

# **Feed Processing Techniques & Treatments for Improving the Nutritive Value of Roughages**

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# Introduction

## Crop Residues (Non-maintenance)

**Categories :** **Category-I :** High fibre, Low nitrogen  
e.g.. Straw, stovers

**Category-II:** High fibre, High nitrogen  
e.g. Tree leaves, Shrubs

**Cost :** Sheep, goat 65% total production & Cattle / buffaloes 70%  
Poorly utilization: ligno-cellulose complex (Gupta and Puri., 2001)

## Objectives of Processing

1. Palatability & Particle size
2. Detoxification
3. Keeping quality & Improves feed value
4. Economical production
5. Uniform mixing
6. Free from bacteria, fungi
7. Balanced nutrient intake, reduced feed wastage

# Processing Techniques & Treatments

## A. Physical

## B. Chemical

## C. Physico- Chemical

## D. Biological

### Wet

- Soaking
- Boiling
- Chopping
- Bhusa making
- Washing
- Ensilage

### Dry

- Grinding
- Pelleting
- Irradiation
- Hay making
- Baling
- Densification

### Alkali

- NH<sub>3</sub>
- Urine
- Acids
- Salt
- Oxidizing agent

### NaOH /Pelleting

- Lime /Pelleting
- Urea/Pelleting
- NaOH/Temperature

### Enzymes

- Root fungi
- Mushroom

# A. Physical Treatments

## a. WET Treatments

### 1. Soaking: feed soaked for 12-24 hrs in water

#### Advantages

- Improves nutritive value
- Improves Dry Matter Intake (DMI)
- Improves animal performance  
eg. Paddy straw

#### Disadvantages

- fungal growth
- spoilage of feed

## 2. Chopping

Fodder is cut into 1-4 cm long pieces

Two types:- Hand operated  
Power operated

Advantages

- Increases voluntary intake
- Decreases selective feeding
- Less storage area is required

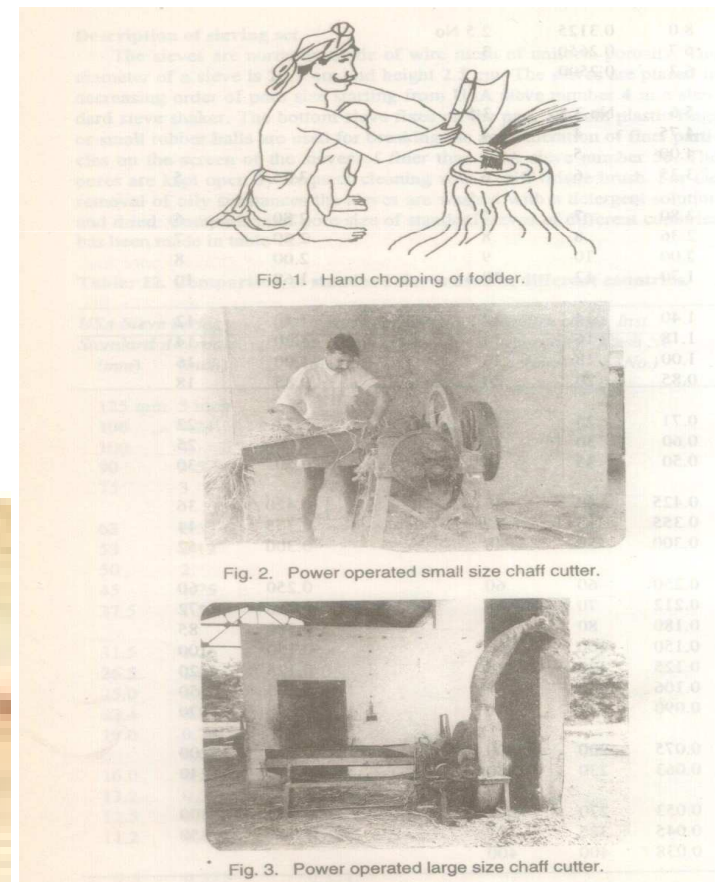


Fig. 1. Hand chopping of fodder.

Fig. 2. Power operated small size chaff cutter.

Fig. 3. Power operated large size chaff cutter.

## 3. Steaming method

Steam is passed through the feed under high pressure.

### Advantages

1. Breaks chemical bond between lignin, cellulose and hemicellulose hence better utilization of fibrous carbohydrates.
2. Softening and expansion of fodder and results in increased voluntary intake

### Disadvantages

Expensive as steam production equipments are needed

## 4. Water washing

Detoxify the ANF

## 5. Ensilage

Green fodder- conserved

Good quality silage – should contain 35-40% moisture

- less than 15% CP

- Fermentable carbohydrates

## a. Dry Methods

### 1. Hay making





## 2. Grinding



## Advantages of grinding:

- Helps uniform mixing
- Avoids selective feeding
- Improves palatability
- Increases surface area for enzyme activity
- Improves feed utilization

## Disadvantages:

- Dustiness
- Nutrient loss due to heat generation while grinding.

