good characteristics and mating them to produce a new generation with similar characteristics. 3 main types of fowl (meat producer, egg producer and dual-purpose) are used for improved breeding depending on the interests of the breeder. The main aim of poultry breeding is to achieve good-quality meat, increased egg

production and a healthy flock. Breeders should be sure to do the following:

- Observe the external features of the cocks, hens, growers and chicks to learn which features indicate a healthy chicken;
- Always choose birds that are lively and alert;
- A potentially good layer has a long, straight back and a broad bottom;
- Always check the belly or navel spot of newly hatched chicks;
- Keep new birds isolated for a few weeks before introducing them into the flock.

It is important to select good-quality cocks and hens. They should be properly selected, then crossed in order to improve the quality of a given flock of chickens.

A good breeding cockerel should:

- Be big and strong with a well-developed red comb;
- Be healthy and alert all times;
- Be able to service ten hens;
- Be young (8 to 16 months).

A good breeding hen should:

- a. Be a good layer (with wide, moist cloacae, a wide sternum and space to fit 3 fingers between the pelvic bones);
- b. Show good mothering ability (e.g. she should actively look for food for chicks);
- c. Produce 15-20 eggs per clutch;
- d. Lay big eggs weighing more than 40g;

- e. Incubate the eggs well;
- f. Have a broad head (with bright eyes, wax comb and wattles);
- g. Have smooth and strong legs;
- h. Be big and able to feed well in order to support her internal organs;
- i. Be healthy.

Qualities of eggs suitable for incubation or hatching

The period during which fertilised eggs grow and hatch into chicks either naturally (through a hen sitting on the eggs) or through a mechanical method is called incubation. If temperature, relative humidity and ventilation are ideal, the period of incubation should be 21 days. A good poultry breeder must spend time with his/her chickens at least daily in order to observe incubating hens and those with chicks. Eggs that are suitable for hatching/incubation should:

- Be of normal size (weighing 39-41 g for indigenous breeds and 55-60 g for exotic breeds);
- Come from good parent stock;
- Be clean;
- Be of similar size, weight and (oval) shape to each other.

Breeders should:

- Disqualify eggs of extreme size (too small or too big);
- Disqualify eggs of abnormal shape;
- Avoid trying to hatch eggs with soft shells. The shell should be strong;
- Incubate eggs mechanically (where necessary) using sunlight or an enclosed box with a bulb.



Conditions necessary for egg incubation and hatching

- The laying site (box or other) should be isolated;
- Laying boxes must be of an appropriate size;
- The box should be kept in the shade or in dark place away from parasites and predators;
- Dry straw should be placed in the laying boxes;
- The box should be cleaned, disinfected and fumigated after each hatching;
- The environment should be tranquil and well-ventilated;
- Good feed should be continuously available.

Management and production systems

Poultry production can be classified into to 3 broad systems:

Free range extensive or backyard: This is the most common (and the traditional) form of keeping birds in South Sudan. Birds scavenge freely during the day and are housed in sheltered accommodation at night (either with the family or in tiny structures inside the compound). The system is inexpensive, requires little labour and involves all members of the family (chickens are predominantly managed by women and children). A household keeps an average of 5-30 birds with minimum input.

The disadvantages of this system are that many birds are lost and never found because they move freely and are exposed to predators. They lay also eggs anywhere they find suitable. Controlling disease among the flock is impossible since their movement is uncontrolled and they often scavenge for food (and thrive in unregulated

environments). It is this system that the Government and many development partners are trying to improve.



Semi-intensive: This system is characterised by higher levels of inputs and labour than the free range system. Feed is provided on a daily basis. The farmer must provide clean water and housing as well as veterinary care.

Intensive/commercialised: This is mainly done by experienced farmers with access to feed, health services and a reliable market. Under the intensive system up to and more than 5,000 broilers and layers can be kept in a chicken house. The birds are provided with preventative healthcare and optimal commercial feeds that account for 70% of the production costs. Intensive chicken farming is done using either the built-up deep litter system or the battery cage system.



