

# **Training Manual on Improved Animal Feeding and Fodder Conservation Practises from Prosopis Juliflora in Sudan**



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# **Training Manual**

## **on**

### **Improved Animal Feeding and Fodder Conservation Practises from Prosopis Juliflora in Sudan**

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## Acronyms

APRC	Animal Production Research Centre
CBO	Community Based Organisation
IFAD	International Fund for Agricultural Development
Kg	Kilogram
PEAKS	Pastoralist Environmental Association in Kassala State
PENHA	Pastoral and Environmental Network in the Horn of Africa
<i>spp</i>	Plural of species
ToT	Training of Trainers

## Introduction

Generally the smallholder farmers in developing countries have limited resources available for feeding to their ruminant livestock. They are unable to select the basal diet according to the requirement for production unlike their more fortunate counterparts, but use whatever is available at no or low cost. Therefore the strategy for improving animal production should be to optimize the efficiency of utilization of the available feed resources, and thereby to maximise animal production.

It has been observed that community members and especially women in villages of Eastern Sudan used to take care of animals inside their homes. Their jobs, besides taking care of kids at home, cooking the food and cleaning, include feeding and watering the animals in the house. Women depend mainly on pasture plants as the cheap and easy way to feed animals. Animals used to graze those plants. However during the dry season there is a great shortage of pasture and of course water and production of those animals during this period is greatly reduced. During the dry season animals are fed on grown forages and stored roughages from the last season. In addition to that the use of feed concentrates is not very common at those areas except for feeding crushed sorghum cereals for newly delivered animals. Women usually raise goats, sheep, chickens and sometimes a donkey at home.

However, mesquite (*Prosopis Juliflora*) tree was introduced to Sudan since 1917 from South Africa and Egypt and planted in Khartoum (Broun and Massey, 1929). The establishment of this tree in Sudan was because of its unique abilities to tolerate drought and salty soil making it suitable to various ecological zones throughout the country with an emphasis on dry areas. *Prosopis spp*s are fast growing, nitrogen fixing and often colonize eroded, overgrazed or drought-affected lands. In Sudan *Prosopis spp*s became invasive weed and invading agricultural lands along irrigation channels and water courses. The most invaded areas (90%) in Sudan are in Eastern Sudan

namely in Gash Delta which stretches from Kassala northwards passing Wager and southwards up to the borders with Eritrea, in Atbara River, along Khor Baraka, extending from the delta up to 130 km upstream and in water collection pits along Kassala-Gadarif and Port Sudan highway. In most invaded areas, mesquite impenetrable thickets smothered and excluded native vegetation.

Talking about *Prosopis* eradication is no more relevant, instead control and management programs should be developed. Programmes of uprooting of *Prosopis spp* was initiated by the Federal Ministry of Agriculture –Sudan in 1995. A programme for containment of mesquite was planned in New Halfa – Sudan in 1996, with little success (El Tayeb *et al*, 2001). These programs were not successful due to lack of sustainability and follow up. *Prosopis spp* are native in the Americas, there is a long history of using all parts of the tree for trading wood, food and fodder. However, when introduced to Africa, Asia and Australia, the indigenous knowledge of origin rarely followed and *Prosopis* remained under-utilized and unmanageable. The crude protein contents of pods are 16% suggesting it as a good source of protein for livestock.

A recent study in 2009 was done in Sudan in a collaborative work between PENHA and APRC (Abedelnoor *et al*, 2009). The conclusion drawn up from this study is that *Prosopis juliflora*-leaves silage could be safely incorporated in sheep concentrate diets up to 15% inclusion rate for maintenance purposes especially during the dry season where there is a great shortage of green fodder. However for the milking goats the same feeds could be used at the rate of 5% *Prosopis juliflora*-leaves silage inclusion rate for moderate milk production and body weight maintenance. In another experiment done by Mabrouk *et al*, (2012) revealed that ground *Prosopis juliflora* pods could replace upto 30% of sheep concentrate diet without any negative effect on their body performance. Studies in Brazil and Mexico, Habit and Saavedra (1988) showed that *P. Juliflora* pods flour could replace up to 60% of wheat

flour in rations for lactating cows and that dry matter intake, weight gain and milk production increased with increasing pods flour. The total replacement of wheat flour by ground pods was also favourable for beef cattle (Brazil trial). In Mexico, trials with sheep showed that replacement of sorghum flour with *P. Juliflora* pods flour increased live weight gain up to 45% inclusion rate. In dry season ruminant animals may eat *P. Juliflora* pods. Furthermore most of its seeds shed in their feces intact resulting in the spread and invading of the tree. However, the ground pods may be an appropriate alternative feeding form that minimized the seed dispersal.

