

Processing Methods of Animal Feed Stuffs

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Animal Feed technology

It deals with:

- Processing of feeds, fodders
- Preparation of formula feeds for which the knowledge of nutritional requirement of various livestock and poultry
- Quality control of feed ingredients
- Feed plant management
- Storage of feed ingredients and feeds

Defined as:

The application of physical, chemical, biochemical, biological, physiochemical and engineering methods to increase the nutrient utilization of feeds and fodders in animal system

Objective of feed processing

- To make the feed more palatable.
- To detoxify or remove undesirable ingredients.
- To make the storage easy and safe.
- To increase nutrient content and nutrient availability .
- To change the particle size or density of feed
- To make animal production more economical

Roughage processing methods

- **divided into two groups:** based on the addition or deduction of water content of roughages.
- **Dry processing method**
- **Wet processing method**

Dry processing methods

- In these methods water content is reduced to a desired level.
- **Baling:**
 - The forage is cut and dried in the field condition.
 - Dried forage is then baled or bundled with Baler
 - By this method we make storage and handling of forage easy and convenient.
- **Chopping :** It is also known as chaffing:
 - The forages are chopped into small pieces as fine or coarse particles.
 - Chopping avoids the selective feeding thus wastage of plant material is reduced.
 - The machine used for the intended purpose is called chaff cutter.
 - Chopping facilitates easy handling due to increased bulk density
 - also improves digestion due to exposure of relatively large surface area of roughages for microbial digesting

- **Grinding :**
- It is a process of particle size reduction.
- **Course grinding:** roughages improves the feed consumption and growth rate
- **Fine grinding:** reduce the digestibility of CF: due to faster rate of feed particles in GIT
- High cost: grinding of roughages is not economical.
- **Pelleting :**
- The ground roughages are pelleted and fed to animals.
- Improves the consumption of poor quality roughages.
- A complete feed: Pelleting poor quality roughage with 30 % concentrate.
- The size of pellets is 12/64" to 48/64" and has a density of 40 lb/ cft.



Mash

Crumble

Pellets

- **Dehydration :**
- It is a process of reduction of moisture content in a dehydrator using a temp. 600-1500⁰F for a short time period of 3-5 minutes.
- dehydrated forage: retains: lot of DM and CP
- No loss of leaves, but carotene content is reduced
- **Cubing :**
- It increases the density of roughages upto 30lb/cft.
- good quality hay is sprayed with water to increase the moisture content upto 14%
- broken down rather than to ground the roughage, so that there is minimum of fine particles in the cube.
- Cubing: Alfa- alfa hay is done: Developing country



B: Wet processing methods:

- Soaking is a process of mixing or spraying water on roughages so that stems become soft and mixing of concentrates with roughage is uniform which improves the feed intake and digestibility of roughages.
- When green roughages are chaffed, there is no need of soaking and fed as such or mixed with dry roughage or concentrate mixture.

Processing of grains

- divided into two groups :
- **Wet processing methods:** It includes
 - Grinding
 - Dry rolling,
 - Flaking
 - Pressure cooking
 - Exploding
 - Pelleting
 - Reconstitution
 - Extrusion
 - Gelatinization
- **Dry processing methods:**
 - grinding, dry rolling, popping, micronizing , extruding and roasting, decortivating /dehulling and crumbling.

Soaking :

- Grains are soaked in water for 6 to 24 hours.
- soaking softens the grains: swells: palatable
- Soaked grains are easily mixed with roughages and wastage is reduced.
- soaked cakes of mustard and neem seed cake: are filtered: remove toxic factors
- **Reconstitution:**
- It is similar to soaking water is added to mature dry grain(10%): to raise the moisture content:25 to 30 %
- stored the wet grain in an oxygen limiting silo for 14 to 21 days prior to feeding.
- It also increases the solubility of the grain protein.

Steam rolling:

- grain: steam: different periods of time depending upon the pressure used prior to rolling.
- At atmospheric pressure, 100°C temperature and 16-20 % moisture containing grain is steamed for 8 to 20 minutes
- At pressure of 20 to 60 psi preconditioning, grain having a temperature of 121 to 150°C and 18-25 % moisture is steamed for a period of 1 to 2 minutes only.
- This only softens the grains without any significant change in starch granules.
- The only advantage of steam rolling over dry rolling is the production of large particles with little fines.