Birds in a battery cage system. (There are ethical concerns growing against keeping birds in cages)

Improved poultry production requires land, housing, access roads, continuous water supply, fencing, security, transportation, equipment, a source of heat, waste disposal

facilities, storage space, access to veterinary and extension services and market information, knowledge of composting, risk awareness and risk management, records and record keeping.

Poultry housing

Good-quality poultry housing is required to:

- Protect birds from danger (predators and thieves);
- Protect birds from bad weather (rain, extreme heat and strong winds);
- Provide birds with a place to sleep and lay eggs;
- Prevent the spread of poultry disease;
- Enable better control and monitoring of birds.

A good poultry house should:

- Be well located and ventilated;
- Be located in a fenced compound at least 50 metres from the nearest residential area so as to avoid pollution by noise and odours;
- Have wide doors and numerous windows to allow maximum circulation of light and fresh air (as well as to facilitate easier cleaning).

NB/Houses meant for young chicks should be located at least 50 metres from those containing older birds in order to minimise the risk of transferring disease.

Floor space requirements are as follows:

- 1m² for 10 chickens (round house) and 1m² for 5-8 chickens (wood or stick house);
- 15m² for 100 chickens (i.e. 5-6 birds per metre during the laying period) and 4m² for 25-30 chickens (wood or stick house).

The poultry house should face east to west to follow the course of the sun. It is important to ensure proper ventilation as air removes excess heat, moisture, dust and odours from the building as well as diluting airborne disease-causing organisms.

It is important for the building to be on a raised floor or well ramped. Feeders and drinkers should be cleaned daily and the entire house monthly. Droppings should be collected regularly for use as manure for the farm and garden.

The floor of the poultry house should be covered with sawdust, sand and straw. A water bath should be located at the entrance of the poultry house and regularly disinfected. The house should be disinfected and fumigated at least once every six months. The roof should be checked and repaired, along with any cracks in the walls or floor. The walls should be coated with cow dung to prevent against the build-up of ticks.

Poultry equipment

Other equipment in the poultry house should include night perches, laying boxes, feeders and drinkers. Birds should be monitored daily, protected from the sun and rain, well fed and kept warm. 1m² for every hen and 10 chicks is recommended.

The following equipment is required to keep 100 birds using the deep litter system where automated machines are not available:

1. Feeding and watering:

- 3 chick feeders (2 inches of feeding space per bird, 3 inches deep);
- 3 chick drinkers (2-litre capacity);
- 2 chicken feeders (4 inches of feeding space per bird, 6 inches deep);
- 2 chicken drinkers (8 to 10-litre capacity);

- Feed scoops (plastic plates or bowls can be used);
- 2 buckets;
- 1 roll of twine (for hanging the feeders).



Day old chicks in brooding pen

2. Brooding

- 1 brooder box;
- 3 kerosene lamps or 3 100-watt bulbs;
- 4 rolls of plastic sheeting (for open-sided houses only).

3. Cleaning and handling of manure:

- 1 broom;
- 1 shovel;
- 1 wheelbarrow.

4. Egg handling (for layers only):

- 1 laying nest (20 cells);
- 6 egg trays (30-egg capacity each);
- Plastic bags (for packing and marketing eggs).

5. Miscellaneous

- 1 weighing scale;
- 4 chicken crates;
- Record books and sheets;
- 2 jute sack-loads of litter material.

Poultry feeding

Food is a basic need of all living things. The growth, health and performance of all organisms is related to the amount and type of food they can access and consume. Poultry in particular are very good at converting feeds; therefore, the type of feed they are fed will depend on the purpose for which the birds are kept (i.e. for either meat or eggs). Feeding is more regular in birds confined to small spaces compared to birds which are allowed to fend for themselves under a free-range system. Feed should be given to birds in balanced rations composed of water, carbohydrate (which usually constitutes about 70-80% of the feed and is required for energy), protein (which should constitute 10-40% of the feed as it supplies amino acids and is vital for egg production), minerals (which can come from bone, ash, shells or salt) and vitamins (which are very useful for building the health of birds and are found in green vegetables).

