

NA-188E



# Fibrous Feeds and their Utilization



*A Farmers' Guide on Feeding Fibrous Feed to Buffaloes and Cattle*



NA 188



**SAREC/NARESA Buffalo Research and Development Programme, Peradeniya, Sri Lanka**

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**How do ruminants obtain their nutrients ?**

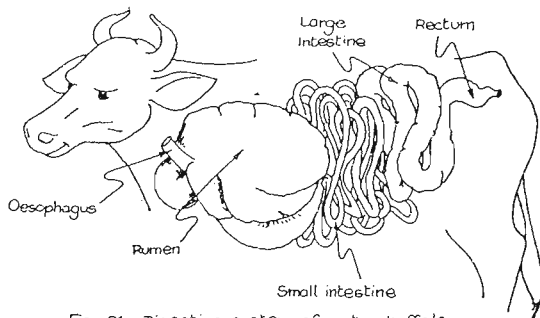


Fig: 01 - Digestive system of water buffalo and cattle.

Ruminant animals like buffaloes and cattle possess a complex stomach made up of the true stomach and three pre-stomach compartments (Fig. 1). The digestion of fibrous feeds begins in these sac-like compartments, through microbial fermentation. For this reason, ruminants are able to use fibrous feeds which are not digested by animals having simple stomachs such as the horse, pig and dog. They also use dietary proteins and non protein nitrogen eg. urea as a source of nitrogen to synthesise microbial proteins which would then be available to the animal. More details of the digestive process in ruminants are given in Leaflet No.2 of this series.

**Do buffaloes and cattle have a regular supply of good quality grass and fodder ?**

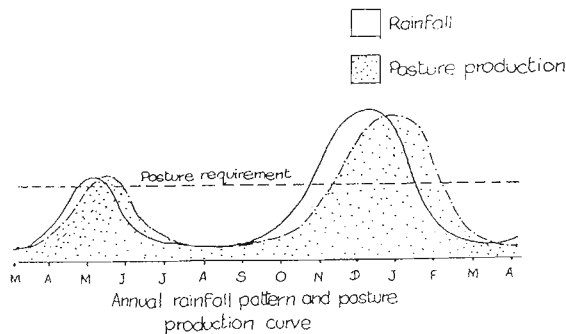


Fig: 02 - Schematic diagram showing pasture availability and its relationship to the North-East (Maha) and south-west (Yala) rainfall pattern.

The major sources of nutrients for ruminants as stated above are fibrous feeds such as natural grass and fodder. But the availability of green grass and fodder is seasonal being dependent on the rainfall pattern as shown in Fig. 2. This is true for most of the regions of the country, except to a lesser degree in the hill country, wet

zone. As shown in the diagram, the availability of green forage is very low during the dry months of the year, usually from June to October and again from January to April. Even when available, the nutritive quality is very low during such periods.

During the dry periods, forage consumed is insufficient and poor in quality and therefore does not meet the nutrient requirements of the animal to produce milk or maintain the expected growth rate. Generally, to overcome the shortfall, supplementation of the feed with concentrates such as rice bran and coconut poonac becomes necessary. However, the high cost of these inputs discourage the small producer from feeding concentrates to his animals.

**What other sources of fibrous feeds can be used to overcome these shortages?**

There are generally other resources of fibrous material available around your homesteads which could be easily used as feed for buffaloes and cattle. These materials can be classified as (1) agricultural crop residues and (2) agro-industrial by products.

