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Exploration of alternative feed resources for economical livestock feeding

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Indian livestock sector is one of the largest in the world. There is urgent need to meet the demand of increasing number of livestock and also enhance their productivity. Adequate supply of feeds and fodder is essential for enhancing their productivity. In India, the latest estimate on demand-supply gap in fodder availability shows a net deficit of 30.65% green fodder and 11.85% dry crop residues in year 2020. This shortage is due to increasing pressure on land for growing food grains, pulses and oilseeds and less attention being given to the production of fodder crops. There is a need for alternate feed resources to meet the demand of growing livestock and poultry in our country. The efficient utilization of alternative feed resources is the need for improving the production of animal and enhancing the socioeconomic status of farmers.

Non conventional feed resource

Non conventional feed resources are generally Shrub fodder, tree fodder, and agro-industrial by products which have not been utilized traditionally in livestock feeding. Their use in livestock ration is increasing day by day due to shortage of animal feeds. The utilization of the non conventional feed resources in livestock feeding is limited due to meager information on their nutritive potential. Non conventional feed resources vary from country to country and region to region.

Tree leaves as alternative feed resource

Fodder trees and shrubs have high potential values as sources of feed for domestic livestock. The leaves of fodder trees contain high level of proteins (10 to 30% of dry matter) and can replace the concentrates without any adverse effects on animal health. The secondary plant metabolites like tannins present in tree leaves, enables the ruminants to receive higher levels of dietary protein at post rumen for digestion and

absorption. The nutrients from fodder trees retain the microbial activity in gastrointestinal tract of ruminants, which increases their efficiency of livestock. Some of the most commonly used fodder trees are *Leucaena leucocephala*, *Bauhinia variegata*, *Grewia optiva*, *Celtis australis*, *Robinia pseudoacacia*, *Bambusa arundinacea*, *Albizia stipulata*, *Morus alba* & *Quercus leucotrichophora*. These plants resulted as a good source of nutrients (proteins, fats, carbohydrates, fiber and minerals) and can be used as substrates deficit in either of these nutrients for livestock grazing. They also contain some anti-nutritional factors (ANFs) like saponins, tannins, mimosine etc. They are generally not lethal but reduce animal productivity and may cause toxicity. These anti-nutritional factors need to be removed or inactivated by various procedures before the use of the ingredients in the diet. Leaves and fruit residue of shrubs like Seabuckthorn can be used to feed poultry and livestock with a stimulatory effect on growth and performance.

Crop Residues

The crop residues are mainly fibrous materials that are by-products of crop cultivation. Crop residues have in general a low crude protein content, in the range 3.3 - 13.3% on dry matter basis. Rice straw, Maize stover, Maize husk, Sorghum stover, Cassava leaves, Sugar-cane tops and leaves & Banana fruit wastes are most commonly used crop residues in animal feeding. Fibrous residues, such as rice-straw, sugar cane tops and leaves, banana leaves and stems, and maize stover are plenty but under-utilized. Rice & Wheat straw are regularly fed to ruminants, especially mature draught stock or even the productive animals. Mostly straw feeding is done with supplements of green fodder and concentrates. Stover is the field residues of large cereals, such as maize and sorghum. Maize stover consists of the whole plant residues left in the field after corn harvest. It includes stalks, leaves, husks, and cobs. The husks are more digestible and nutrient-dense than leaves but make up only about 12% of the residue left in a field. Sugar cane is harvested for production of sugar, charcoal, alcohol and conversion to bio fuel. On-farm by-products of cane harvest include cane tops, terminal leaves, nodes and bundle sheath, which forms the valuable source of animal feed.

Agro-industrial by-products

Agro-industrial by-products refer more to by-products derived in the industry due to processing of the main products. They are in comparison to crop residues, less fibrous, more concentrated and have a higher nutrient content. The use of Agro-Industrial By-Product can be used as a part of livestock feed. Their use will facilitate the farmers for economical and profitable farming, because feeding cost will reduce which is more than 70 percent of the total cost of production. Lots of agro-industry by-products have low quality, and some of them contain anti-nutritional factors which influence feed palatability, digestibility, and impaired animal production performance. Most of these products are low in major nutrients and do not form properly balanced diets. The difficulty of the use of these feed sources as fresh material for extended periods and the lack of efficient ways for their integration in feeding regimes may account for their under-

utilization. They are fairly good source of digestible protein and may be used for livestock feeding along with the concentrate mixture

- 1) Agro-industrial by-products of plants origin:-**The agro-industry by-products of plants includes oil-seed-meals, plant shell, seed, fruit pulp, fruit pomace, and others. By-products from cotton, sugarcane, groundnut, soybean, and palm oil production are potentially useful as animal feeds. Most of these are abundant with crude protein, dietary fiber and phenolic compounds. By-products of milling industry are bran, waste flour, hulls of some seeds. Solvent-extracted cake from soybean and oil-yielding rape, sunflower are by-products of the oil industry. By-products of the fruit and vegetable industry are products resulting from peeling fruits and vegetables, pomace, stones of some fruits, e.g. tomatoes.
- 2) Agro-industry by-products of animal origin:-**The agro-industry by-products of animal origin includes whey, fishmeal, meat and bone meal, blood meal etc. Fishmeal, blood meal & Meat meal are rich source of animal protein. Bone meal is a nutritious substance obtained from sterilized bones & contains about 30% Ca, 15% P. Poultry excreta is rich source of protein, calcium, phosphorus and minerals and can be used as source of nitrogen in the cattle ration.
- 3) Molasses:-**Molasses is the readily available source of sugar and phosphorus to the animal body. The urea molasses diet can be successfully fed as a sole ration with little protein supplement and forage to growing calves and lactating animals. In concentrate mixture, inclusion of 10 to 15% molasses increases the palatability of the concentrate mixture.

