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Non-conventional Feed Resources: An Overviews

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Introduction

Imbalance between feed availability, price of feed ingredients and livestock products *i.e.*, milk, meat and eggs result in poor animal performance, low growth rates, reduced reproductive efficiency, high morbidity and mortality rates, etc. This problem is especially acute in the countries of South Asia such as Pakistan, Nepal, India, and Bangladesh. Here the lack of sufficient feed is widespread, resulting in low availability of good quality feed from all available sources for this need to develop technology for expanding the utilization of non-conventional feeds and fibrous agricultural residues. Insufficient attention has been given to these feed resources in the past and it is considered opportune to focus more attention on them now.

The large livestock numbers are both an asset and a liability. Most of the low productive animals are owned by poor people who, because they do not have any alternative sources of livelihood, cannot reduce their numbers. Steps must therefore be taken to improve production through better utilization of the available feed resources, reducing losses from mortality and morbidity due to infectious diseases and parasitic problems, more appropriate management and genetic improvement. These are primarily crop residues and other poor-quality roughage and foraging materials. The largest proportion of these feed resources are crop residues, rice and wheat straws, stovers of sorghum, millets and maize and sugar cane bagasse from sugar cane processing. Most of these materials are low in protein and are highly fibrous. Furthermore, the available energy is in a highly lignified form. Methods for breaking down lignocellulosic combinations in these feeds through chemical and microbial treatments have been developed with variable success, and such treatments have led to improvement in their intake and utilization. The most successful of these methods is ammoniation of straws,

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using urea and steam treatment of sugar cane bagasse with or without the addition of urea and molasses.

More recently some work has been started on microbial degradation of lignocellulosic materials using the *Coprinus* fungus. The treatment results in loss of dry matter, but is associated with an increase in the microbial protein content of feeds. The time needed for the treatment is now being reduced and methods are being found to reduce dry matter loss. Similarly, much work has been initiated on microbial degradation of organic animal farm waste, slaughter and marine by-products and their utilization as animal feeds.

The major problem with the crop residues is their bulk. Treatments are necessary for improving their utilization and for reducing the bulk so that the cost of transportation and storage can be minimized. More accurate information is needed on the availability of feed resources, since these are based on indirect estimates utilizing information on areas under different crops and the ratio of grain to residues. A sizeable quantity of the straws, stovers and other by-products are not utilized for animals. More accurate calculations of available feed resources and their utilization by the farmers are necessary. It will also be necessary to identify regions with surpluses and chronic shortages, so that systems of animal feed security and establishment of feed and fodder banks can be developed.

The Feed Resources

Crop residues, Agro-industrial by-products (AIBP) and non-conventional feed resources (NCFR) are three main classifications of feed resources.

1. **Crop residues**

Crop residues are fibrous by-product mainly produced form crop cultivation which is low in protein (3-13% of DM), fermentable energy, mineral and organic matter digestibility. rice straw, paddy straw etc

2. **Agro-industrial by-products**

These are by-products which produced after processing of main agriculture product. It is low in fibre and high in protein and energy as compared to crop residue. e.g., molasses, wheat bran, rice bran etc.

Fig. 1. Pulse and their by-products as a feed

3. Non-conventional feed resources

Feeds which has not been use traditionally or commercially for livestock feeding. Traditional feeds include those feed which is of crop origin while NCFR includes feed from perennial crops, animal and industrial origin. e.g., Oil palm by-products, single-cell proteins, feed materials of plant and animal origin (e.g., poultry excreta), and poor-quality cellulosic roughages from farm residues such as stubbles, haulms and vines. Other agro-industrial by-products also exist such as slaughter-house by-products (e.g., feather meal) and those from the processing of sugar, cereal grains, citrus fruits.

Many of the NCFR are currently designated as wastes, which is an inaccurate description. They are wastes to the extent that they have not been shown to have an economic value through utilization and conversion by animals into valuable products for human benefit. Recycling, reprocessing and utilization of all or a portion of the wastes offer the possibility of alleviating the existing limited feed resources.

Fig. 2. Vegetable waste as al livestock feed

The AIBP and NCFR are of three categories:

I. Energy-rich feeds: bananas, citrus fruits, pineapples, sugar cane and root crops (e.g., banana waste and molasses).
II. Protein supplements: oilseed cakes and meals, animal by-products, by-products from the food industries and fish meals (e.g., coconut cake and feather meal).
III. By-products: cereal milling and palm oil refining (e.g., rice bran and palm oil mill effluent POME).

Inclusion in Feed Formulations

Optimum levels of utilization of individual feeds provide an important guide to their inclusion in practical diets for individual farm animals. These levels are the technically optimum levels of individual feeds which can be used to advantage, based on several studies on the nutritive value and practical feeding trials for example, that a 30 per cent level of poultry excreta can be included up to 30% and 5-10% in the diet of ruminant and poultry birds, respectively. Similarly, oil palm by-products can be included up to 30-40% in the diet of ruminants. Cows and bulls in India appear to tolerate a salseed meal up to 40% level. The amounts that are expected to generate good response in the animals are approximated at these levels of inclusion. The most pressing development need in terms of feed resource utilisation is more focused attempts to apply known information to large-scale on-farm testing. From more fundamentally oriented research at the station or university farm level to real farm conditions, major shifts in adjustments are required.

Techniques to enhance feedstuff utilization

Many researchers develop a set of technologies to improve the nutritive value of low-quality feed sources. The most popular ones include ammonia treatment of cereal and rice straws and mixing several AIBPs in the form of hard feed blocks.