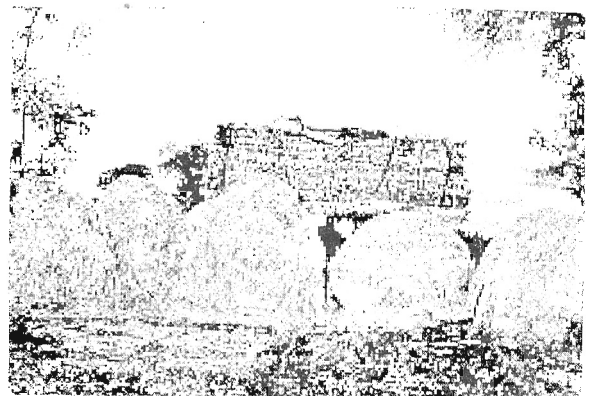


Plate 1. Stacks of rice straw

**Crop residues**

- cereal straws from rice, millet and kurakkan
- stover from crops like maize and sorghum
- straw from legume crops like green gram, cowpea, ground-nut and soya bean

- other crop residues like sugar cane tops, sweet potato vines and manioc leaves

In general, you may not have considered feeding these fibrous feeds because they may not be eaten readily by the animals. This is due to low palatability and low digestibility. The low digestibility of these fibrous material is due to the high fibre content (more than 18%), low essential nutrient content as soluble sugars and proteins, minerals and vitamins and in some instances due to the presence of "anti-nutritive" factors.



Plate 2: Sugar cane bagasse

### Agro- industrial by products

- sugar cane bagasse
- fruit and canary waste
- waste tea leaves
- poultry litter

Although some of these materials may be available in abundance, they are very rarely used as cattle and buffalo feed due to various reasons.

*What are the problems associated with fibrous feed ?*

The nutritive values of these feeds and the limitations in their use for ruminants are given in the table below.

Fibrous feed	DM%	CP%	EE%	C. fibre%	Dig. %	Limitations
Rice straw	93	5	1 - 2	36	30	Low CP, Oxalic acid
Pulse straw	89	15	2-3	36	57	High lignin
Cereal straws	85-92	5-9	2-4	36-48	47-62	Low CP, Coarseness
Banana pseudostems	12-18	5-8	1-2	25	63	High water, tannin
Manioc leaves	27	15-20	5-8	15-20	57-62	High HCN content
Sweet potato vines	20	10-14	3-5	35-38	48-58	
Sugarcane tops	35-40	4-8	2-3	30-38	38-48	High silica and low palatable
Bagasse	88-92	2-4	1-2	45-49	25-34	High lignin; low digestibility, low CP
Spent tea leaves	87	14-17	4-6	22-26	-	High tannin
Poultry litter	90	20-24	1-2	20-40	25-32	High silica, dusty
Palm press fibre	90-94	3-5	1-2	40-46	27-32	High lignin; low CP; low digestibility
Canary waste	10-18	5-8	1-3	18-24	54-62	High perishability, low storage quality

DM - dry matter; CP - crude protein, EE - ether extract (fat), C.fib.- crude fibre, Dig.% - digestibility.

**How can you overcome these limitations and use these fibrous feeds ?**

A number of simple methods are available to increase the palatability and the digestibility of fibrous feeds. These are :

■ **Physical Treatment**



Fig: 03 - Chopping coarse fibrous feed

This is done by chopping, grinding, soaking in water, etc. Only the physical nature of the feed is altered but, not its chemical composition, eg. particle size, length, moisture content.

■ **Chemical Treatment**



Fig: 04 - Treating coarse fibrous feed with chemicals.

One chemical or a combination of them are used in different ways. In this method, chemical reactions, bring about structural changes in the fibrous material. The commonly used substances are caustic soda, caustic potash, urea and wood ash.

■ **Supplementation**



Fig: 05 : Feed supplementation

In this method, deficient nutrients in the fibrous feed are supplied through one or more of the following. Coconut poonac, rice bran, mineral mixtures, urea and tree fodder are generally used. Supplementation with cheap and readily available resources is the most convenient and efficient method which can be practised by farmers.

**Practical guidelines for the use of rice straw and stover as ruminant feeds**

**Collection and storage of rice straw:** Rice straw is seasonally available and in certain areas it is produced twice a year. Straw must be collected as soon as possible after threshing. After collection, the fresh straw must be properly dried before storage, to preserve its keeping quality. Straw must be stored in a manner that will keep it dry. Wet straw allows mould to develop and soon becomes unsuitable for livestock feeding. Mouldy straw is unacceptable to ruminants and if consumed, may cause certain metabolic disorders or toxicity due to the presence of mycotoxins.

