

## DW01: Animal feed characterization

### Generalities

#### 1. Bromatology : Bromatos= food , Logos=study

The discipline dedicated to food analysis is bromatology, a specialty focused on the study of ingested nutrients. Bromatology studies the chemical composition, nutrients, physical properties, and toxicology of foods.

Animal nutrition describes the nutritional needs of farm animals and the means and methods to satisfy them.

#### 2. Food

All substances ingested by an animal with a view to contributing to the coverage of its nutritional needs:

- \* Maintenance needs: which allow the renewal of living matter
- \* Production needs: which allow the growth of the animal and the production of meat, milk, etc.

The nutritional needs of ruminants are covered by two categories of products belonging to:

- ➔ To coarse foods (fodder)
- ➔ To concentrates (cereals)

#### 3. Classification

##### 3.1. According to nutritional intake:

*Energy foods*: products rich in carbohydrates and lipids (cereals, green fodder)

*Nitrogenous foods*: Protein-rich foods (cakes, animal products, protein and non-protein nitrogenous materials: urea, ammonia).

*Mineral and vitamin foods*: Natural or synthetic products containing large amounts of minerals and vitamins.

##### 3.2. According to their uses in breeding

At different physiological stages and periods of the animals' lives, we distinguish between foods:

- ➔ breastfeeding
- ➔ weaning
- ➔ of growth
- ➔ fattening

##### 3.3. Depending on the congestion in the digestive tract

Based on the MS (dry matter) content of foods and the volume they occupy in the digestive tract, we distinguish:

- *Coarse foods*

Foods rich in fiber and whose MS content determines their quantity= fodder

- *Concentrated foods*

Food rich in MS and provide many nutrients, the basis of nutrition for monogastrics and the basis of supplementation for ruminants.

## Part 01 : The fodder

- We distinguish according to the dry matter (DM) content and the preservation method:
  - Green fodder: 12 to 30% dry matter
  - Silage: 15 to 40% dry matter
  - Hay: 84 to 30% dry matter
- *These fodders constitute the bulk of the basic ration of ruminants. They vary according to the season and the region;*
- The fodders are plants or mixture of plants cultivated mainly for their vegetative parts (leaves, stems, roots), intended for feeding ruminants.
- There are several types of fodder:
  - dry fodder
  - green fodder
  - silage
- A 4th category of foods can be assimilated to fodder: roots and tubers and their derivatives

### Morphological composition

Made up of herbaceous plants mostly grasses secondarily legumes  
*cultivated in the form of permanent or temporary meadows*

#### 1. Dry fodder

- *Fodders*: are dried green fodder (vetch, oats, etc.)
- *Straws*: are agricultural by-products (wheat, etc.)
- **The fodder** Are foods rich in fiber. Their MS content determines their quality
- High fiber feeds are:
  - ✓ less appetizing
  - ✓ less rich in protein
  - ✓ less digestible
- Hay, due to its richness in fiber, allows for better rumination;
- It also helps to secure fodder stocks.
- **Straws are** By-products of cereal crops can also be used as fodder in times of drought which reduce fodder availability
- High fiber forages reduce DM (dry matter) consumption;
- Food is not expelled from the rumen until its digestion is complete;
- A cow can consume 3% of its weight in DM equivalent from excellent hay, but only 1.5% from poor quality hay;
- The nutritional value of roughage depends on:
  - plant species
  - of their stage of maturity
  - harvesting systems

- of the storage system
- Early harvested hay (less than 10% flower) stored properly provides high quality roughage;

## **2. Green fodder**

- **Are the grasses and legumes:**
  - ✓ sorghum
  - ✓ rye
  - ✓ clover
  - ✓ Alfalfa
- Their true quality depending on:
  - The age of the plant
  - Climatic factors

### **Pasture grass**

- element of high nutritional value;
- can meet all the production needs of animals;
- consumed at will, it alone allows a daily production of 20 to 22 kg of milk
- Green fodder represents 15 to 35% of total nitrogenous matter;
- Their energy value decreases with the aging of the plant;
- The mineral composition varies depending on the stage of vegetation.

### **Conservation of fodder**

- To meet the needs of animals in all seasons, it is essential to preserve fodder
- 3 methods are mainly used:
  - ① *Drying* natural product used to produce hay
  - ② *Dehydration* which leads to dehydrated fodder, packaged in plugs or granules
  - ③ *Silage*, wet preservation method is based on acid fermentation
- Forages provide maximum nutritional value to the animal feed table.
- The goal is that the values in the table should be as close as possible to those in the field.

### **Dry storage**

- The aim is to ensure a regular stock of food during periods of low availability.
- The principle is based on field drying and storage in bales.
- To preserve this fodder, which will generally come from surplus spring grass, the farmer will have to choose between haying and silage. The choice will depend the type of stabling, harvesting and storage methods (equipment, buildings, etc.).
- There are different types of preserved fodder
- ✚ **Dehydrated fodder**, alfalfa is the most frequently used;
  - dried properly, its dehydration results in very little or no change in the chemical composition
  - low loss in UF, MAT and PDI
  - Dehydrated fodder has fairly high carotene contents of 100 to 200 mg/kg

