KP14
Knowledge Product 14

CCARDESA
Centre for Coordination of Agricultural Research and Development for Southern Africa

DECISION TOOL:

Climate Smart Diet Management Options for Livestock in the SADC region

CLIMATE SMART AGRICULTURE
KNOWLEDGE PRODUCTS FOR EXTENSION WORKERS
Customised Information Tools for Agricultural Professionals

Audience: Local Level Extension Staff (Government, NGO/Civil Society, Private Sector)

Livestock | Decision Point | Gender | Youth | Climate Smart | Practice

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WHAT IS CLIMATE SMART AGRICULTURE (CSA)?

CSA comprises three interlinked pillars, which need to be addressed to achieve the overall goals of food security and sustainable development:

1. **Productivity:** Sustainably increase productivity and incomes from agriculture, without negative impacts on the environment

2. **Resilience:** Reduce exposure of farmers to short-term risks, while building capacity to adapt and prosper in the face of shocks and longer-term stresses (resilience). Attention is given to protecting ecosystem services, maintaining productivity and our ability to adapt to climate changes

3. **Mitigation:** Wherever and whenever possible, CSA should help to reduce and/or remove greenhouse gas (GHG) emissions. This implies that we reduce emissions for each unit of agricultural product (e.g., through decreasing use of fossil fuel, improving agricultural productivity and increasing vegetation cover).

CSA = Sustainable Agriculture + Resilience – Emissions.

How is CSA Different?

1. CSA places greater emphasis on **hazard and vulnerability assessments** and **emphasises weather forecasting** (short term) and **climate scenario modelling** (long term) in the decision-making process for new agricultural interventions

2. CSA promotes the **scaling up of approaches** that achieve **triple wins** (increase **production**, increase **resilience** and [if possible] **mitigate GHG emissions**), while at the same time **reducing poverty** and **enhancing ecosystem services**

3. CSA promotes a systematic approach to:

   a. Identifying **best bet** opportunities for agricultural investment

   b. Contextualising **best bet** options to make them **best fit** their specific context through learning and feedback loops

   c. Ensuring the **enabling environment** is in place so that farmers (and other stakeholders) can invest in CSA practices and technologies to catalyse adoption

Key Messages:

1. To make climate smart decisions on which climate smart diet management options for livestock best suits your farmers, you need to understand:

   a. The farming system

   b. How livestock are currently managed within the system

   c. Farmers perceptions of problems and opportunities

2. Climate Smart diet management options include:

   a. Non-conventional feeds

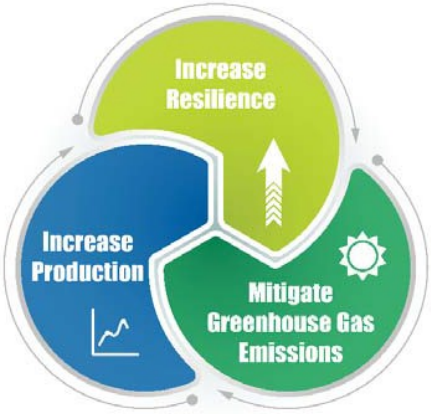
   b. Improved digestibility

   c. Improved protein content

   d. Use of supplements.

Entry Points for CSA

- CSA practices and technologies
- CSA systems approaches
- Enabling environments for CSA.



CLIMATE SMART DIET MANAGEMENT OPTIONS FOR LIVESTOCK

Climate change, especially prolonged drought events, reduce the availability of feed and water for livestock. This **Decision Tool** aims to help field-level extension staff make climate smart decisions on which diet management option best suits their farmers' context. This tool is not designed as a technical guide to implementation. It is designed to assist extension staff in making **climate smart decisions** on improvements to their farming systems with their farmers as clients. Reference to technical guides relevant to the practices and technologies outlined are included at the end of the tool. The tool focuses on some of the **Best Bet Climate Smart Diet management options** for livestock production in the Southern African Development Community (SADC) region. These are just some of the many options available. They are listed in no particular order and have been selected as best bet because:

- They are climate smart (see table 1)
- They are applicable in multiple agro-ecological zones across the region
- They have high potential to address major constraints to livestock production in the region (Table 1).