Well dried and properly stored straw can be kept for nearly 2 years without deterioration of the nutritive value and acceptance by the animal. Well dried straw can be made into bales or stacked loosely in a hay barn or similar structure. Straw must also be stored in a manner that will allow adequate cross ventilation, or heaped on a rock or on a raised wooden platform in the form of a "Goyam Kolaya". When stored in the open, precautions must be taken to prevent termite damage by stacking on an elevated base and protected from rain .

## **Methods of treatment of straws and stover:**

### **Physical Treatment**

Rice and other cereal straws have to be chopped into 8-10 cm. lengths before treatment. But maize stover which is thicker and harder, need to be chopped to a length of 4-6 cm. Chopping alone will not improve the intake since they are coarse in nature. Therefore, improvement in the texture is also an important factor to be considered. This can be easily done by soaking the chopped material in water for 6-8 hours before feeding. This will not only improve the palatability but also remove certain detrimental but water soluble compounds from the feed (e.g. oxalic acid in rice straw).

One disadvantage is that, along with the detrimental substances some of the water soluble nutrients are also lost (sugars and proteins). Weigh the daily requirement of chopped fibrous feed and spread on a clean cemented floor or on a plastic sheet. Sprinkle water on the feed, using a watering can or a large tin with a perforated base. The amount of water to be used is 1 bottle (750 cc) for every Kg of fibrous feed. While sprinkling the water, turn the fibrous feed many times to ensure proper wetting of the material. After wetting, cover with a polythene sheet and allow sufficient time for absorption of water. This takes about 6-8 hours depending on the type of material. A convenient way is to prepare the feed for the next morning on the previous evening and evening ration in the morning of same day. This method of treatment will improve the intake of straw and stover by 30-40 %.

### **Chemical Treatment**

This can be done with caustic soda (NaOH), caustic potash (KOH), burnt lime (CaO) or urea [ $(\text{NH}_2)_2\text{CO}$ ]. Of these chemicals, the cheapest, least hazardous and most convenient is urea. Treatment with urea was very popular sometime ago in Sri Lanka. Even today in many countries, this method is widely used to improve fibrous feeds. The chemical recommended for use in this method is fertilizer grade urea.

Chopped straw or stover (straw may be used without chopping) is spread on a cemented floor on a polythene sheet. Sprinkle 4% urea solution using a watering can or a tin with a perforated base. The 4% urea solution is made by dissolving 40g of urea in 1 litre of water. For treatment the ratio of straw : water should be 1:1. After treatment, the treated straw must be well covered with a polythene sheet to prevent the escape of ammonia gas, which is formed from urea. Another convenient method for preventing ammonia loss is to pack the treated straw into polysack bags and tying the open ends and then covering with a polythene sheet. The treated straw is ready for feeding after 7 days of storage. Therefore, to meet the daily requirement for feeding, the treatment of straw once started, must be done daily for use beyond the 7th day.

After 7 days of storage, open the polythene cover to expose the treated straw and allow exposure for 0.5 - 1 hr to facilitate the liberation of excess free ammonia. Urea treated straw must be introduced to animals gradually by increasing the amount fed at the rate 10% per day. This will allow time for the animal to adapt to the new feed over a period of 7 to 10 days.

### **Important points to remember :**

- ▶ Collect and properly store an adequate quantity of straw for drought feeding.
- ▶ Treat straw daily to meet the requirement for one day.
- ▶ Do not feed refusals on the next day.
- ▶ Do not exceed the concentration of urea solution more than 4%.
- ▶ Do not feed treated straw as soon as the polythene covering is opened. Animals may refuse to eat.
- ▶ Continue feeding of treated straw until grass becomes available again.
- ▶ The amount should be at least 10% of the total straw intake (100g per kg of dry straw). For cows producing over 2-3 lit/d, a concentrate feed must be given at the rate of 1kg for every 2 litres of milk produced. But concentrates are expensive and therefore to reduce the cost of feeding concentrates, urea treated straw must be given with fresh grass

which is rich in soluble carbohydrates, whenever possible.