It is important to provide the right feeding and drinking equipment to poultry in order to guard against disease and avoid contamination. Use of the correct equipment also avoids wastage of feed and water (which account for 60-80% of the cost of rearing birds under the intensive system). Using appropriate feeding and drinking equipment also facilitates the provision of medicines or vaccines to animals via water or feed.

Hygiene is very important in all poultry systems. Feeders and drinkers must therefore be provided in sufficient numbers (to avoid competition) and cleaned before daily use in order to avoid disease. 1 metre of space should be provided for every 15 chickens. The feeders and drinkers should

be shielded against the rain and sun and raised off the floor to avoid contamination.

Composition of poultry feeds and their importance

Required nutrients	Role of each nutrient	Sources of nutrients	Locally available food types	Possible results of inadequate nutrients
Energy	Maintenance, energy and growth	Cereal and bran (millet, sorghum and rice)	Millet, sorghum and corn	Cessation of growth, reduced egg production
Protein	Growth, meat (muscle) and egg production	Groundnuts, sesame, cake, dry (leftover) fish, blood meal, termites, worms, insects	Meat, fish, chicken soup, groundnut, soya bean cake	Weight loss, reduced egg production
Minerals	Egg production, formation of bones, reproduction	Bone meal, salt and oyster shells	Salt, pepper and bones	Failure to produce eggs, soft bones and eggshells
Vitamins	Body regulation, egg production	Green leaves (Leucaena, Moringa, Cassava)	Fruit, wild greens	Poor-quality eggs, reduced resistance to disease
Water	Important for digestion, control of body temperature and cleansing of the body	Drinkers	Water	Weight loss, dehydration

Locally available ingredients that can be used in poultry feed

Carbohydrate

- Millet and sorghum are ready for immediate use and are available in most villages/localities;

Protein

- Groundnut or sesame cake can be pounded without sieving;
- Fish can be dried and pounded without sieving;
- Blood meal: 1 matchbox of salt is added to 5 litres of blood or 1 teaspoon of salt to 2 cups of blood. The mixture is boiled until it coagulates and is then dried out in the sun and finally, pounded.

It is important that all protein feeds are served using the feeder.

Vitamins

Leucaena and Cassava leaves are cut and should be dried in the shade (not in the sun) so the leaves will keep their green colour. The leaves can either be ground or hung up so the birds have to jump to reach them (thus providing exercise while eating).

Minerals

- Bone meal:
 - Bones can be collected from abattoirs, slaughterhouses and butchers. Fish bones can also be used;
 - A fire should be set and the bones added to burn until they are coated with white ash;
 - The burnt bones should be taken off the fire and left to cool;
 - The bones should be pounded into a fine powder using a mortar and pestle;
 - The bone meal should be sieved, collected and rationed.
- Mixture of bone meal and salt:
 - Mix 13 parts (matchboxes) of bone meal with 1 part (matchbox) of salt (ratio 13:1).

How to formulate a ration for a free range poultry system (all age groups)

Feeding birds concentrates from commercial feed makers

Ingredient	Small quantity (~ 2 tins)	Large quantity (~ 25 tins)
Sorghum	2 tins (1 kg) or 4 cups	3 tins or 6 cups
Millet	2 tins (1 kg) or 4 cups	3 tins or 6 cups
Maize	2 tins (1 kg) or 4 cups	20 tins (1 kg) or 40 cups
Groundnut/sesame	2 matchboxes	1 tin or 2 cups
Bone meal/salt	1 matchbox (1 part salt with 13 parts bone meal)	Half a tin or 1 cup
Fish or blood meal	2 matchboxes	1 tin or 2 cups
Leucaena/Cassava	2 matchboxes	1 tin or 2 cups
Termites	Always give to chicks	Always give to chicks
Water	Always provide clean water	Always provide clean water

When using ready-made concentrates (from commercial feed-making companies), the following quantities are recommended for both the deep litter and battery cage systems:

For 100 broilers:

- 200 kg of Broiler Starter for chicks aged 0-5 weeks;
- 300 kg of Broiler Finisher for chickens aged 5-8 weeks.