These are best bet options. An understanding of the local context and farmers' priorities is required in order make these options **Best Fit** to individual farmer's needs.

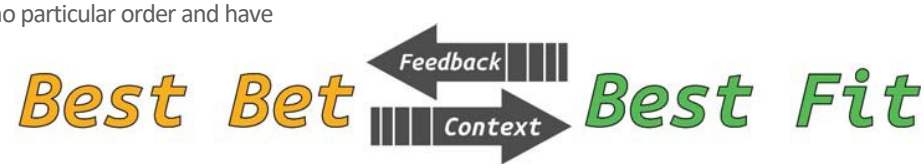


Table 1: Best Bet Climate Smart Diet Management Options for livestock for the SADC region.

Climate Smart Diet Management Option	What is it?	3 Pillars of CSA		
		Increase production	Increase resilience	Mitigate GHG emissions if possible
Non-conventional feeds	Use of any feeds ingredient not for human consumption (e.g., *Jatropha*, brewer's mash, orange pulp)	Can supplement conventional feed to enhance productivity	Reduces pressure on land to produce fodder	As these are by-products of industrial processes; no additional inputs to produce fodder are required
Improved digestibility	Feed manipulations to improve acceptability and palatability of feed (e.g., dual-purpose sorghum, molasses, fermentation)	Less feed is required to reach the same levels of production. Potentially, this means less pressure on land from livestock	Less feed is required to reach the same levels of production. Potentially, this means less pressure on land from livestock	N/A
Improved protein content	Feed manipulations to increase the quantity of protein in livestock diets through introduction of woody species of fodder (e.g., by inclusion of fodder shrubs and other leguminous plants)	More efficient conversion of food to weight gain & productivity	Woody shrubs are more tolerant to droughts and hence provide a more continuous source of fodder. Diversification of diet reduces the effects of drought on availability of fodder in pasture & rangeland	Woody shrubs and trees lock carbon
Use of supplements	Hay, silage, concentrates and nutritional blocks include nutritional, mineral and/or anti-stress additives as part of a supplementary feeding regime	Can supplement conventional feed to enhance productivity	Can help livestock get through lean periods by preserving fodder	N/A

HOW ARE LIVESTOCK CURRENTLY MANAGED WITHIN THE FARMING SYSTEM

To make climate smart decisions on diet management options, we need to understand current management practices for each variety of livestock in the farming system.

This includes the following elements:

- **Livestock holdings:**
  - Type and numbers (age, male and female, should all be recorded)
- **Livestock housing:**
  - Housing structures, if any?
  - Bedding used, if any?
  - Housing times – day/night/seasonal changes?
  - Are animals all housed together or are they separated by age, sex and species?
  - Are feeding troughs provided?
  - When is manure collected, if at all?
  - How often is manure collected, and what is it used for?
- **Crops grown on farm:**
  - What are the main crops grown by the farmer on their land?
  - What is the typical yield?
  - What is done with the crop residue?
- **Livestock feeding:**
  - Stall fed, tethered, open grazing or a combination?
  - How does this change over the year?
  - Where do animals graze (if they do)?
  - What plants/residues/crops/trees do the animals feed on?
  - How do feeding habits change throughout the year?
- **Cultivated fodder:**
  - What are the main types of crops planted on the farm, specifically as forage material for livestock feeding?
  - Are any multipurpose trees (MPTs) and shrubs grown?
  - How much land is used for each crop?
- **Collected fodder:**
  - Does the farmer collect any naturally occurring fodder material? If so, how much does this source of feed contribute to the diet of their animals (as a percentage)?
- **Purchased feed:**
  - What feeds does the farmer purchase, if any?
  - How does this change throughout the year (or from season to season)?
  - How much does this cost?
- **Processed fodder:**
  - Is any of the fodder processed (e.g., chopped, bailed, silage, hay, etc.)?
- **Grazing:**
  - Do the animals spend any time grazing?
  - If so, how much does this source of feed contribute to the diet of the animals (as a percentage)?
- **Sources of household income:**
  - What are the main contributors to household income?
  - How much does income from livestock contribute to total household income?
- **Use of livestock within the farming system:**
  - Why does the farmer keep each type of livestock?
    - » For own consumption or sale (meat or dairy or other product)?
    - » As a coping strategy (sale in lean periods/household shock)?
    - » As a status symbol?
    - » As draught animals?
    - » For transport?
    - » For manure for crops or fuel?
    - » A combination of reasons?
- **Sale of livestock and livestock products:**
  - How many animals has the farmer sold over the past three years , and what were their weights?
  - How much did the farmer receive per head of livestock sold?