### ■ Supplementation

This method will help to provide nutrients deficient in rice straw and stover. Supplementation will improve the quality of the ration in the following manner.

- a. By optimizing rumen conditions by providing deficient nutrients such as minerals to improve digestibility (**catalytic effect**)
- b. By providing deficient nutrients to balance the feed (**supplementary effect**)

Supplementation does not change the structure of the fibrous feed, but facilitates its utilization. Supplementation is an easy method for the farmer than chemical treatment. Moreover, the feed can be offered to the animal on the same day. Type of supplement to be fed, depends on the nutrients that are deficient in the basal feed.

Type of supplements:

1. Urea to provide rumen ammonia nitrogen
2. Urea- molasses- mineral (UMM) multinutrient mixture to supplement rumen ammonia nitrogen, soluble sugars and minerals
3. Concentrates to supplement proteins, carbohydrates and minerals
4. Tree fodder to supplement proteins and soluble sugars

#### 1. Use of urea as a feed supplement

Besides the use of urea for chemical treatment of fibrous feed, it could also be used with fibrous feed as a feed supplement. This could be done by sprinkling urea on fibrous feed or mixing in the concentrate feed mixture.

Urea supplementation is equally effective as urea treatment with fibrous feed, but the level of urea must not exceed more than 1.0 - 1.5% on dry matter basis.

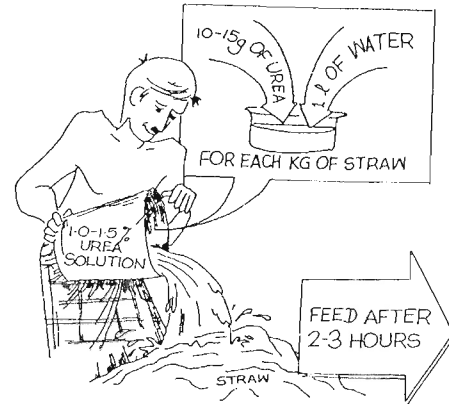
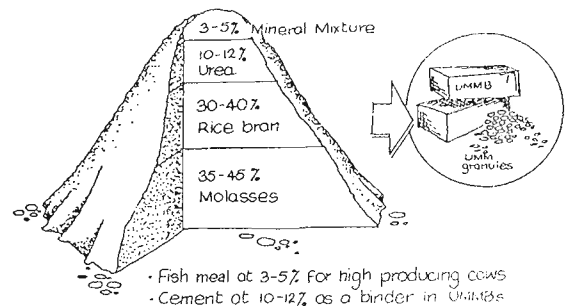


Fig: 06 - Sprinkling urea over coarse fibrous feed to use as a feed supplement.

For each kg of straw, sprinkle 1 litre of urea solution prepared by dissolving 10 - 15 g of urea in 1 litre of water. Urea sprinkled straw could be fed after 2-3 hours of sprinkling. One must make sure, as in feeding of urea treated straw, that a source of readily available carbohydrate must be given and also that introduction of urea supplemented straw must be done gradually.

It is very important to remember that urea if given in excess could lead to toxicity. In the event that excess urea is fed, the animal will exhibit symptoms of ammonia toxicity such as purple or blue coloration of the mucous membranes of the mouth, muzzle and eyes. In such a situation, administer 1-1.5 litres of vinegar orally and call a veterinary surgeon.

#### 2. Use of Urea-Molasses-Mineral Multinutrient Mixture as a feed supplement



Composition of UMM Feed Formula  
Fig - 07

It is one of the most convenient and cheapest ways of supplementation of low quality fibrous feed such as rice straw. The UMM mixture provides complete supplementation of nitrogen, energy and minerals. This is widely used in many countries and is currently becoming popular in Sri Lanka. (See Leaflet 2 of these series).