For 100 layers:

- 200 kg of chick mash (20% protein) for pullets aged 0-8 weeks;
- 550 kg of grower mash (16% protein) for pullets aged 8-20 weeks;
- For layers, mash feed consumption will increase from 101 to 135 g per day between the ages of 22 and 66 weeks.

Other routine practices

1. Watering: Chickens must be provided with clean water every day. Drinkers should be regularly washed and should be placed on a raised platform or hung up to avoid soiling of the water.

A) Early morning

- Fresh water should be provided early each morning;
- The hens' nest should be checked (it should have plenty of soft materials and be kept in a dark place);
- The flock should be observed to check that all birds are active;
- The birds should be tamed by offering small amounts of feed during each visit.

B) Mid-afternoon

- All eggs should be collected;
- Chickens should be allowed to roam in the yard and food provided to confined birds.

C) Evening

- Clean water should be provided;
- All birds should be shut in the house;
- Any eggs laid during the day should be collected;
- Brooding hens that remained in the nest should be identified and given fertilised eggs to sit on.

2. De-beaking: This is done to chickens raised under the intensive system, who can develop a bad habit of pecking eggs and each other. Usually a sharp-edged blade is used to cut the tip of the beak (two-thirds of the upper beak and one-third of the lower beak). De-beaking should be done carefully so as not to damage the nostrils of the chicken;
3. Culling: This is the removal and slaughter of birds from the flock (usually, birds that are unhealthy, weak, poor producers, inferior or aged). As soon as chicks hatch, all those showing abnormalities such as crooked legs, etc. should be culled;
4. Brooding: This is the provision of care to chicks from the day they hatch until till they are about 10 days old (for improved birds);
5. Vaccination: These are medicines given to birds to prevent a particular disease. All drugs or vaccines should be handled with maximum care and should be administered only by

veterinary officers, trained community animal health workers or para-veterinarians.

Suggested intensive management practices for improved layer breeds

Age of the bird (weeks)	Management practices
0	The house should be thoroughly washed and disinfected 2-3 weeks before the ar-
0	1-2 days before the arrival of the chicks, brooding facilities should be set up (see
0-1	<ul style="list-style-type: none"> - Reception of chicks and provision of optimum brooding care - Vaccination of chicks against Newcastle, Marek and Gumboro disease before 10 days of age - Feeding of chicks with mash
1-2	<ul style="list-style-type: none"> - Continuation of brooding care - Completion of vaccinations as above
2-4	<ul style="list-style-type: none"> - De-beaking (if not done at 1 day old) - Continuation of brooding care - Gradual phasing out of supplementary heating
4-6	<ul style="list-style-type: none"> - Continuation of brooding care - Discontinuation of supplementary heating - Vaccination against Newcastle disease, Gumboro and fowl pox
6-8	<ul style="list-style-type: none"> - Separation of cockerels from pullets where straight-run chicks were brooded - Continuation of routine management practices
8-10	<ul style="list-style-type: none"> - Changing of feed to grower mash - Change to adult-size feeders and drinkers - Deworming of birds
10-12	<ul style="list-style-type: none"> - Initiation of feed restrictions if necessary - Continuation of routine management practices
12-14	<ul style="list-style-type: none"> - Continuation of feed restrictions if necessary - Continuation of routine management practices
14-16	<ul style="list-style-type: none"> - Continuation of feed restrictions if necessary - De-beaking if necessary (be sure to provide ample feed and water during the days following de-beaking)
16-18	<ul style="list-style-type: none"> - Full feeding - Vaccination against Newcastle - Vaccination of breeder flocks at 18 weeks against Gumboro disease and H5N1 (Bird flu)
18-19	<ul style="list-style-type: none"> - Transfer of birds to the laying house (be sure to leave about a week be-
>19	<ul style="list-style-type: none"> - Introduction of layer mash between 19 and 21 weeks

General healthcare management

Diseases and parasites in South Sudan are a major challenge to chicken production. Since their occurrence is relatively predictable, a seasonal disease control plan can be worked on to reduce risk. For example, Newcastle disease is common between January and April.