- What is the overall milk production from the farmer's animals?
- How much cash does a farmer get paid per litre of milk?

- **Labour:**
  - Who performs each animal husbandry task (men, women, children)?
  - How much time is spent on each task?
  - Do any tasks require hired labour, and if so how much does this cost?

- **Seasonality:**
  - What are the sources of feed for each month of the year?
    - »This can be added to a seasonal calendar if you have one.
  - How much does feed availability vary over the course of a typical year?
  - Do labour requirements change throughout the year (for men, women, children)?

FARMERS PERCEPTIONS OF PROBLEMS AND OPPORTUNITIES

To select the Best Fit climate smart diet management option(s) for livestock with your farmers, it is always best to start by asking farmers what they think are their main problems and opportunities. Table 2 outlines a simple problem/solution matrix template that can be used to troubleshoot problems and opportunities.

- List the major problems faced by farmers in livestock production.

- What do farmers view as the solution to the problems identified?

The problems can then be ranked using a simple pairwise ranking tool (Table 3).

Once the problems and potential local solutions have been identified and ranked, you should spend time with your farmers to discuss the proposed solutions in more detail and consider if other solutions the farmers have not thought about might be an option.

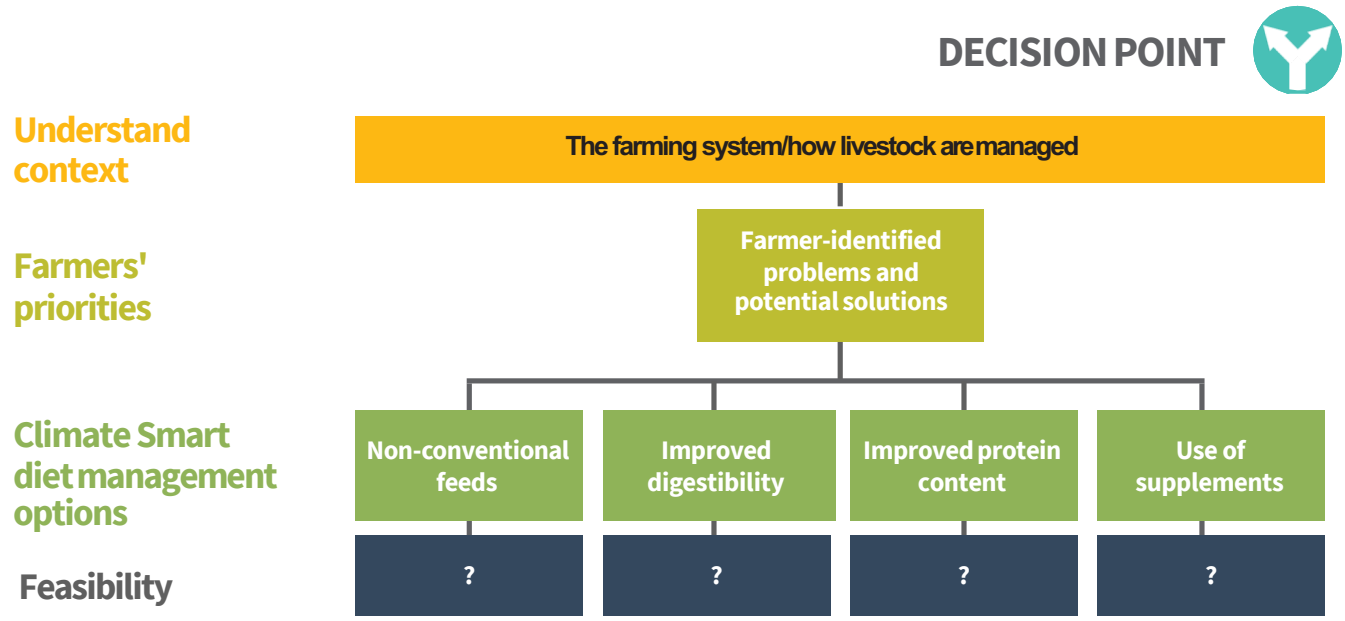
Table 2: Problem/solution matrix.