- **Steam flaking:**
- Steam treatment 15 to 30 min.
- due to which moisture content in grains rises: to 18-20 %
- After rolling of such grains, flakes are produced.
- Process ruptures starch granules: improves physical texture, nutrient utilization and performance
- **Pressure cooking and flaking:**
- grains are first cooked under steam pressure, cooled to room temperature and then rolled.
- The product is more or less similar to steam flaked grains but the processing is much expensive.
- Grains are cooked: steam at 50 psi for 1.5 min in air tight chambers, temperature of 300⁰F.
- When flakes are made, this temperature is reduced to 200⁰F and moisture content up to 20% by passing them through cooling and drying tower.

- **Extrusion:**
- A process of cooking in which feeds are also expanded by the application of adequate pressure is known as extrusion.
- purpose of extrusion: gelatinization of starch in grains or complete feeds.
- It is also used for the incorporation of urea in starchy feeds
- control of pathogenic microorganisms in feeds of animal source.
- **Exploding:**
- The process of swelling of steam treated grains under high pressure and sudden expose to atmospheric pressure or
- grains are treated with high pressure steam (250 psi) for 20 seconds followed by sudden decrease to atmospheric pressure is known as exploding.
- It is done in steel vessel fitted with valve for injecting steam to raise pressure inside the grain containing vessel to 250 psi for about 20 sec.
- After that outlet is opened through which treated grains escape in the shape of expanded grains with the husk removed.
- This happens due to entry of large amount of moisture in the kernels due to high pressure.

- **Pelleting:**

- The process of densification of a ground grain or composite feed with or without the application of steam or moisture is known as pelting.
- The ground feed material is forced to pass through the holes of specific size by a mechanical process.
- **The machine used for the purpose: pelleting machine.**
- The purpose of Pelleting is to change dusty and unpalatable feed material into more palatable easy to handle large particles by application of optimum amount of heat, moisture and pressure.
- **Normal size of pellets: 3.9 mm to 19 mm cylindrical shape.**

- **Gelatinization :**

- Complete disintegration of starch granules: by application of moisture, heat and pressure is known as gelatinization.
- **It improves the digestion of feed by increasing water absorption ability and rate of action of amylase on soluble carbohydrates (starches).**

Dry processing methods

- **Cracking or dry rolling:**

- It is the disintegration of kernels into particles with the application of pressure by moving rollers.
- It is done by a combination of breaking and crushing of the grains.
- The physical properties of dry rolled or cracked grain would be very similar to that of grains coarsely ground in a hammer mill.

- **Crimping:**

- The process of rolling of feed ingredients with the use of corrugated rollers is called crimping.
- The process may include conditioning and cooling of the processed feed.

- **Crumbles:**

- The feed of granular particle size produced from the grinding of pelleted feeds is called crumbles.

- **Popping/puffing:**

- It is produced by the action of dry heat (370-425⁰C) for 15-30 seconds causing a sudden expansion of the grain which rupture the endosperm
- rupture of starch granules makes the starch more available to digestion
- About 3% moisture of grain is lost during heat treatment.
- Popping reduces the density of grains and increases palatability
- digestibility of starch improve
- Popped grains are also a good carrier for molasses.

- **Micronizing:**

- The popping of grains with the application of infra red heat energy having wavelength of 3×10^8 to 3×10^{11} cycles/second is called micronizing.

- **Roasting :**

- The treatment of grains with direct flame is called roasting.
- It causes expansion in volume due to heating and generally increases digestibility.
- Roasting of whole soybeans inactivates enzymes or inhibitory factors which improves the nutritive value for poultry.

- **Grinding:**

- The process of reduction of feeds into particles with the application of pressure and shearing.
- It is simplest and least expensive method which is accomplished with the help of hand stone mill, hammer mill and roller mills.
- The size distribution of grains depends on the shape, size and hardness of the kernel.

- **Advantages of grinding:**
- It is prerequisite for mixing, Pelleting or extrusion.
- It increases the particle number: increase surface area : improve feed utilization
- It avoids selective feeding of grains and reduces the scope of shorting out less palatable feeds by the animals from the compounded mash.
- Grinding increases compactness and reduces space requirement for storage