Sources of disease

Diseases can enter the village, town or compound through:

- Soil and air;
- Sick and dead birds in the same flock;
- Wild animals, domestic animals and humans;
- Contaminated drinking water;
- Contaminated feed;
- Unhygienic animal housing;
- Contact with markets or between villages; and
- Bird migrations.

Prevention of disease

All preventative practices should begin with hygiene and sanitation. The cleaner and more hygienic a poultry house and its surroundings, the more chance there is of minimising diseases and pests. To prevent disease from entering and spreading through villages or among flocks, the following should be considered:

- A 2-week quarantine of all new poultry (gifts and purchases) in the village;
- Isolation and treatment of all sick poultry to protect others;
- Slaughter and burial of sick chickens where necessary;
- Burning or burial of dead birds;
- Disinfection of the place in which the dead bird was found.

Please note: Hands should always be washed with soap after any contact with sick animals or after burning or burial.

The impact of poultry disease includes:

- Loss of flock and income;
- Weight loss and delayed growth among birds;
- Reduced egg production rates.

Diseases of poultry can be divided into 3 broad categories: viral, bacterial and parasitic. Additional conditions are caused by nutritional deficiencies.

Vaccination against common diseases of poultry

The table below (which is not exhaustive and is intended for use as a guide) shows common diseases of poultry, their vaccines and the age at which to administer vaccines to birds. The first step is to be aware and to request information from local extension and veterinary officers in the Ministries of Agriculture and Animal Resources. People learn best from experience and the exchanging of lessons between farmers is invaluable; therefore it is advised that poultry keepers make contact with others in their area.

Age of the bird	Vaccination	Disease(s) against which protection is provided
1-7 days	Intra-ocular (NDV 1/0) through the eye	Newcastle disease
18-20 days	Gumboro Vaccine IBDV through drinking water	Gumboro disease
3-4 weeks	NDV Lasota through drinking water	Newcastle disease
3-4 weeks	Fowl Pox vaccine (FPV) through a jab in the web	Fowl pox
6 weeks (repeated at 8 weeks)	Komorov (NDVK) through intra-muscular injection	Newcastle disease

Common poultry diseases

Newcastle disease (Samir, Malaac Ajith, Bololo)

General	Newcastle disease is a lethal virus that spreads quickly among the flock. A mortality rate of 90-100% is common. The disease attacks birds of all ages and occurs mostly at the beginning of winter when the weather is dry and cold (mid-November to February in Bahr-el-Ghazal, February and March in the Shilluk Kingdom and March in the equatorial area).
Birds affected	Chickens of all ages and (less frequently) guinea fowl and ducks
Agent	Virus
Transmission	Newcastle disease spreads through direct contact with respiratory, ocular and oral discharges and faeces. It attacks both the respiratory and nervous system of birds.
Symptoms	These include difficulty breathing, gasping and weakness, followed by the paralysis of one or both wings and legs. The bird may have a twisted neck and run in circles.
Treatment	None. Vaccination offers the best protection. In commercial poultry, birds should be vaccinated at two weeks and the vaccination repeated at 6-8 weeks.
Prevention	Chickens should never be bought at market between December and March. All new birds entering the compound should be quarantined for 15 days. Any sick birds should be isolated and slaughtered. Birds of all ages should be vaccinated at least 15 days prior to the known outbreak period of the disease. Sick birds should NEVER be vaccinated.
Vaccination	Newcastle vaccine can be administered orally, through the nostrils or via drinking water. It can also be injected. In a free-range system, chickens must be vaccinated before the wet season. Vaccination must be done 15 days before the outbreak season and repeated after 3 months.