### 3. Pelleting:

- Agglomerated feeds
- Purpose - dusty & unpalatable feeds are converted into more palatable

#### Advantages:

- 1) avoids selective feeding.
- 2) Better digestion due to more surface area
- 3) Easy handling, less storage area.

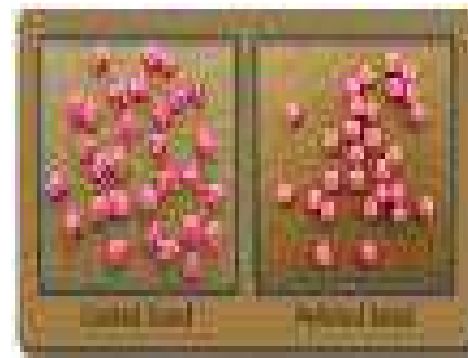
#### Disadvantages:

- 1) Needs infrastructure- more costly.





**Pellets**



## 4. Baling

### Advantages:

Easy handling

Less storage space.



Forage



cut



dried



field bales.



## 5. Irradiation

- X-ray, Gamma ray

- Fibrous carbohydrates



Oligosaccharides



## 6. Bhusa making

Dry roughages



Bullocks continuously  
rotated on dry roughages.

## Advantages of Physical Treatments

1. Avoids wastage
2. Easy handling
3. Proper mixing
4. Selective feeding
5. Improved digestion - Microbial digestion

## B. Chemical Treatments

### 1. Alkali

-NaOH

Two types

- Wet method -1.2-1.5% NaOH

- Dry method - NaOH sprayed

- KOH

-Ca(OH)<sub>2</sub>

### 2. NH<sub>3</sub>

**Anhydrous:** 3-4% NH<sub>3</sub> ----- N<sub>2</sub> for rumen microbes

Disadvantages: 4-methyl-imidasol.

**Crazy cow /Angry cow /Bonker cow**

**Aqueous NH<sub>3</sub> :** 20-35% NH<sub>3</sub> for straw treatment.



### 3. Acid Treatment :

- $\text{HNO}_3$ ,  $\text{H}_2\text{SO}_4$
- Partial solubilization - Cellulose
- hemicellulose

### 4. Oxidizing agents :

- $\text{H}_2\text{O}_2$ , sodium thiosulfate ,sodium sulfite.
- Highly effective on nutritional improvement

### 5. Urine treatment :

Urine-----Urea----- $\text{NH}_3$ -----Degradability

### 6. Salts :

$\text{NaCl}$

$\text{Na}_2\text{CO}_3$

## **Advantages of Chemical Treatment**

1. More palatable
2. Prevent mould, fungal attack
3. Improves Dry Matter Intake
4. Improves livestock productivity
5. Improves nutrient utilization

## **Disadvantages of Chemical Treatment:**

1. Additional work
2. Cost
3. Technology not suitable in Indian context
4. Skill full human resources required

## C. Physico - Chemical Treatments

- Combination
- Synergistic effect

eg. Pelleting / NaOH  
Lime / Pelleting  
Urea / Pelleting  
NaOH / Temperature

## D. Biological methods

### 1. Enzymes

- Cellulase - from rot fungi
- Capable of depolymerising lignin
- @ 25 mg/100 kg of straw

### 2. Beneficial Fungi

- White root fungi
- *Ganoderma applanatum*
- *Cariolus versicolour*
- *Sporotricum sp.*
- Degrades lignin of ligno-cellulosic straw upto 65 – 75%

### 3. Mould

- *Aspergillus terreus* GN-1

## **Advantages of biological treatments**

1. Simplification of compounds
2. Release of enzymes
3. Fast growth rate of microbes

## **Disadvantages of biological treatments**

Cost

Technology

Extra work

Skill full human resources

# Conclusion

1. DMI Increases
2. Improves palatability
3. Digestibility of CP higher
4. TDN increases (Reddy.,1995)
5. Increases FCR
6. Growth rate
7. DM & CP degradability higher @ 4% urea treatment  
(Choudhary *et al.*, 2003)
8. Wheat straw, Paddy straw - EE digestibility increases -  
Nutrient digestibility increases - growth rate increases  
in buffalo calves (Praveenkumar *et al.*, 2004)

THANK YOU

