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Department of Animal Nutrition

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Lecture on

**Feed processing technologies for improving
nutrients utilization in farm animals
(Lecture-3)**

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Heat treatment

- Heat ruptures the enzymes resistant carbohydrate protein bonds and makes the nutrients available for absorption.
- Maillard reaction and other deleterious reaction may result due to heat processing of the grains and it may lead to creation of new linkages between peptide chains.
- Heat treatment causes denaturation of proteins and gelatinization of starch resulted into improved ME .
- Heat treatment of grains also increases amino acid availability. Soybean Meal cooked at 112-130 °C contains protein with twice the nutritive of raw soybeans. Hot water soaking or tannin extraction of sorghum improved FCR in broilers.

Effects of heat treatments on protein and carbohydrates

- The optimum temperature and pressure for heat treatment of proteins is reported to be 110 °C for 30 min at 1.345 Kg/cm² atmospheric pressure.
- Heating of grains also eliminates the heat labile antinutritional factors (ANFs) such as trypsin inhibitors, hemagglutinins, saponins etc. in soyabean and gossypol in CSM.
- Heat treatment of grains increases their water absorption ability; facilitate faster conversion of starch to soluble carbohydrates sugars and energy.

Popping

- Popping is a method of dry hot processing of grains and it is accomplished by raising the temperature of the grains to 1780 C without moisture.
- It involves heating of grains at an air temperature 370-425 0 C.
- In treated grains 3% moisture is lost and causes expansion of grains.
- The density of the grains is reduced and it improves digestibility of starch.

Pelleting

- It is a mechanical process of densification of ground grain or composite feed with or without application of moisture or steam.
- Increased temperature and time of heating reduces lysine availability in Maize. Effects of pelleting vary with method of preparation and foodstuff combination
- Fine and dusty feed particles which often create problems in handling by the stockman, mill workers and also during eating for the animals. Fine irritant particles cause coughing and often irritation in eyes and nostrils when handled.
- To facilitate the consumption of less palatable or otherwise unpalatable feeds by dilution and masking of taste by the main feed ingredients in feed mixture.

- To reduce feed wastage because it is easy to collect left overs pellets which can be again fed after mixing with fresh pellets.
- To ensure uniform distribution and consumption of micro ingredients into the mixed feed.
- Due to higher density most of the mineral supplements settle in dry mash but there is no such scope after agglomeration.
- To reduce bulkiness of the feed which generally increases voluntary feed intake and needs much less space for storage.
- To facilitate handling and transportation as densification increases the density of feeds due to which greater amount of feeds are loaded in the same space of carriage. There is also space problem during the loading and unloading of feed mash.



Dry roasting: It refers to treatment of grains with dry heat, resulting in expansion in volume of grains and increased digestibility. The moisture content of the grains is reduced by 5%. Dry roasting of soybeans improves its nutrient utilization. Mercier (1966) reported that heating makes starch six times more accessible to amylase.

Extrusion: It is a special method of cooking, also expended feeds by adequate pressure. Extruding machine applies heat and pressure by means of friction. It has been found to improve utilization of soyabean nutrients. Mercier and Fillet (1975) found maximum expansion and 170-200°C with improved alpha amylase digestibility for raw starch from 18% to 80%.

Exploding: During exploding the grain is first subjected to steam at high pressure in closed chamber and suddenly decreased to atmospheric pressure resulting in rapid expansion of the grain. Generally steam pressure of 15.9 to 17.6 kg/cm² for 15- 20 seconds is used. Improved digestibility in sorghum has been reported on exploding

B. Roughage processing methods: - Different processing methods are used for the processing of green and dry roughages. In most of the cases processing has little effect on the digestibility of fodders but there are several other advantages of processing like increased voluntary intake, less wastage of hard and fibrous parts, increased density, less space requirement for storage and convenient handling etc.

1. Processing of green roughages:- Two kinds of processing are commonly used for the green fodders. One is the routine chaffing for facilitating uniform mixing with chaffed dry fodders and reducing wastage of fodder by decreased shorting opportunity.

A. Silage or green chopping:- The green fodders are chopped with the help of a chaff cutter into 1 to 4 cm length. Chaff cutter used for fodder chopping is selected on the basis of the quantity of fodder to chop. For moderately large amount of up to 5 quintals, a manually operated chaff cutter is used while for large amount of several tones the power operated large size chaff cutters are used.

B. Ensiling of green fodders: - Green fodders are conserved by ensiling for feeding during the lean period. For good quality silage making the moisture content should be 35- 40% and crude protein level should be less than 15% on dry matter basis. The fodder should have adequate amount of fermentable carbohydrates.

C. Hay making: The process of quick dehydration of green fodders to increase dry matter to more than 82% is called hay making and such dried fodder is called hay. The hay is generally prepared by sun during in tropical countries. Dehydration method is used where sun light is inadequate and energy is available at a reasonable price.

Processing of dry fibrous crop residues

The dry fibrous crop residues available for the feeding of livestock are largely poor quality roughages like straws of wheat paddy finger millet and barley and maize. These straws and stovers are now considered as conventional dry roughages for the feeding of farm animals in India.

Purposes of processing dry crop residues

1. To increase the voluntary intake by improving palatability
2. To dissociate cellulose and hemicelluloses from the lignin and silica for increasing microbial action resulting into increase in digestibility of organic nutrients
3. To increase energy availability for physiological functions by reducing losses in digestive processes.
4. To enrich the crop residues with deficient nutrients either by treatment or supplementation.
5. To reduce the bulkiness through densification.

Methods of processing dry roughage for nutritional improvement

Physical methods: Shani making, Chaffing, Bailing, blocking, pelleting , irradiation water washing ,water soaking steam processing and boiling comes under physical methods.

Chemical methods of processing of dry roughage:

Acid treatment: Treatment of roughages with various organic and inorganic acids although changes their chemical composition to certain extent without any significant alteration in the nutrient utilization. The advantage obtained, if any is not commensurate with the expenditure and labour inputs. This process couldnot be adopted due to its little practical utility.

Treatment with oxidizing agents: Lignin in roughages can be disintegrated by treatment with various oxidizing agents like alkaline hydrogen peroxide, ozone, sulphur dioxide, sodium sulphite, sodium thiosulphate, sodium hypochlorite and bleaching powder. Although some of the oxidizing agents are highly effective in nutritional improvement of fibrous crop residues but cost of treatment is very high.

Alkali treatment: Amongst different alkalies i.e lime, caustic soda, sodium bicarbonate, NaOH, Urea-ammoniation, ammonia treatment and hydrogen peroxide are important. **Urea ammonia treatment seems most useful.**

Biological methods: Silage making, Microbial fermentation, Enzyme treatment.

Discussion.....

Thank you