

**BIHAR ANIMAL SCIENCES UNIVERSITY**

**Bihar Veterinary College, Patna**

**Department of Animal Nutrition**

**UG Lecture (UNIT-I)**

**Methods of Feed Processing for Improving Nutritive Values  
of Inferior Quality Roughages**

**Dr. Kaushalendra Kumar**

**Assistant Professor, Bihar Veterinary College, BASU, Patna**

**e-mail: [drkaushalbvc@gmail.com](mailto:drkaushalbvc@gmail.com)**

## **Purpose of processing of poor quality roughages ?**

- **Increase voluntary feed intake**
- **Increase palatability**
- **Reduce lignin and silica for increasing microbial action**
- **Improve digestibility**
- **Increase energy availability**
- **Improve enzymatic and microbial digestion**
- **Reduce bulkiness**

# **Dry roughage processing methods**

## **Physical methods of processing**

- **Chaffing**
- **Threshing**
- **Grinding**
- **Water treatment**
- **Steam treatment**
- **Densification**
- **Irradiation**

## **Chemical methods of processing**

- **Acid treatment**
- **Alkali treatment**
- **Ammoniation**

## **Biological methods of processing**

- **White rot fungi treatment**
- **Enzymes**
- **Mushroom**

# Physical methods

## Chaffing

- Cut into 1 to 4 cm long pieces
- Improves feed intake
- Avoids wastage

## Threshing

- Long straw into fine size
- Softer than long straw
- Improves feed intake

## Grinding

- Grind in hammer mill
- allow uniform mixing

## Irradiation

- Application of X-ray & gamma rays breaks the ligno-cellulose bond
- Improves digestibility
- No practical utility due to high cost and health hazard

## Water soaking

- Deeping of dry roughage in the water for 3-4 hours
- Dry fodder gets saturated with absorbed water which causes softening
- Water soluble harmful compound `Oxalate` is removed
- Better calcium utilization
- Increases voluntary feed intake

“Saani method of traditional feeding system”

## Densification

- Dry roughage can be pressed in a compact feeds
- Reduces the space required for storage

## Baling

- Compressed product of loose straw by a baling machine
- Volume may be reduced to one third

## Pelleting

- Chopping followed by grinding & steaming to pass through a dia

## CCFB making

- Forage block and complete feed block

# Complete feed block making machine

Cont....

