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Conceptual Paper

Revolutionizing Livestock Feeding with Bypass Protein Technology

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Introduction

The protein requirements of highly productive animals are substantial. Soluble protein, biodegradable protein and rumen bypass protein make up the total raw protein of the feed. Around 60 to 70% of dietary protein meals fed to animals are degraded to ammonia in the rumen. A significant fraction of this ammonia is eliminated in the form of urea in the urine. As a result, a significant amount of the protein in costly cakes/meals is wasted.

Protein degradation in the rumen can be decreased through the application of an appropriate treatment to the dietary protein meal. Bypass protein technology refers to the method of preventing dietary protein from breakdown in the rumen. Rumen bypass protein is not broken down by the rumen bacteria and is exclusively available for absorption in small intestine. This increases availability of intestinally digestible protein (IDP) from linseed, rapeseed, soya etc. for animals. Protein requirements might be challenging to meet solely with rumen degradable protein. Because of this, these animals require a higher percentage of rumen bypass protein. Protein meal degradability in the rumen can be lowered from 60-70% to 25-30% when treated in a suitable manner (NDDB, 2021).

How are different types of bypass protein made?

Extra protection of proteins can be achieved by chemical and physical methods.

- Formaldehyde treatment is based on basic principle that it significantly reduces protein solubility at pH 6.0, making it highly resistant to microbial attack without significantly affecting its digestibility in the small intestine.
- It is less expensive than heat treatment.
- Maximise the bioavailability of amino acids.
- Controls *Salmonella* and mould growth in feedstuff
- The level of formaldehyde used in the treatment of protein meals is not more than 0.8%, and after 2 days of incubation, it drops to below 2 ppm, in accordance with the health and safety requirements of both animals and consumers; additionally, no significant change is reflected in its naturally occurring levels in meat and milk.
- Use of alkali (NaOH, NH_4OH) for encapsulation of proteins and methionine analogues and derivatives.
- Although being considered as antinutritional factors, tannins (polyphenolic substances) exhibit excellent potential.
- Heating is most common way, soyabean protein is modified via heating until it begins to brown, which causes Maillard reaction. Melanoid polymer is formed when heated carbohydrate reacts with lysine. Although some lysine is lost, protein solubility is reduced. By using carbs like sugars, it may speed up the browning reaction and requires less heat.
- Heat treatment produces two types of bypass soybean meal: expeller modified and protein modified. As beans are passed through an expeller to extract oil, frictional heat is generated. This heat may increase the bypass protein level by 40-60%.
- Soybeans are crushed, and hexane is used to extract the oil. Hexane is extracted and recovered using heat. A protein known as trypsin inhibitor is denatured with further heat. The resulting meal has a Rumen Undegradable Protein (RUP) level of 30%. Nonetheless, this process results in loss of melanoidins and some lysine.

Sr no.	Feedstuff	Percentage Bypass
1	Wheat grain	20-36
2	Lucerne	40-50
3	Berseem	37-52
4	Rice straw	63
5	Groundnut cake	22-37
6	Cottonseed cake	49
7	Coconut cake	70-81
8	Mahua seed cake	75
9	Linseed meal	11-45
10	Fish meal	71
11	Feather meal	83-86
12	Blood meal	76-81

Table 1: Degree of rumen protection of various feedstuff.

Feeding trails with treated meal	Farm location	Increase in comparison to control			
		Milk (%)	Fat (%)	Protein (%)	Net income (Rs. /Ani. /day)
Sunflower meal in cows	Sarsa	1.00	0.30	0.20	9.85
Rapeseed meal in cows	Ravipura	1.10	0.20	0.20	9.61
Rapeseed meal in cows	Sarsa	0.90	0.30	0.10	9.25
Guar meal in cows	Ravipura	0.90	0.20	0.20	8.60
Sunflower meal in buffaloes	Chikhodra	0.80	0.40	0.30	14.49
Rapeseed mela in low yielding cows	Sarsa	0.70	0.20	0.20	5.88

Table 2: Summary of feeding trails on bypass protein as top feed (NBBD).

Benefits of bypass protein

- In order to increase the protein availability in dairy animals' diets and to promote higher levels of milk production, bypass proteins can be considered as an effective technique and a sustainable strategy.
- Lactation and growth both phases require a source of RUP and, therefore, A young cow nursing her first calf and reaching the breeding season might benefit from an RUP-rich protein supplement.
- It improves milk fat and SNF content.
- Enable young animals to reach early maturity.
- Provides better resistance against disease in growing and lactating animals.
- It is cheap source of protein for animals.
- Increase the supply of limiting amino acids like lysine and methionine to the small intestine.

Economics

According to the level of milk production, treated protein meal may be offered directly to the animals as top feed @ 1 kg/animal/day or it can be added in cattle feed @ 25% and this feed can be offered @ 4-5 kg/animal/day. Protein meal treatment cost around ₹ 2.5 to 3.0/ kg however considering increase in milk production it is always cost efficient.

Conclusion

Improvement in production level of the dairy animals is the upmost goal of farmers and cooperatives. With deficit of feed and fodder and exponentially growing livestock population, sustainable use of feeds and fodders and an improved efficiency of nutrient availability to animal is essential. Thus, bypass nutrient technology becomes as an important aspect in livestock sector.