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Role of Feed Enzymes in Livestock Production

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Abstract

Nowadays, the demand for animal-based products has been increasing at a rapid rate which requires newer strategies for improving animal productivity. The main problem with the livestock sector in the developing countries is high feed cost and low available resources to meet their nutritional requirement. With the advancement in research, feed enzymes have been proven to improve the livestock feed efficiency. All the animals in nature require enzymes to digest the feed which are produced by animals themselves or by the gut microflora. However, the digestive system of animals may not be effective totally in utilizing the nutrients in the diet. In the animal production, the biggest portion of investment is in the feed. If the animal doesn't utilize the feed efficiently then production suffer huge losses. Therefore, supplementation of the specific enzymes improves the feed ingredient value thereby leading to improved feed utilization.

Introduction

The supplementation of feed enzymes along with the animal diet has been in practice since late 1980s. The inclusion of these enzymes in the feed formulation have been predominant in poultry and pig. In the recent years the use of these enzymes in ruminant nutrition and aquaculture have been gaining potential interest. The dependency on this enzyme supplementation has been increased where the enzyme activity also plays role in breakdown of antinutritional components of the feed in addition to improvement in nutrient utilization. In order to be beneficial to the animal, the feed enzymes must target specific feed components which are either harmful or of little use or no use. This leads to wider utilization of ingredients required to improve the animal performance.

Mode of Action

Enzymes used in the supplementation exhibit diverse modes of action. Recognized as feed

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additives, several studies have been done to understand the mechanism of action of feed enzymes (Bedford and Partridge, 2011; Ravindran, 2013). The exogenous enzymes can break the bonds of those feed components which are not hydrolyzed by endogenous enzymes. This breakdown of the bonds helps in degrading of the unfavorable factors of feed which are responsible for increased gut viscosity and reduced digestion, thus achieving better nutrient utilization. They can interfere with endosperm integrity and also help in the release of nutrients bound to the cell wall. For example, β-glucanase can disrupt the endosperm wall of barley and cellulase and pentosanes can cause release of protein from the aleurone layer. Low digesta viscosity can be maintained by enzymes by reducing chain length of polysaccharides to improve nutrient absorption. Feed enzymes can manipulate the number of substrates present in the gastrointestinal tract to cause a change in bacterial population in the gut to support the increase in the beneficial bacteria and decrease in the harmful bacteria (Bedford and Cowieson, 2012).

Types of Feed Enzymes used in livestock

Carbohydrases

Enzymes are divided based on the substrate on which they act on. Carbohydrases are enzymes which break carbohydrates into simpler sugars. They are divided into those that target non starch polysaccharides (fibre degrading enzymes) and starch degrading enzymes.

Fibre degrading enzymes

Fibre is made up of complex carbohydrates in plant cell walls. Nutrients such as starch and proteins are trapped in insoluble fibrous cell walls. Pigs and poultry lack enzymes to digest this fibre and therefore cannot utilize the nutrients. Soluble fibre forms viscous gels in digestive tract, trapping nutrients and slowing down the passage of feed in gut. Xylanase and β-glucanase are main fibre-degrading enzymes used in animal feed. Other fibre degrading enzymes currently used in animal nutrition, but to a lesser extent. include B-mannanase, pectinase and α-galactosidase. The addition of enzymes in poultry feed have been linked to decreased digesta viscosity, decrease in the quantity of dirty eggs and improved yolk color.

Starch-degrading enzymes

Amylases causes breakdown of starch in grains, grain by-products and vegetable proteins. In pigs and poultry, starch digestion leads to more energy extraction in feed which is utilised in meat and egg production. In diets of piglets, amylases supplementation compensates for less amylase secretion due to low feed intake.

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Proteases

Proteases are the protein-digesting enzymes used in pig and poultry nutrition to break down storage proteins. Storage proteins can bind to starch. Proteases can help break down storage proteins, releasing bound energy-rich starch that can then be digested by the animal. Proteinaceous anti-nutrients such as trypsin inhibitors and lectins inhibit digestion by blocking the enzyme trypsin and reducing digestibility respectively. Proteases can be used to reduce the levels of trypsin inhibitors and lectins, thus improving protein digestibility.

Phytases

Phosphorus is an important element for bone development and metabolic processes in pigs and poultry. In the plants, phytate forms complexes with minerals (such as phosphorus and calcium), proteins and starch, making them unavailable for absorption. Pigs and poultry do not produce the phytase enzyme that breaks down phytate. Phytate supplementation releases phytate bound minerals which can then be digested and absorbed by the animal to improve the efficiency of meat and egg production.

Feed enzymes are most widely adapted by broiler industry. As digestive system is simple in poultry the specific feed enzymes are useful in overcoming the defects in digestion. Broilers are sensitive to various antinutritional factors and show a more favorable response than layers. β-glucanase supplementation reduces sticky droppings in poultry which is helpful especially in layers where less dirty eggs can be obtained. Multienzyme supplementation is more effective in broilers. The young piglets rely mostly on enzymatic digestion for the utilization of nutrients. Hence supplementation of feed enzymes is necessary for digestion of high fibre cereals and protein meals thus improving the digestion in piglets (Prokopieva *et al.,* 2020). Plant feed sources are cheaper than the traditional feed meal in aquaculture species. Therefore, feed enzymes can play effective role in increasing utilization of plant protein sources. Phytase supplementation in fishes may decrease the inorganic phosphorus requirement in fish diets. Enzyme supplementation in ruminants is complex. However recent studies have shown that exogenous supplementation of fibrolytic enzymes helps in improving fibre digestibility and helps in efficient feed utilization in ruminants (Arriola *et al.,* 2017).

Conclusion

The supplementation of enzymes in feed helps in efficient nutrient utilization and aids in the better growth and performance of the animals. However, effective feed strategies are required for efficient use of feed enzyme supplementation. The feed enzyme supplementation in the future can be improved by refining enzyme formulations measuring various specific enzyme activities, antinutritional compounds affecting the growth of the animal. Though there have been various

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studies in the poultry and piglets regarding the improved nutrient utilization by addition of specific enzymes in diet, still research is required in the ruminants as well as aquaculture species. Feed enzyme is a promising field in the future research aspects where the enzymes can be modified to suit the needs of the animal based on their gastrointestinal tract environment. Hence improved nutrient utilization and growth performance can be observed.

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