Fowl Pox

General	Fowl pox occurs in the wet season when new corn is on the market.
Birds affected	Chickens (mostly chicks) and occasionally guinea fowl
Agent	Virus
Transmission	Fowl pox is transmitted through insects, dry wounds or contact with sick birds.
Symptoms	These include itching, pustules and nodules on the head and around the eyes and mouth. Sometimes pus is discharged from the eyes and nose and in dead birds, can be found in the mouth and throat.
Treatment	Treatment is required as soon as the disease appears. Pus should be cleaned from the eyes and mouth and cooking oil applied twice per day along with glycerine or iodine (Betadine).
Prevention	Vaccination should be done at the beginning of the dry season and the quarantine of new birds respected. Poultry houses should be disinfected every 6 months.

Pasteurellosis (Fowl cholera)

General	This is characterised by sudden mortality. 90% of infected birds may die. Infection can occur through stress and the consumption of contaminated feed.
Birds affected	All poultry (mostly ducks)
Agent	Pasteurella bacterium
Transmission	Through chicken feed, stress or poor hygiene
Symptoms	These include inflammation of the crest or comb, respiratory problems, yellowish diarrhoea and loss of appetite,
Treatment	Antibiotics (Tetracycline, Chloramphenicol and Sulphonamides).
Prevention	Vaccination is possible of chickens over 6 weeks old. Hygiene should be respected and stressful conditions avoided.

Salmonella gallinarum (Fowl typhoid)

General	Fowl typhoid spreads quickly. Chicks can die after 4 days.
Birds affected	All poultry, but specifically chicks
Agent	Salmonella bacterium
Transmission	Salmonella is transmitted through contact with sick birds or from mother hens to chicks (through eggs or droppings).
Symptoms	Chickens will appear sleepy or drowsy and may produce white diarrhoea. Chicks may have bloated stomachs.
Treatment	Antibiotics (Tetracycline, Chloramphenicol, Sulphonamides with vitamins).
Prevention	Destruction of eggs laid by sick birds, isolation of sick chickens, burning of dead chicks and disinfection of the poultry house.

Coccidiosis

General	Coccidiosis is dangerous to chickens. Fowls aged 6-8 weeks are most susceptible to an attack of this disease.
Birds affected	All poultry (mostly chickens)
Agent	Coccidian and Eimeria parasites
Transmission	Through contact with chicken droppings, infected birds and contaminated feed and water
Symptoms	These include bloody faeces, retarded growth, ruffled feathers, drowsiness. Death is likely within 10 days.
Treatment	Sulphonamides, Amprolium
Prevention	Coccidiosis can be avoided through regular cleaning and disinfecting of the poultry house. Overcrowding and litter-wetting should be avoided. In commercial poultry, coccidostats can be added to feed. Sanitation is however the most important factor in the prevention and treatment of this disease.

Internal parasites

Worms

General	These present a high risk to birds.
Birds affected	All species (mostly young birds)
Agent	Various types of worm
Transmission	Through droppings and contact with the ground (insects and groundworms).
Symptoms	These include weight loss, delayed growth, reduced egg production and diarrhoea. (sometimes with worms in the faeces).
Treatment	Deworming
Prevention	Deworming should be done every 2 or 3 months and feed distributed in feeding troughs. The poultry house, feeders and drinkers should be regularly cleaned.

Recent Diseases

It is also important to note that there are emerging diseases for which scientists have not found a vaccine. An example is the avian influenza (bird flu) virus. This has a high mortality rate and if it occurs in your poultry, all infected birds should be removed and burnt in a pit.

External parasites

These may attack birds of all ages at any time, but occur most frequently in humid poultry houses with poor hygiene. Examples are mites, fleas and ticks, which cause weight loss and feather and skin irritation. Lice can be seen around the nose, mouth and belly. Treatment is done by dusting with dry lime or ash or applying oil. Nests may be protected with dry tobacco leaves mixed with ash.