The main goal of preparing this manual is to provide equip rural women with training on improved animal feeding and fodder conservation practises in Kassala state based on the action-oriented research conducted by PENHA-APRC and the following trainings. This training manual is expected to help trainer and the participants to work together in the process of exchanging knowledge and discussion and also to clearly demonstrate the opportunities with using *Prosopis* as animal feed and hence improving their livelihoods.

## **AIMS AND OBJECTIVES OF THE TRAINING**

### ***Overall Aim***

The main aim of this training is to introduce the trainees to the development of appropriate technologies in order to improve food resources for smallholder livestock owners in Kassala State.

The ultimate aim is to increase animal productivity and food security by offering smallholders with more viable alternative feed including Muskit for their animals especially during the long dry season.

The trainees will be equipped with new knowledge, practical skills and tools on how to use *Prosopis Juliflora* (pods) efficiently as an alternative animal feed both under sedentary /nomadic systems of animal production. Trainees will also acquire better practical skills on how to best use crop fodder and crop residues.

## **Specific objectives**

- Provide trainees with knowledge/information on the potential benefits of *Prosopis* spp. (muskit) as an animal feed in Sudan
- Introduce trainees to the importance of better animal feeding concepts by better utilization of available fodder resources including *Prosopis* spp. (muskit) and other crop fodder available in the area
- Train the participants through practical demonstration how to use *Prosopis* spp. fruits as animal feed during the dry season by mixing it with other feed stuffs to improve its palatability and nutritive value
- Demonstrate to trainees how to efficiently use available crop residues and grasses
- Identifying methods and/or technique to be used for the introduction of these feed stuffs in the feed ration
- Equip the participants with training of trainers (ToT) skills in the light of the experience gained from this training exercise with the view of replicating such training more extensively.
- Understanding the role and contribution of women in animal feed management

## **Training components**

The training package shall be composed of the following:

- Introduction and open discussion about feed resource challenges including outline of the objectives of the training course.
- Identifying available/traditional fodder sources and introducing new approaches
- Fodder production based on crop residues (mash/feed blocks)
- Fodder production using silage system (including construction)
- Discussing and initiating the set up of community-based fodder production teams (who can produce for the local markets and train other community members)

## **Main beneficiaries**

Trainees will be drawn through the local CBO - Pastoralist Environment Association in Kassala State (PEAKS) from among local pastoralist in close collaboration and consultation with local community leaders. There will be about 30 women participants per round mostly drawn from the Kassala State. The training is built based on the existing competence developed by PENHA, APRC and PEAKS.



## **Criteria for selection**

1. Own minimum 3 animals.
2. Aged between 18 to 60.
3. Have the ability to learn new skills and motivated to share others.
4. Have a good social standing in the community.
5. Ability to attend and successfully complete the training.
6. At least 10% to 25% of the trainees should be literate in order to be able to help in transferring the information through discussions.

## **Training Duration**

The training period will be four days including one preparatory day and one wind up day. The proposed time frame shall be assigned to different partners.

## **Training Venue**

This is will be decided after consultation with PEAKS and the local authorities in Kassala state.

## **Training Outputs**

- Equipped pastoralist women participants mostly from River Atbara and Rural Ghirba with new practical skills and awarded certificates of attendance
- Training evaluation report produced after the PENHA, APRC and PEAKS training.

## **Training Outcomes**

- Drew the attention of participants to the importance of using available animal feed resources.
- Improve animal productivity in order to reduce the level of poverty and ensure environmental rehabilitation
- Training women in using of some simple technologies in feed keeping (drying under shade and chopping of green forages) for better utilization of these feed resources.
- Women gathering from different villages making connections and knowledge exchange.
- The formation of producer groups including women in all villages aiming at conducting training, hygiene and education which gained some political and financial support from local authorities.

## **Preparatory phase**

PENHA, APRC and PEAKS will meet to do the preparatory work and drawing a draft programme with clear division of labor among the partners.

## **Training facilitators**

The team will consist of the following partners who have an established working relationship. They include:

1. Pastoral and Environmental Network in the Horn of Africa (PENHA)
2. The Animal Production and Research Centre, Khartoum, Sudan (APRC) in collaboration with local authorities and experts.
3. Others.