Aquatic plants

Azolla is a small aquatic fern that flows on the water surface. Azolla meal is a non-conventional feed ingredient may be used as poultry feed to reduce feed cost. They are easily digestible because of its high CP content and low lignin content. Azolla is rich in protein, almost 20-25% CP on dry weight basis. Fresh azolla can be mixed with regular ration or can be given directly. It contains almost all essential amino acids, minerals apart from appreciable quantities of vitamin A precursor beta carotene. Azolla is a good source of protein and may be used upto 10% level in the broiler diet. Azolla nowadays being used as unconventional feed and protein supplement for animals like ruminants, pigs, poultry and fish. Azolla is good source of probiotics, protein (mainly essential amino acids) with higher lysine, arginine and methionine content, minerals, vitamins (Vitamin A, Vitamin B, beta carotene, vitamin B12).

Nutritional characteristics of some important crop residues and agro-industrial by-products

Feed resource	Dry matter (%)	Crude protein (%)	Crude fibre (%)	Organic matter digestibility (%)
Maize stover	Highly variable	3-11	21-37	50-60
Sugarcane tops	18-35	2-4	29-37	48-65

Sugarcane Bagasse	Highly variable	1.5-2.5	35-50	49
Molasses	67-80	1-2	-	80
Poultry litter	80-87	40-45	18-21	54
Cassava leaves	73-78	21-26	8-23	55-60
Rice bran	87-91	11-17	10-20	59-67
Rice hulls	88-95	1-2	28-56	28-37
Wheat middlings	84-91	13-21	2-12	68-85
Wheat straw	87-93	2-5	36-46	38-55
Rice straw	89-96	2-5	29-41	48-56

CONSTRAINTS IN THE USES

The major constraints in their uses are availability in terms of time, location, seasonality and storage, low nutritive value, high moisture content & presence of anti-nutritional factors & lack of technical skills in the utilization of such feeds. Collection and transportation of these by products is difficult and sometimes cost of collection can be unusually high.

TECHNIQUES TO ENHANCE FEED UTILISATION

- 1) **Supplementation:-** Supplementary feeding with nitrogen, energy and minerals have been used in order to improve their feeding value. supplementation of low quality feed stuff with grains and concentrate feeds is most common to provide a balanced feed. Appropriate use of several by-products and browse foliage could partially or totally replace common grains and concentrate feeds without causing any negative effects on livestock performance.
- 2) **Chemical treatment:-** Chemicals such as ammonia gas or ammonia generated from urea under conditions causes rupture of ligno cellulosic bonds and makes cellulose available for microbial action. Ammonia treatment increases crude protein content, feed intake and digestibility of treated straws thereby improving livestock productivity.
- 3) **Ensiling:-** By products such as citrus pulp and crop residues with high moisture contents should be processed in order to improve their storage quality. Ensiling techniques can be safely used to extend the storage period of these by-products separately or combined with other by-products such as molasses or wheat bran.
- 4) **Feed block technology:-** Compressed Complete Feed Block technology provides scope for incorporation of deficient nutrients, use of unconventional and agro-industrial by products for optimum livestock production and also provides cheaper transportation cost of bulky materials from surplus to scarcity areas. These block considered as catalytic supplements are able to enhance digestion of low quality fibrous feedstuff through balanced synchronized and fractional supply of main nutrients to the animal on poor diets. Most commonly used solid feed

supplementation blocks, i.e. urea-molasses blocks or multivitamin blocks, provide the nitrogen, minerals and vitamins lacking in fibrous feeds.

- 5) Deactivation of secondary compounds:-** Plant secondary compounds such as tannins and saponins, could positively affect nutrients feed intake and digestibility, ruminal fermentation activities & animal performance. Tannin-binding agents such as polyethylene glycol (PEG) enhance the nutritive value of tannin-rich trees and shrubs by forming stable complexes with tannins, preventing the binding between tannins and proteins. Studies have shown that incorporation of PEG in the diet breaks tannin-fibre complexes, which consequently allows their digestion by microbial enzymes.

CONCLUSION

The major reason for low levels of animal production in India is the inadequate supply and low level of feeding due to serious shortage of feedstuffs. Crop residues, agro-industrial by-products and browse foliage are increasingly becoming important in their role as feed in the future. While feeding attention needs to be paid towards the inclusion level of the resources as they vary with the crop one intends to use. The farmer should also know about the deleterious factors of the fodder and treatment regarding the same. Many of these countries are now giving attention to research and development of alternative feed resources that can encourage wider utilisation and improve the efficiency of animal production. Local agencies like milk unions, krishi vigyana kendras and village level self-help groups should act as sub-centres of technology transfer and harness benefits of these innovations.

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