Importance	External parasites are small organisms that attack the skin and feathers of a bird. Some (such as ticks, fleas and other bugs) will drain blood and until the bird dies from exhaustion. External parasites are also dangerous as they may transmit disease to poultry.
Transmission	By contact between birds and through cracks in the floor, walls or roof of the poultry house
Symptoms	These include loss of weight, feathers and productivity. Chickens may be noisy at night and refuse to enter the house. They may also peck at their own body due to irritation caused by mites.
Treatment	Application of insecticide (Sepou or louse powder) to the infected area and the environment (poultry house) Sepou or Louse powder.
Prevention	Regular cleaning, disinfection and fumigation of the house (including smearing of the walls with whitewash to repel insects), proper fencing to ensure protection from rain

Scaly legs

This is caused by external parasites that irritate the skin on the bird's legs. It is common in birds above 2 years of age. The bird's legs will develop visible scales that will eventually cause lameness. The disease is treated by dipping the legs in oil or kerosene (once a day) until the scales disappear.

Marketing

Free-range farmers of local chickens do not often produce surplus eggs for sale but when they do, the eggs are sold at the farm gate. Local breeds are very popular and frequently found on all local markets. They are more likely to be eaten by families compared to cattle and goats. They can be sold, bartered or given as gifts and are served in most restaurants and grills in the major cities and towns.

Chicken is a very popular delicacy across East Africa and particularly in South Sudan where it is known as Kuku Choma. Eggs are fried and sold by street vendors, so the demand for them is high.



In the case of birds raised using the intensive system (such as broilers), farmers have to sell by the seventh or eighth week and as such are more likely to supply restaurants and supermarkets. Most frozen broilers found in supermarkets are from other countries (some as far away as Brazil). For layers, eggs are required daily and are traded at all local markets and supermarkets. The demand for eggs is higher than the supply in South Sudan, with the shortage met through the import of eggs from neighbouring countries such as Uganda, Sudan, Kenya and Ethiopia.

Bibliography

- Achariya, Handbook of Animal Husbandry. Tamil Nadu University of Agriculture, India, accessed 2015
- Anyanwu et al., 2008, A Textbook of Agricultural Science for schools and colleges, page 270
- Balogun ST, 1989, Tips on Poultry Health Management, NAERLS Nigeria Extension Bulletin, 36
- Christine, A. et al., 2009. Improving village chicken production: A manual for field workers and Trainers (ACIA and Australian Aid)
- Dafwang and Odiba, 1993, NAERLS Nigeria Poultry Management edited by J.O. Yusuf.
- Guide to intensive cereal beef production (ADAS short-term leaflet 202, UK, 1977)
- JN Methu and EM Kiruiro, 2003. Making silage for more milk in the dry season, KARI Headquarters Library
- Key Factors for Poultry House Ventilation, 5M Publishing, 2012
- Livestock and Meat Marketing. CCAHC Marketing Policy Committee, UK, 1979
- Norwegian People's Aid (NPA) South Sudan Poultry Production Training Manual, 2012
- Sileshi, Z and Desalegn, L: Sheep and Goat Flock Management. Ethiopia Sheep and Goat Productivity Improvement Programme
- SSSLP 2002: Training Notes for Community Health Workers, Malawi
- The Merck Manual for Pet Health (Edition on poultry disease)
- Udo, M.G. 2006. Sustainable Livestock/Range Management System: A Way Forward to the Progressive Development of South Sudan (Paper presented at a Workshop on Environmental and Natural Resource Management in Southern Sudan, GoSS).

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The guide on crop production covers crop agronomic and cultural practices for eleven selected crops namely Sorghum, Maize, Rice, Sesame, Cowpeas, Groundnut, Beans, Cassava, Sweet Potatoes, Tomatoes and Kale. In each of the guides you will find information on seed varieties, cropping seasons, land preparation, spacing, pest and diseases management, harvesting techniques and marketing. The second guide on animal production covers husbandry techniques for Cattle, Goats, Sheep and poultry. The guide provides technical information on selection, housing, feed types and feeding, diseases (including disease management) and marketing. The third guide contains a set of guidelines on Ox Ploughing, Agricultural Marketing, Agrodealership, Village Savings and Loans Association, Community Mobilization and Farmer Field School.