Problem	Solution
1	
2	
3	
4	
5	

Table 3: Pairwise ranking template.

Pair	Problem considered more important
Problem 1 vs Problem 2	
Problem 1 vs Problem 3	
Problem 1 vs Problem 4	
Problem 1 vs Problem 5	
Problem 2 vs Problem 3	
Problem 2 vs Problem 4	
Problem 2 vs Problem 5	
Problem 3 vs Problem 4	
Problem 3 vs Problem 5	
Problem 4 vs Problem 5	

The **Decision Point** tree below outlines how an understanding of the context and an assessment of farmer priorities can lead to climate smart decisions on diet management options.




La Rosa, 2014

BEST BET DIET MANAGEMENT OPTIONS FOR ADDRESSING CLIMATE RISKS IN LIVESTOCK PRODUCTION

Below are four climate smart diet management options for livestock. They are listed in no particular order. All are broadly applicable across the SADC region. In many instances, a combination of these options will give optimum results. While these are best bet options, they are not universally applicable. CSA is context specific and each of these options will need to be tested under local conditions and adapted to make it **Best Fit** the local context.

Before assessing feasibility of the climate smart diet management options identified, each option should be discussed in more detail.

NON CONVENTIONAL FEEDS

There are two categories of **non-conventional feeds:**

- By-products of industrial processes
- Plants or plant materials that have not previously been used as animal feed.

By-products of industrial processes:

These are usually mixed with other feedstuffs and can provide alternative or supplementary feed with varying nutrient value. However, they are usually only available close to where they are produced. Transport costs may be prohibitive and shelf-life may be short. The cost may also be prohibitive. This type of non-conventional feed is likely only a viable option to farmers practising intensive meat and/or dairy production at a significant scale.

Some examples of non-conventional feed are listed below:

- Cottonseed meal
- Soybean meal
- Groundnut cake
- Brewer's mash.

The use of animal by-products such as meat and bone meal (and blood meal) for ruminant livestock feeding should be discouraged, due to potential negative effects on animal and human health, e.g., the outbreak of 'mad cow' disease in Europe during the 1990s.

Molasses is an agro-industrial by-product that can be widely used. It is generated during sugar extraction. Molasses contains 50%–60% sugar, with some minerals, especially potassium (K) and calcium (Ca). It is low in crude protein and does not contain fibre. It can be mixed with urea in liquid licks. It can also be used in mixtures of molasses, urea and vitamins to spray on poor-quality roughages, or formed into blocks. It can also be used as an additive to improve the quality of silage.

Plant material that has not previously been used as animal fodder:

These materials may be locally available or newly introduced. They include a variety of perennial crops, multipurpose trees and shrubs. Local knowledge should always be tapped regarding the potential for using locally available options as alternative or additional feed sources. Fodder trees and shrubs have high potential value as a source of feed for domestic livestock. They can be successfully integrated into production systems to provide:

- Feed resources for use in mixed diets of livestock
- Fuel
- Mulch
- Erosion control when planted as wind breaks
- Maintenance or rehabilitation of degraded rangeland areas.