## **Role of the CBO - PEAKS**

- 1- Selection of the trainees.
- 2- Selection of the trainers in collaboration with PENHA and APRC.
- 3- Arrange the venue for the training.
- 4- Supply the training materials and the stationary.
- 5- Monitoring and evaluating the project in collaboration with PENHA and APRC.
- 6- Prepare the final report of the workshop and attendance report in collaboration with PENHA and APRC.
- 7- Prepare the financial and narrative report.
- 8- Be overall responsible for the workshop

## Lecture 1: Animal feed resources in Sudan

### What is feed?

The term feed is normally given to any type of feed ingredient that the animal could eat, make use of it and reflects that usefulness in a form of body maintenance, or milk production, or meat production, or egg production.

Animal feed resources in Sudan:

1. **Pasture plants:** this refers to plants that emerge after the rain or in valleys and never require any kind of fertilization or other advanced plantation technologies.
2. **Green forages:** this refers to plants that grown purposely for animal feeding and many plantation technologies are applied e.g. lucerne, Abu70 and corn forages.
3. **Agricultural by-products:** those are what is left in the fields after harvesting the main crop like sorghum stover and broad bean straw.
4. **Agro-industrial byproducts:** those appear as a byproduct to a certain type of industry and proven to be a valuable source of animal feed.
  - Oil industry byproducts like groundnut cake and sesame cake.
  - Sugar industry byproducts like molasses and bagasse.
  - Flour industry like wheat bran.
5. **Feed additives:** like salts, vitamins and some medicines. Those feed additives although added in very small quantities; they are still needed in animal ration.

### \*Discussion



Women during lectures

## **Lecture 2: Animal feed resources-Kassala state**

Kassala state lies in the semi-desert area that supposed specific type of plants grown in. In addition to that the seasonality of Al Gash River, therefore very limited number of plant varieties is there. Animal feed resources in Kassala State include the following (sample of these are demonstrated in the session):

1. Pasture plants
2. Grown forages like abu70.
3. Agricultural byproducts
4. Flour byproducts
5. Dura
6. Others

### **\*Discussion**

### **Lecture 3: Preservation and conservation of animal feeds**

In Kassala state animals depend on pasture as their main and only feed source throughout the rainy season. But during the dry season where rains and pasture become poor, most livestock owners (cattle and camels) move to other places where pasture is still green. However, for small ruminants no movement and they are kept inside and feed bought and brought to them at home. Also some feeds kept from the rainy season are used. Mostly those feeds consist of sorghum byproducts and kept in peaks like pyramids surrounded by a thorny fence to keep animal out. Normally those feeds kept under direct sunlight without any kind of shelter.

During the dry season the main priority for local people is to keep the animal itself maintaining its body weight. That goal could be achieved through the provision of medium quality feed for that animal by:

1. feeding the animal on concentrate diets beside sorghum stover and abu70.
2. feeding the animal on previously preserved feed.
3. Roughages to be chopped before fed to animal to maximize feed utilization.
4. putting feed in feeders instead of the ground to decrease losses.

Some Technologies for feed preservation:

- Manual choppers.
- Under shelter drying.



Drying Abu-70 under shade



Drying abu-70 and lucerne under shade

## Lecture 4: How to make concentrate ration?

### What is the concentrate ration?

- The concentrate ration as the name indicated is a mixer of different feed ingredients those have been grounded and mixed uniformly to ends with complex of very high nutritional value that has to be diluted a bit before fed to animals.
- The concentrate ration has to be accompanied with some source of roughage to maximize digestion especially in sheep and goats.

Table 1. An example for concentrate ration containing traditional ingredients.

No.	Feed ingredient	Quantity/kg
1.	Dura	50
2.	Wheat bran	37
3.	Groundnut cake	10
4.	Salt	1
5.	Lime stone	2
	Total	100

**Training aid:** Balance.



Table 2. An example for concentrate ration containing *Prosopis Juliflora* pods\* supported the daily growth rate of 121.4 g of indigenous lambs.

No.	Feed ingredient	Quantity/kg
1.	Sorghum grain	25
2.	Groundnut cake	30
3.	Wheat bran	12
4.	<i>Prosopis spp.</i> Pods	30
5.	Lime stone	2
6.	salt	1
	Total	100

\* Mabrouk et al. (2012).

