Promoting growth and feed efficiency with bioactives

The demand for ruminant protein sources is growing. Due to the emergence of antimicrobial resistance, the livestock sector is expected to increase production without the use of AGPs . Plant extracts appear to be a promising alternative option.

BY SEBASTIEN CONSTANTIN, BUSINESS DEVELOPMENT MANAGER BIOACTIVES, PANCOSMA

Since the 1940s the livestock market has been restructured to meet the global population's food requirements. Intensification has been accompanied by great improvements in genetics, housing and other farm practices. Research in animal nutrition has also contributed to a deeper knowledge of digestive physiology, requirements, as well as a better knowledge of raw materials and their nutrient contents. This is why there have beem remarkable improvements in animal performance in recent decades. In the field of animal nutrition, livestock performance has also been greatly improved through the supplementation of antimicrobial growth promoters (AGPs) which are antimicrobial agents fed at a non-therapeutic concentration level. Today, driven by growing population and improved incomes, global demand for livestock products is forecast to increase in the years ahead. The demand for ruminant protein sources (milk and meat) is expected to have grown at an annual rate of 1 – 1.5% between 2006 and 2050. However, consumer expectations have changed and, from now on, the forecast demand is expected to be not only quantitative but also qualitative. The livestock sector still needs to increase its production but in a challenging context of sustainability and health expectations from consumers. Indeed, new concerns emerge all the time regarding the environmental impact of agriculture. Effluent management, pesticide use and carbon footprint are daily topics of discussion. Among these concerns, the use of AGPs is an issue today worldwide due to the emergence of antimicrobial resistance. The use of AGPs can potentially compromise the therapeutic effectiveness of antimicrobial agents in veterinary and human medicine. The World Health Organization has released recommendations to restrict the use of AGPs. Several countries have already followed this recommendation, including the European Union with an AGP ban in 2006.

Table 1 – Results suggest that plant extracts could be used to replace monensin in commercial beef feedlot diets without impairing animal performance and by improving integrity status of the animals.

Parameter	Monensin	Plant Extracts	*P*-value
End Weight (kg)	417.50	429.30	0.01
ADG (kg)	1.70	1.77	0.04
DMI (kg/d)	8.96	10.05	0.09
Cold carcass (kg)	242.70	247.30	0.10

Ongoing challenge

The proposed mechanisms of action of antimicrobial agents are mainly based on direct antibiotic influence on the microbial composition. In ruminants, ionophores support a shift in fermentation from acetate to propionate by modifying the bacterial population. As propionate is the main glucose precursor for gluconeogenesis, this increased propionate supply provides more energy to the animal, supporting growth and feed efficiency. Nevertheless, recent findings have shown that the mode of action of antimicrobial agents is more complex than simply affecting microbial populations. Antimicrobial agents also appear to induce physiological responses by the host and particularly immune responses. A better understanding of the mechanisms of antimicrobial agents will facilitate the development of effective alternatives which can meet the needs of consumers.

Plant extracts as an alternative

With the objective of finding new alternatives to AGPs, plant extracts appear to be of interest as they have antimicrobial properties, but also due to their ability to trigger specific receptors that induce host responses. Pancosma, an

PHOTO: PANCOSMA

Plants extracts such as cinnamaldehyde, eugenol and capsicum oleoresin appear to be an effective alternative to AGPs in livestock.

internationally-renowned Swiss company, pioneered the development of additives based on plant extracts, identified eugenol (from clove bud oil) and cinnamaldehyde (from cinnamon) for their specific properties with proven effect on rumen fermentation. A decrease in the acetate/propionate ratio has been observed with animals fed a combination of these two active substances. This change leads to an effect similar to that of ionophores when it comes to volatile fatty acid production. Moreover, it had a significant effect on the inhibition of deamination, optimising the use of the degradable protein fraction by limiting ammonia losses.

Capsicum oleoresin (from red chili peppers) was also identified for its beneficial properties. In beef cattle, it induces a change in dietary behavior by altering intake patterns, and increasing salivation. For animals supplemented with capsicum oleoresin, water intake is also higher. These effects are of particular interest in challenging situations such as heat stress. Numerous scientific publications have demonstrated the ability of plant extracts to strengthen animal performance. One displayed results of a meta-analysis in growth and feed efficiency on growing animals fed a mixture of eugenol, cinnamaldehyde and capsicum oleoresin (Bravo *et al.*, 2009). This analysis showed consistent improvements in average daily gain (+2.8%) and efficiency (+2.6%). Furthermore, another study was conducted to determine the effectiveness of plant extracts containing capsicum oleoresin, cinnamaldehyde and eugenol as an alternative to monensin (Hagg *et al.*, 2013). In this study, average daily weight gain was increased for animals fed plant extracts compared to those fed monensin (*Table 1*). Dry matter intake tended to be higher in the plant extract group, and overall performance expressed as feed conversion ratio was not affected. Integrity parameters were also recorded and the percentage of cattle with a healthy rumen was improved when animals were supplemented with plant extracts.

Stability and standardization

The selection and association of plant extracts requires many years of research. Beyond the selection of the components, the dose rate of each extract is decisive. To induce a physiological response, animals must receive precise blends of plant extracts at the accurate dosage for each component.

The term essential oils is often used when discussing plant extracts. Essential oils are obtained from the plant volatile fraction by steam distillation. However, for a defined plant, this volatile fraction can be highly variable. Crop conditions, variety and meteorology can all lead to qualitative and quantitative differences in the composition of essential oils. When using plant extract compounds as feed additives, standardisation is therefore a key factor. The exact composition and concentration of active molecules must be known and transparent to ensure the correct dosage for each application. In the volatile fraction of plants, the most important active compounds are included in two chemical groups: terpenoids and phenylpropanoids. As these compounds are highly volatile, a technological process of encapsulation is then necessary to ensure the stability of the components in feeds.

Conclusion

Plant extracts such as cinnamaldehyde, eugenol and capsicum oleoresin appear to be an effective alternative to AGPs in terms of animal performance. Supplementation of plant extracts requires the use of a standardised and stable product with a transparent and specific composition. Dosage needs to be accurate and aligned with results from scientific studies in order to obtain the desired effect.