One example of such a plant is *Moringa oleifera*, which grows well in many countries in Southern Africa and is often used as live fencing around homesteads and gardens. The leaves of this tree are edible and are highly nutritious. With high total protein digestibility of leaves (crude protein approx. 25%), moringa provides high quality livestock feed. Leaves are free of anti-nutritive factors and high in iron, beta-carotene and in vitamin C, and have been found to increase animal productivity.

IMPROVED DIGESTIBILITY

Livestock grazing natural pasture during the dry season suffer from nutrient inadequacies, as natural pasture is low in protein during these periods. The low crude protein content cannot support rumen function, which requires a minimum of 7% protein. Feed intake and digestibility, in turn, fall below requirements for maintenance. Animals therefore lose weight. Losses of up to 20% have been recorded.

Provision of supplementary protein to grazing livestock has resulted in improved reproductive efficiency in breeding cows, and growing animals attain breeding or slaughter weight earlier.

Some climate smart options here are:

- Silage
- Chocolate maize
- Dual-purpose crops
- Improved composition of grazing and planted pastures.

Silage can be made from green plant residues (e.g., maize, sorghum, Napier grass). Silage is produced when fermenting the green plant material in anaerobic (no air) conditions. This can be done in large heaps or clumps, or in smaller bags or pits depending on the volume of silage being made.

To ferment, silage is left in sealed heaps, pits or bags for about six weeks. Then it can be fed to livestock during the dry season. The fermented plant material is already partially decomposed. This makes it more digestible for livestock. Adding **molasses** and/or **urea** when making the silage makes it even more digestible.

Chocolate Maize – During the severe drought years of the 1980s, different methods of feeding animals were tested in Namibia. Sodium bicarbonate-treated maize (also called chocolate maize, because of the brown colour) proved to be effective, and has since been used as supplementary feed during times of drought. Table 4 details the ingredients of 'chocolate maize' along with the purpose of each.

Video on silage making on Shamba Shape Up

Shamba Shape Up clips - Cows Feeding Silage making

Table 4: The ingredients of 'chocolate maize'.

Ingredient	Purpose
70 kg maize	For energy and protein
4 litres 20% solution of $NaHCO_3$ (sodium hydrogen carbonate)	Rumen buffer
7 kg protein + mineral concentrate	For protein and minerals
14 g Bovatec® (3 level teaspoons)	For improved feed conversion and against coccidioses
2 kg feed quality lime ($CaCO_3$)	For calcium phosphate balance and to prevent bloat.

First chop the maize and then mix four litres of sodium bicarbonate until all the maize is wet. Then mix all the dry ingredients and add to the wet maize. Mix until the dry ingredients have formed a brown coating around the maize (in a concrete mixer this takes about 5 minutes). Leave for 12 hours before feeding. Just 100 grams per day of chocolate maize as a supplementary feed for sheep may be enough to maintain a healthy body condition during the dry season.

Dual-purpose crops. There are some varieties of sorghum available that have been bred to produce grain and fodder. These have been specifically bred to have higher digestibility for ruminants.

Improved composition of grazing or planted pastures. Promoting the growth of more digestible fodder crops within available pasture land may be an option, but this requires an in-depth knowledge of the ecology and biodiversity of available grazing land. Another option may be to grow fields of fodder crops known to be highly digestible to supplement or replace grazing in the dry season. *Cenchrus ciliaris* (Figure 1 – also known as African foxtail Grass, dhaman grass, anjan grass, koluk katai and buffel-grass) is a species well suited for dry land production in planted pastures in areas with rainfall above 400 mm per year.

Figure 1: Cenchrus ciliaris, or African foxtail grass.