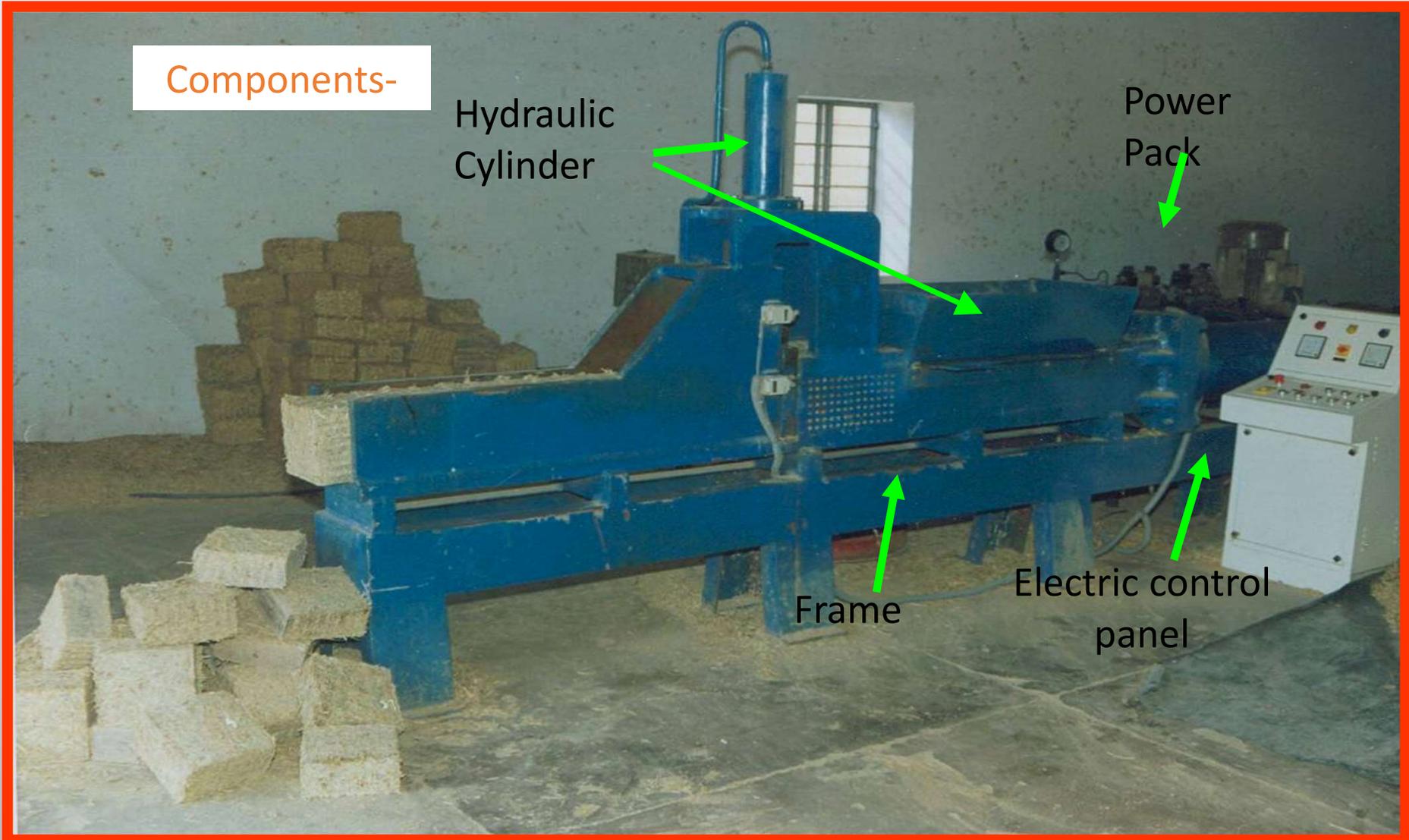
## Components-

Hydraulic  
Cylinder

Power  
Pack

Frame

Electric control  
panel



## **Advantages of complete feed blocks**

- **NCFR feeds can be used to make ration economic**
- **Less storage space (one third)**
- **Easy transportation**
- **Reduces transportation cost**
- **Increase palatability**
- **Minimal fermentation losses**
- **Reduces the wastage of feed material**
- **Saves labour on feeding**
- **Reduce nutrient losses**

# Chemical treatment of dry roughages

## Alkali treatment

- Alkali breaks ligno-cellulose bond (ester linkage) of straw

### 1. Sodium Hydroxide treatment

- 4 kg of sodium hydroxide dissolved in 200 liters of water is sprinkled on 100 kg of straw
- Treated straw is left for 3-4 hours for reaction before feeding

(Sodium hydroxide is costly and corrosive in nature)

### 2. Calcium hydroxide treatment

- 4 kg of calcium hydroxide dissolved in 100 liters of water is sprinkled on 100 kg of straw

(High cost and Low solubility in water)

## Ammonia treatment

- Alkali breaks ligno-cellulose bond (ester linkage) of straw
- Improves digestibility of straw
- Improves nitrogen content of straw

### 1. Anhydrous ammonia

- 100 kg of straw wrapped with polythene cover injected with 3 litre of anhydrous ammonia

### Drawbacks

- Very costly
- Not freely available
- Transportation of gaseous ammonia is difficult
- Need much care and skilled person

## 2. Ammoniation through urea

**Urea** → **Ammonia + Carbon dioxide**

**4 kg urea dissolved in**

**40 kg water**

**Spray uniformly over 100 kg straw or bhusha**

**Preserve the treated material under air tight  
condition using plastic sheets**

**For 3 weeks in hot season**

**4-5 weeks in cold season.**

## **Benefits of Urea-Ammoniation**

- **Increases the protein content**
- **Improves the palatability of straw**
- **Improves the digestibility of straw**
- **Better rumen degradability**
- **Less expensive**