Supplementation

Nutrient supply may increase the nutritional value of low-quality diets. Supplementation with grains and other concentrate feeds is seen to be the sole option to offer a balanced feed from a farmer's perspective. However, when there is a drought, the usage of concentrates results in a large increase in feeding costs. Farmers used certain alternative feed sources (olive cake, bread wastes, etc.), but because they are unaware of the nutritional value of these sources, the diets which offered to small ruminant diets are frequently unbalanced for the main nutrients and unadopted to the physiological state of the animal. Several by-products and browse foliage could be used to partially or completely replace conventional grains and concentrate diets without compromising animal performance. For those farmers, cost-effective feeding solutions should be developed.

Chemical treatment of straws

Chemical treatment of cereal crop waste or residue is one option for decreasing the usage of supplementary feeds, although this takes additional labour and materials and decreases flexibility in application. Ammonia gas, or ammonia produced by anaerobic digestion of urea, weakens fibre and disrupts the complex between lignin and other digestible components in fibrous feedstuffs including straws. The benefits of this strategy on nutritive value of straw and animal performance have been thoroughly proven in the literature. Ammonia treatment improves animal production by increasing crude protein content, consumption, and digestion of treated straws. However, without proper supplements, primarily true protein, energy, and minerals, the technology's benefits may be limited. The high expense of urea and, to a lesser extent, the lack of a plastic sheet to cover treated straw are the main barriers to widespread adoption by farmers. An experiment has been done to reduce the cost of ammonia treatments. Mud may be used instead of plastic sheet to cover urea-treated straw.

Ensiling

Many AIBPs are not frequently employed in animal feeding, although being abundantly available and some of them being rich in certain nutrients (e.g., high crude protein - tomato pulp, high energy - orange and citrus pulp, etc.). Tomato pulp and olive cake, for example, develop rancid and mouldy as a result of the high moisture content. The ensiling process can be used to safely store these by-products alone or in combination with other (molasses, wheat bran, etc.) for lengthy periods of time. Olive cake silage are based on its aroma, colour, pH, and lack of mould. Olive cake silage are used to replace part of the barley hay and straw fed to lactating ewes, does, and cows. It has no significant effect on milk yield or FCM yield. Replaced oat hay and 30 percent of commercial concentrate with citrus pulp and wheat straw silage in lamb diets. Treatments had equal live weights and carcass weights. Lambs fed silage had more muscular conformation in their carcasses. AIBPs silage appears to be a practical and economically viable way for producing sheep with comparable or higher performance than common feed resources.

Feed block technology

It's a good technique to make use of unconventional resources and AIBP. For ruminant feeding, the majority of countries used these alternative supplements. This technology allows extension workers and farmers to determine which ingredients to include in the feed block and how to use it as a supplement in times of drought and other adversity. Furthermore, the blocks can be made when the cost of the components is cheap and kept for later use. These cost-effective supplements are a solidified mixture of agro-industrial by-products (such as olive cake, tomato pulp, grape marc, molasses, and so on), urea, binder (such as cement and/or quicklime), minerals, and vitamins.

Fig.3. unconventional feed block for animal feeding

These blocks are catalytic supplements that help animals to digest low-quality fibrous feeds by providing a balanced, synchronised, and fractionated supply of essential elements. Feed blocks can also be used as a carrier for several reagents, primarily polyethylene glycol, to deactivate tannins in fodder shrubs and trees as a vehicle for several minerals (e.g., Cu, Zn) to improve reproduction performance of small ruminants and to provide anti-helminthic drugs to manage gastrointestinal parasites in browsing animals and rumen modifiers such as saponins to reduce protozoa in the rumen, resulting in higher microbial protein synthesis efficiency. The potential use of feed blocks to partially or completely replace expensive concentrate feeds typically provided to ruminants on low-quality roughages, and therefore lower feeding costs of production.

Shrub-mixed diets

Protein is the most critical nutrient for improving animal performance by promoting efficient roughage fermentation in the rumen. Ruminants cannot be given browse foliage that contains more non-nutritive elements as a sole diet. However, it can be combined with other feedstuffs to provide a nutritionally balanced diet and to reduce the impact of non-nutritive elements. When tannin-free forage is fed with this leguminous shrub, the negative effects of condensed tannins in the *Acacia cyanophylla* foliage may be reduced.

Fig. 4. Acacia and Moringa leaves for animal feeding

Tannins in browse foliage to increase by-pass proteins

Despite the fact that tannins are regarded to be an anti-nutritional element, it is feasible that tannins can be used to benefit production. As a result, efforts should be undertaken to limit ruminal protein degradation in numerous range species (*Atriplex nummularia*, etc.) and concentrate feeds (rapeseed meal, soyabean meal, etc.) in order to boost ruminal protein supply by feeding forage legumes with high soluble phenolic content. Protein protection in the rumen has been shown to be beneficial. Nonetheless, chemicals, primarily formaldehyde, have been utilised to preserve protein against breakdown in the rumen. Industries commonly apply this approach. The use of foliage browses tannins to protect feed proteins in situ is a biologic strategy that smallholders can use. This could be accomplished by mixing a small number of tannin-rich leaves with protein-rich feedstuffs like soybean or rapeseed meals, for example.

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Conclusions

In India, inadequate supply and low levels of feeding due to a severe lack of feedstuffs are the main reasons for poor levels of animal production. There is a significant disparity between animal nutrients demand and supply. It is preferable to build up sufficient and alternative feed resources. However, there are several reasons for their limited use, including their low nutritional value and difficulties in handling and usage for long periods of time. Crop residues, agro-industrial by-products, browsing foliage, and other NCFRs will become increasingly significant as feed sources in the future as human and livestock populations expand. Particular attention should be given to the efficient use of this NCFR for livestock in times of scarcity. Farmers' participation could open up a discussion on the appropriateness of various technologies for better use, allowing researchers to adjust, alter, or refine their technology to response to practical or infield conditions.