Table 3. An example for concentrate ration containing mesquite pods and mesquite-leaves silage fed to local sheep and goats supporting maintenance\*.

No.	Feed ingredient	Quantity/kg (ration 1)	Quantity/kg (ration 2)
1.	Sorghum grain	42	47
2.	Groundnut cake	15	13
3.	Wheat bran	20	12
4.	Mesquite ( <i>Prosopis spp.</i> ) Pods	10	10
5.	Mesquite leave-silage	10	15
6.	Lime stone	2	2
7.	salt	1	1
	Total	100	100

\*Abdelnoor, *et al.* (2009).

## **Practical 1: Components of Animal Feed**

Fair animal feed resources in Sudan contain the following aspects:

1. Oil seed cakes.
2. Cereals.
3. Flour industry by-products.
4. Sugar industry by-products.
5. Salts.
6. Green forages.

## **Practical 2: Weighing the Right Ration**

Spring balance and how it works. Weighing of 1 kg for:

1. Dura.
2. Wheat bran.
3. Normal salt or lime stone.



**Weighing ingredients using the spring balance**

### **Practical 3: Chopping Animal Feed Ingredients**

1. The use of manual chopper in chopping some selected forages of abu70 and barseem
2. The chopped samples should be divided into two parts:
  - Under shade samples (locally made shade)
  - Under direct sunlight samples

Those two parts should be watched carefully (greenish coloration) the day before going to the proposed farm visit.



**Using manual chopper to chop abu-70**



**The chopped grasses**

## **Practical 4: Demonstration of Concentrate Ration**

### **Concentrate ration preparation**

Method:

1. Determine ingredients (Dura, cake and so on)
2. Grinding
3. Weighing using the spring balance
4. Mixing feed ingredients
5. Determine how much to give to the specific animal (sheep and goats)



**Mixing feed ingredients**



**Filling in the concentrate mix to the sack**

# Animal feeding and fodder conservation training program for Training Participants

**Number of Days:** Four

<b>Day One</b>	
8:30-9:00	Opening session
9:00-10:00	Breakfast
10:00-11:30	1-Lect. Forage resources in the Sudan
11:30-12:00	Tea break
12:00-13:30	2-Lect. Forage resources in Kassala state
<b>Day Two</b>	
8:30-10:30 Practical 1	<ul style="list-style-type: none"> <li>• Demonstration of forage sources available in Kassala state and commonly used as animal feed.</li> </ul>
10:30-11:30	Breakfast
11:30-13:30 Practical 2	<ul style="list-style-type: none"> <li>• How to use the balance and the concept of weighing. Example: a kilo of Dura compared to kilo of salt compared to kilo of Barseem.</li> </ul>
13:30-14:00	Tea break
<b>Day Three</b>	
8:30-10:30	3- Lect. Animal feed conservation and preservation
10:30-11:30	Breakfast
11:30-13:30	4- Lect. How to make ration
13:30-14:00	Tea break

<b>Day Four</b>	
8:30-10:30 Practical 3	<ul style="list-style-type: none"> <li>• Using manual choppers to reduce the forage size for efficient use by the animal (Sorghum stover, Abu70 and Barseem).</li> <li>• Direct sun drying against shade drying and the color of green forage in both cases (Abu70 and Barseem).</li> </ul>
10:30-11:30	Breakfast
11:30-12:30 Practical 4	Concentrate ration preparation <ul style="list-style-type: none"> <li>• Grinding</li> <li>• Weighing</li> <li>• Mixing</li> </ul>
12:30-13:30	General discussion and Certificate Award
13:30-15:30	Visit to Kassala farm for broiler production and another visit to pasture and fodder administration farm in Garb El Gash to see forage baler.

## Glossary

Abu70: Local name for sorghum forage (*Sorghum vulgare*)

Barseem: Local name for lucerne (*Medicago sativa*)

Chopped grasses: Grasses that have been cut by a heavy sharp tool to small pieces.

Corn: *Zea mays*.

Dura: Local name for sorghum grains (*Sorghum bicolor*).

Eradicating: A heraldic term denoting a tree that has been uprooted.

Manual chopper: Chopping not using any kind of fuel except for manpower.

Mesquite or muskit: The local word for *Prosopis Juliflora*

Oil seed cakes: By-products of oil extraction from seeds, highly nutritious value.

Prosopis pod: The pods of *Prosopis spp.*



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