### 3. Use of concentrate feeds as feed supplements



Fig: 05 - Feeding of concentrate as a supplementary feed

This is the most common and traditional method of supplementation. Presently this is becoming uneconomical due to the high price of concentrates in relation to the low price received by the farmers for their milk. Concentrates are formulated by the feed manufacturers and are readily available in the market. Generally, farmers prepare these feeds on-farm using common ingredients such as coconut poonac and rice bran. Either way, it is the most expensive feed available for milk production. However, in the event that the basal forage feed is inadequate, as a general rule 1 kg concentrate can be given for maintenance and an additional 1kg for every 2 lit. of milk produced.

### 4. Use of tree fodder as feed supplements :



Fig: 09 - Use of tree fodder as feed supplements.

Feeding of tree fodder is another economical and sustainable system of supplementation. Farmers do not have to spend money to obtain this valuable supplement. This is either naturally available or can be easily cultivated in their homesteads or fence lines. These fodder trees can be either legumes or non-legumes. The common tree fodder that can be used as valuable supplements are Gliricidia (Vetahira), erythrina (Erabadu), leucaena (Ipil ipil), Calliandra, drum sticks (Murunga), wild sunflower (Thiththa Sooriya), Mulberry, Maila, Gansooriya, raintree (Wehimara), Jak (Kos), Kapok, shoe flower (Wada), neem (Kohomba). The use of tree fodder as the sole feed must be limited because of the presence of anti-nutritive factors in some varieties of tree fodders. If properly used, they can contribute tremendously to the nutrition of the animal. (For more details on the use of tree fodder, see Leaflet No. 8).

Generally, tree fodder can form about 30-40% of the forage consumed. Animals with moderate milk production potential can produce a yield of 2-3 liters per day by feeding grass and tree fodder, without resorting concentrate feeding.

### Comparison of the cost of using urea in different ways in ruminant feeding

#### (A) Cost of feeding a cow with urea treated straw

Cost of straw	=	assumed to be cost free
Cost of urea per day	=	Rs. 15.00/kg.
Cost of polythene (day at 20% of the cost being reusable)	=	<b>Rs. 1.26</b>
Requirement of urea for 1 ton of straw	=	40 kg
Cost of urea to treat 1 ton of straw	=	Rs. 15.00 x 40 = 600.00
Daily rice straw requirement of a cow	=	3.5% of body weight

A 300 kg cow consumes  
3.5 x 3 Kg per day = 10.5kg straw/d

No. of days to consumes  
1 ton of straw = 1000/10.5  
= 95 days

Feeding cost / day = **Rs. 600.00/95**  
**Rs. 6.30**

Total cost per day = **Rs. 6.30+1.26**  
**Rs. 7.56**

(B) Cost of feeding a cow with urea sprinkled straw

The cost of feeding 10.5 kg of urea sprinkled straw per day will be to Rs. 6.30, as the cost of polythene can be deducted from the above.

(C) Cost of feeding a cow with urea-molasses-mineral mixture and rice straw

For a lactating cow consuming the following feed, give the amounts of UMMM shown alongside

(a) good quality forage = 0.5 kg / d

(b) medium quality forage and straw = 0.8 kg / d

(c) Poor quality forage and straw or mature grass = 1 kg / d  
Cost of a UMMM = **Rs. 8.00/Kg**

Cost of UMM per day for each of the above feeding systems:

(a) 0.5 x 8 = Rs. 4.00

(b) 0.8 x 8 = Rs. 6.40

(b) 0.8 x 8 = Rs. 6.40

**Note:**

Feed supplement would be sufficient to meet the nutritional requirements of a cow giving less than 5 litres of milk per day. In the case of cows that produce more than 5 litre per day, UMM feed supplement could replace 30 - 40% of the quantity of concentrates, given on the basis of production level.