Source: Wikipedia

IMPROVED PROTEIN CONTENT

Leguminous plants are high in protein, and may be a viable source of supplementary feed or fodder for livestock. There are many ways in which to include forage legumes into the farming system:

- **Rotations**
  - **Ley farming:** Cereal crops grown in rotation with forage legumes
  - **Cut and carry:** The legumes are planted as a cover crop, and then harvested along with the main (fodder) crop to feed to livestock. This has multiple benefits:
    - »Provides high quality feed (high nitrogen)
    - »Suppresses weeds
    - »Adds organic matter to soil
    - » Fixes nitrogen that can be used by the next cereal or fodder crop
  - **Fodder banks:** These are dense stands of forage legumes grown on a small area for two to three years to provide dry-season feed supplementation. After a few years, fodder banks usually become infested with nitrophilous grasses. The area must be planted to a cereal crop, and the system becomes a type of rotation.
  - **Dual-purpose legumes:** Where farmers are reluctant to invest in forage legumes, forage-type grain legumes could be used if their dry matter yields are sufficiently high. Work in Mali showed that by introducing cowpea into the crop rotation, millet grain yields increased by 60% compared with yields of a first-year millet crop.
- **Alley farming:** An agroforestry system (see **KP12 – Climate Smart Agroforestry Options and KP07 – Climate Smart Planting System Options**) where arable crops are grown between hedgerows of legume shrubs.

The hedgerows are pruned periodically during the cropping phase for the following reasons:

- Providing green manure
- Generating additional fodder for animals
- Serving as staking material
- Preventing shading of the arable crop.

Examples of foraging legumes suitable for alley cropping are *Albizia*, *Calliandra, Cassia, Inga, Leucaena, Gliricidia* and *Sesbania* genera.

Intercropping: using forage or dual-purpose legumes in intercropping systems instead of grain legumes (see **KP07 – Climate Smart Planting System Options**). Intercropping cereals with forage legumes can be very productive in terms of biomass and protein yields.

Access Agriculture contains many videos including ones on how to make concentrate feeds at home

Preparing low-cost concentrate feed

1 year ago

Concentrate feed from a shop is rich in nutrients, but is also costly. You can make your own feed at half the cost

USE OF SUPPLEMENTS

Supplements are provided for livestock when grazing or browsing is not sufficient to meet their nutritional requirements. Supplements come in many forms, some of which are described above – crop residues, agro-processing by-products, molasses, silage, chocolate maize, fodder banks, etc. Other forms of supplements include concentrates and mineral licks.

Concentrates: These can be made at home from a mixture of ingredients such as maize, millet, rice bran and groundnut cake. A base mixture is appropriate for all livestock and additional ingredients can be added to make it specific for cattle, sheep, goats, chickens or fish. The box shown provides a link to a short video on how to make concentrates at home.

Mineral Licks: These can be provided to animals to achieve the following:

- Supplement a specific nutrient(s) known to be deficient in the area
- Promote more efficient digestion

Supplements can be expensive in terms of labour and financial cost, and the farmer must be clear on the aim of supplementation:

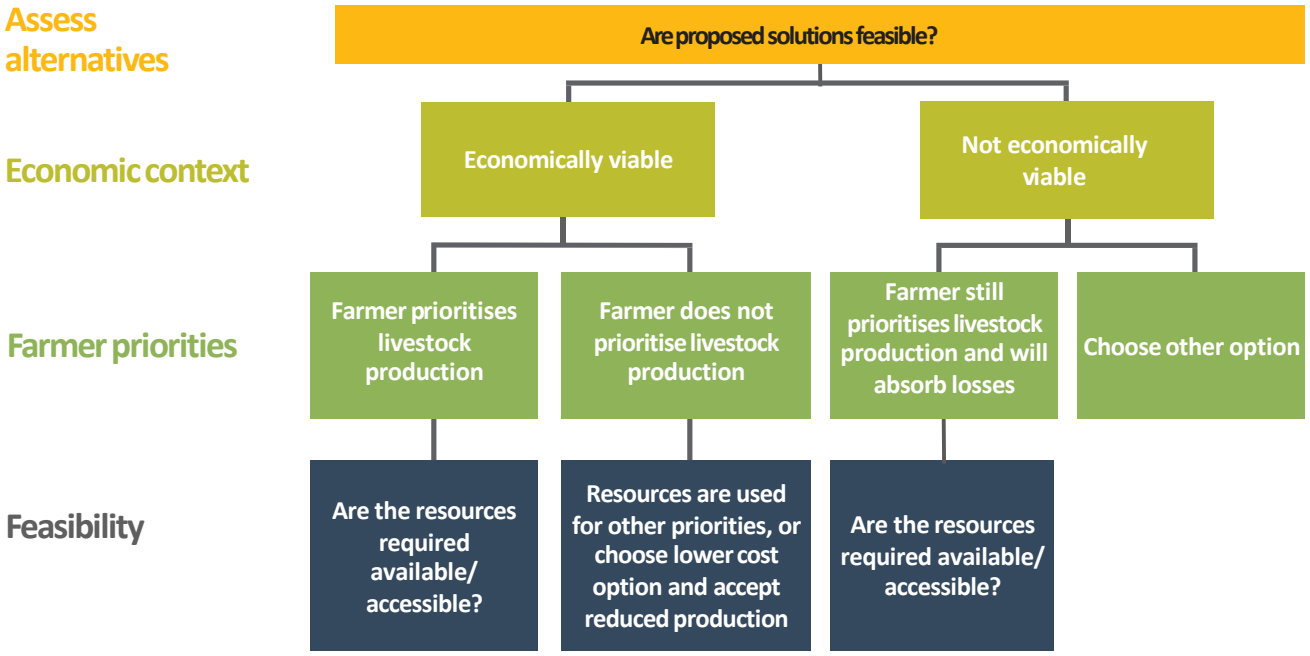
- Is protein, energy, a combination of protein and energy, or minerals lacking?
- What is the aim of supplementation?
  - Should animals gain in condition, must dry animals maintain mass (maintenance) or must lactation be supported?

Animals in different production phases need specific types and quantities of supplementary feeding.

FEASIBILITY

The following **Decision Point** outlines a decision tree that can be used to help make decisions on whether climate smart diet management options identified and selected are actually feasible in the individual farmer's context.

DECISION POINT



ECONONOMIC VIABILITY

Will the costs of the climate smart diet management option result in increased returns for the farmer, or are they unsustainable? In some cases, the farmer may lose out in the short term (initial investment costs), but benefit in the longer term.

Labour is a key factor that must be assessed in terms of economic viability. Farmers rarely account for the cost of their own family labour, but consider wage labour costs. Understanding who is responsible for key livestock management tasks is critical in assessing if there are opportunity costs associated with the proposed option. Extra labour may be required to chop maize and sorghum residues at harvest time, or to cut and carry fodder crops.

- Who will do this work?
  - Men, women, children?
  - Household members or labourers?
- What would they be doing if they are not doing this task? For example:
  - Will children need to miss school?
  - Will women not be able to go to market to sell milk?

These are known as opportunity costs, and must be factored in.

Accurate economic forecasting is not easy as there are many factors that need to be considered. Discussing this with your farmers can help identify major factors that might help you decide on economic viability at this stage. Collecting accurate data on costs incurred, production attained and externalities such as climatic conditions and pest and disease outbreaks throughout the year and reflecting on these, will help you and your farmers make informed decisions.

FARMER PRIORITIES

If meat and/or dairy production is a primary source of income for the farm, or livestock are a key source of draught power, diet management is likely to be a higher priority as it directly affects the household economic status. However, livestock are often kept in mixed systems as a coping strategy, to be sold if cash is needed or as an investment.

In these systems, simply keeping the livestock alive may be more important to the farmer than ensuring optimum weight gain and productivity; hence, diet management may be less of a priority.

Different livestock are used for different purposes, and may be prioritised accordingly.

FEASIBILITY

Finally, you need to work with your farmers to assess if the preferred options are feasible in terms of accessibility and availability.