- Dehydrated alfalfa is characterized by a high nitrogen value

#### **The hay**, hay made from:

- of natural meadows
  - of sown crops
  - of crop residues (cereals)
- Hay is a dry fodder that removes its water content by drying in the field (3 days)
  - In order to preserve the hay while optimizing storage space, it is put into bales.
    - \* The nutritional value and ingestibility (suitability to be consumed by an animal) of preserved fodder are determined by those of the green fodder at the time of mowing.
    - \* Forage harvested at the leafy stage has a better nutritional value than at the earing stage;
    - \* The species and physiological stage will determine the cutting date for silage or hay.
    - \* the nutritional value of fodder varies with the method of exploitation: Depending on the stage at harvest, the dry matter content as well as the Total Nitrogenous Matter (TNM) content change
  - \* Quality declines rapidly with advancing maturity. The protein content of forages decreases by 0.5% per day of delay;
  - \* Harvesting at the earing or flowering stage allows a higher yield level to be achieved;
  - \* The optimal harvest date (earring start) ensures quality and yield.
  - \* Hays have varying UFL values (vary depending on harvest stage and conditions)
  - \* provide high quality roughage if it is:
    - harvested early “- 10% in flowers”
    - and stored properly
  - \* Wilting causes a fairly significant decrease in energy value, it is less pronounced in legumes due to the fragility of their leaves;
  - \* The mineral content of grass hay is of the same order as that of the corresponding green fodder, while that of legumes is lower;
  - \* Hay is almost always low in zinc and copper;
  - \* are rich in vitamins when dried away from the sun, so when their color is still green (proportional to the degree of drying: total loss after 4 – 6 months of storage).

#### **Wet preservation**

- Forage stored in wet form is appetizing;
- The principle is based on sealed, anaerobic storage (silage).

#### **Silage**

- Silage is a fermentation process aimed at preserving green fodder in a fresh state with all its nutritional qualities;
- The fodder is harvested then acidified and sterilized by lactic bacteria;
- It is a method of moist preservation of fodder in the absence of oxygen (grass, corn, beet pulp, etc.), which is chopped then stored in a silo away from the air;
- Lactic fermentation allows a good part of the nutritional properties of fodder to be preserved;

- Silage involves fermentation where lactic bacteria transform, in a humid environment and in the absence of O<sub>2</sub>, soluble carbohydrates into lactic acid.
  - \* "Rapid Acidification": to prevent the yeast from transforming the sugars into alcohol
  - \* Good compaction otherwise the yeasts breathe and produce CO<sub>2</sub> and heat
  - |   |                       |
|---|-----------------------|
| { | Nutrient losses       |
|   | (-) good conservation |
|   | Mold formation        |
  - \* **Lowering the pH prevents** the harmful activity of other microorganisms;
  - \* *as long as anaerobiosis is maintained, the stabilized silo (pH 3.8 - 4.5) can be stored for more than a year;*
  - \* *It takes a period of 4 to 6 weeks to achieve stabilization.*
  - \* The main silage foods are:
    - grass
    - whole plant corn (or wet grain)
    - beet derivatives (wet and pressed pulp)
    - immature cereals
    - whole plant pea
  - **Grass silage**
    - ↳ leave to remain on the ground for a limited period
    - ↳ The pre-wilted grass is swathed
    - ↳ harvest make the silo
    - ↳ fermentations
  - Preserving corn by ensiling allows its initial nutritional qualities to be preserved
- Whole plant corn silage has the following qualities:
- ↳ of coarse fodder (leaves, stems)
  - ↳ of a concentrated feed (grains)

**NB/**The type of silo used can have an impact on the quality of the silage. Silage is made:

⇒ either in different types of silos:

↳ horizontal silos (molehill, trench or sausage silo)

↳ tower silo

⇒ either by wrapping round or square bales

## The wrapping

Wrapping is the technique that offers the most flexibility in terms of plot yields. The first cut should be made at the start of earing (in order to maintain a material richer in protein).

– From this stage, particular attention must be paid to the fodder depending on its future:

↳ silage can be made between 15 and 30% DM

↳ wrapping ideally requires 50% DM

↳ The dry method requires a longer drying phase in the field to obtain 75% DM

- For wet roads, this is where the quality of fodder conservation comes into play.
- The dry method is more advantageous because it proves to be stable:
- silage can suffer losses of around 15 to 25%. More airtight, the wrapping technique shows better results with only 3 to 5% losses.

### **The meadows**

- A meadow is an agricultural area intended for the cultivation of fodder plants used for animal feed;
- It is composed of grasses, legumes and other dicotyledons, intended to be grazed or mown;
- The species present in the meadows depend on the soil and climate conditions of the plot as well as the method of exploitation;
- The consumption of these fodders can be carried out:
  - ↳ directly to the field by pasture
  - ↳ at the trough in the form of green fodder
  - ↳ or preserved (by drying (hay) or by fermentation (silage))
- There are three types of meadows:
  - permanent meadows
  - temporary meadows
  - artificial meadows

#### **Permanent meadows**

- These are those where the grass seed, once sown, perpetuates itself and multiplies by itself: unsown “natural” meadows or meadows sown for more than 10 years.
- Are always grassy

#### **Temporary meadows**

- These are meadows aged 0 to 5 years, sown with forage grasses in pure culture, in a mixture of grasses or legumes.

#### **Artificial meadows**

- Are those that are sown with the seed of 1, 2 or 3 species of plants considered suitable from 0 to 5 years old sown exclusively with forage legumes (alfalfa, clover, etc.) in pure culture or in mixture.

We find: Annual artificial meadows - Perennial artificial meadows.