# Urea-Molasses-Mineral Block

<b>Molasses</b>	<b>= 45%</b>
<b>Urea</b>	<b>= 15%</b>
<b>Mineral mixture</b>	<b>= 15%</b>
<b>Salt</b>	<b>= 8%</b>
<b>Calcite powder</b>	<b>= 4%</b>
<b>Bentonite</b>	<b>= 3%</b>
<b>Cotton seed meal</b>	<b>= 10%</b>

## Specifications

<b>Urea (%), Max:</b>	<b>15.0</b>
<b>Crude Protein (%), Min:</b>	<b>58.0</b>
<b>Phosphorus (%), Min:</b>	<b>1.5</b>



## **Precaution during urea feeding**

- **Never feed to young animals below 6 months of age.**
- **Never cross the limit of 116 gm of urea for adult cattle and 10 gm for sheep.**
- **Provide sufficient drinking water**
- **Uniform mixing of urea is essential to avoid urea toxicity.**
- **Avoid dietary inclusion of urea suddenly.**
- **Provide sufficient amount of soluble carbohydrate for efficient utilization of urea**

# Urea Toxicity

- Urea degrades to ammonia
- Ammonia utilized by rumen microbes to synthesize microbial protein.
- Microbial protein digested in small intestine to provide protein for animal use.
- Optimum ammonia concentration: 5-8 mg per 100 ml rumen liquor
- Above this level blood ammonia level rises
- 1mg ammonia/100ml blood- toxic
- 3 mg ammonia/100ml blood- lethal

## Common reasons

- Improper dose rate of urea
- Improper mixing of urea in feed
- Accidental use by animal at farmers door

## Symptoms

- Bloat
- Excessive salivation
- Respiratory difficulty
- Bellowing
- Convulsion

## Treatment

- Drenching of 20-40 litre cold water (inhibit ureolytic activity)
- Drenching of 4-5 litre of 10% acetic acid (binds ammonia).

## Biological method of processing

- The idea of using biologically-treated straws as animal feed originated from mycologists engaged in producing edible mushrooms using straw as the substrate for growing soft-rot and white-rot lignolytic fungi for human consumption.
- Aerobic lignolytic fungi, which belong to the following **three major groups**, play a major role in lignin degradation:
  - i) **Brown-rot fungi preferentially attack cellulose and hemicellulose, leaving behind a brown residue,**
  - ii) **Soft-rot fungi e.g. Chaetomium cellulolyticum leaves the attacked lignocellulosic material watery-soft and breaks down cellulose and hemicellulose**
  - iii) **White-rot fungi e.g. Phanerochaete chrysosporium, which is capable of degrading lignin without much affecting cellulose and hemicellulose**

## Solid-state fermentation of straw using lignolytic fungi

- In the mid-eighties, an Indo-Dutch project entitled, “Bio-conversion of Crop Residues”, was launched in India, involving a few animal nutrition research centres, e.g. NDRI, Karnal, Southern Regional Station of NDRI, Bangalore, Bharatiya Agro Industries Foundation (BAIF), Pune and Pantnagar Agriculture University, Uttarakhand.
- At NDRI Karnal, Dr Flegel, a mycologist under the project, supplied a non-toxic alkalophilic-cum-lignolytic fungi, *Coprinus fimetarius*, which could grow in the alkaline conditions of urea/ammonia treated straw.
- Use of the urea-treated straw as a substrate for the growth of this lignolytic fungi provided the dual benefit of keeping contaminants at bay through higher pH and at the same time providing nitrogen for mycelial growth.

## Karnal process

- It is essentially a biological treatment of lignocellulosic material in a *solid state fermentation*.
- In the first stage, the wheat or paddy straw is treated with 4 % urea, keeping moisture level at 40% and then ensiled for 30 days.
- In the second stage, 10 kg treated straw is mixed thoroughly with 60 g single superphosphate and 6g calcium oxide dissolved with 8 lt of water.

- The inoculum of *Coprinus fimentarius* culture grown on millet seeds is evenly cast on the mineralized and moisturized (to about 65% moisture) treated straw.
- This process is repeated again and again till the required material is treated.
- Substantial increase was noted in the amino acids content of the treated straw and also indicated that the ammonia captured by *Coprinus fimentarius* was mainly utilized for synthesis of amino acids losses.

**Discussions.....**

**Questions, if any.....??**

**THANKS**