- Are the required inputs (including labour) available?
  - Where can they be sourced from?
  - How frequently will they be required – regularly or once off?
- If available, are the required inputs accessible?
  - Is credit available and affordable?
  - Will the farmer be able to access the required resources?
  - Are they close by?
  - Will she/he be able to transport them?
  - Do men and women have equal access to inputs (including credit)?

TO SUMMARISE

STEP 1: Understand the context

- What is the farming system?
- How are livestock currently managed?
- What problems are identified by farmers?

STEP 2: Select 'Best Fit' options

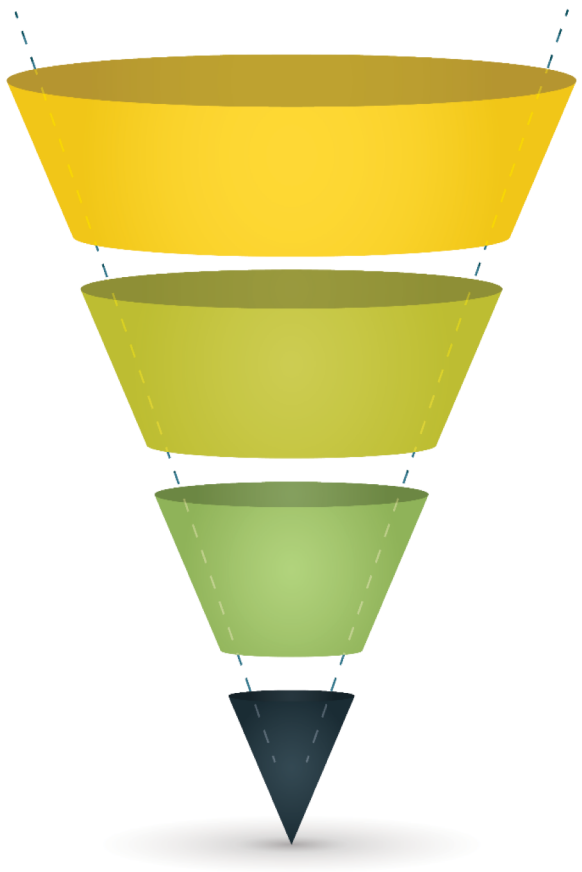
- What local solutions are proposed?
- Are there other alternatives?

STEP 3: Assess feasibility

- Assess economic viability
- Crosscheck with farmer priorities
- Are other options available?

STEP 4: Test and improve

- Try different options
- Collect data and reflect on possible improvements.



WHERE CAN I FIND MORE INFORMATION?

The following resources, which were used as reference for the development of this Knowledge Product, provide valuable additional reading on this subject. Please also refer to the CCARDESA website (www.ccardesa.org), the full series of Knowledge Products, and associated Technical Briefs.

- See also the following **CCARDESA Knowledge Products:**
  - **KP07** – Decision Tool: Climate Smart Planting Options for Maize & Sorghum
  - **KP12** – Decision Tool: Climate Smart Agroforestry Options
  - **KP15** – Decision Tool: Climate Smart Pasture/Rangeland Management Options for Livestock in the SADC Region
- Access Agriculture – Videos on silage making and making concentrate feed at home
  - Can be very useful to show to farmers. Available in multiple languages. If you sign up (free), you can get access to downloadable technical guides and much more. A good resource to return to on any topic
- **Food and Agriculture Organisation of the United Nations (FAO)** – Climate Smart Agriculture: Building Resilience to Climate Change – Section IV; A Qualitative Evaluation of CSA Options in Mixed Crop-Livestock Systems in Developing Countries
- Shamba Shape Up
  - Various videos and leaflets available. May take some time to find the ones you are looking for, but well worth it
- **International Livestock Research Institute (ILRI)** – FEAST:
  - This is a useful tool to help make decisions on livestock interventions
- **International Livestock Research Institute (ILRI)** – The feasibility of low emissions development interventions for the East African livestock sector: Lessons from Kenya and Ethiopia.
  - A good overview of some climate smart practices that are applicable in the SADC region.

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