PHYTOGENICS: A TOOL TO IMPROVE EFFICIENCY IN LAMB FEEDLOTS

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"For successful lamb feed lotting, it is essential to have a basic understanding of the lamb's digestive system. A major issue is that the lamb's rumen is designed to act as a fermentation vat in which roughage (grass, straw, etc.) is broken down by microbes into volatile fatty acids, ammonia, and methane. This system benefits both the lamb and the microbes, as the lamb does not possess the enzymes capable of breaking down the roughage."

Lamb production plays an important role in the global food system and is a popular meat choice in many countries. China is the top producer of lamb meat, followed by Australia, New Zealand, Turkey, Algeria, and the United Kingdom. Lamb meat production systems vary from extensive to intensive, impacting performance and meat characteristics.

Lamb production through feedlot finishing is one of the main procedures to shorten the slaughtering age and ensure high-quality prime cuts. Feed costs for livestock are a substantial portion of production costs and can account for more than 63% of the total production costs in sheep (Neary, 1997; Raineri *et al.*, 2015). It is unlikely that feed costs will decrease soon due to increased competition for feed resources by energy industries and a growing human population. Improving feed efficiency is becoming more critical as feed costs continue to rise.

In recent years, there has also been an increasing concern about the environmental impact of ruminants due to their contributions to global greenhouse gas (GHG) emissions.

FEEDING THE FEEDLOT LAMB

For successful lamb feed lotting, it is essential to have a basic understanding of the lamb's digestive system. A major issue is that the lamb's rumen is designed to act as a fermentation vat in which roughage (grass, straw, etc.) is broken down by microbes into volatile fatty acids, ammonia, and methane. This system benefits both the lamb and the microbes, as the lamb does not possess the enzymes capable of breaking down the roughage. The microbes get to live in an ideal environment for them and help in roughage utilization.

Lambs need a high-energy and protein diet to proliferate. Cereal grains are usually the cheapest energy source and also supply some protein. Grains generally comprise between 65% and 85% of the finishing diet.

Regardless of equipment, there are typically two strategies for feeding grain. One is free-choice feed-

ing (also known as *ad libitum*, *ad lib*, or full feeding), where the animals always have feed available. The other is restricted feeding (or limited feeding), where producers dictate when and how much feed animals receive. Each has benefits and drawbacks, and the producers must decide which strategy is most appropriate based on their equipment and management ability.

ACIDOSIS

The lamb's digestive system is not designed to handle large amounts of grain. When suddenly introduced to grain, the rumen microbes will produce large amounts of lactic acid that cause severe animal metabolic stress.

The animal controls rumen acidity during eating and rumination by secreting saliva. When lambs eat, saliva containing sodium bicarbonate helps neutralize the acidity caused by microbial action. The quantity of saliva secreted depends largely on time spent eating and ruminating, as this is when saliva production is the greatest. Lambs can produce more than six liters of saliva in a day.

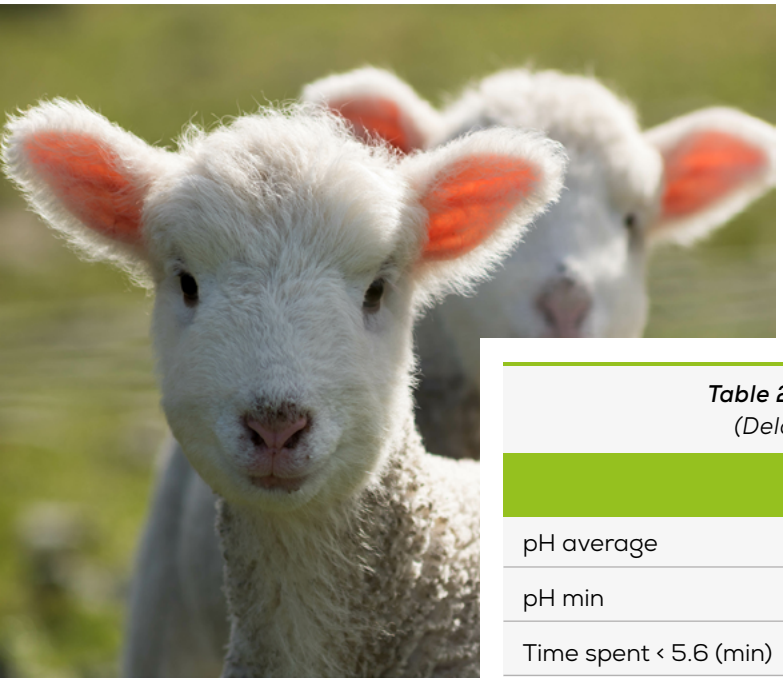
The amount of acid produced from fermentation is directly proportional to the digestibility of the feed. Therefore, only about half the acids are made from fermenting straw compared to the same weight of cereals. Because grain feeding requires less chewing and rumination time, the animal produces less saliva when fed cereal grain than when fed straw. The result is that if large amounts of cereal grains are fed to lambs, the rumen pH will drop to about 5.4 to 5.2. Diets with a lot of grain but lacking fiber usually lead to rumen acidosis.

The primary carbohydrate of cereal grains is starch. Cereal grains differ greatly in their starch content, with wheat and corn having the highest values (average 76%), followed by barley and oats (average 61% and 42%, respectively). The rate and extent of starch fermentation in the rumen differ significantly between grains and varieties of grains. Also, lambs differ from cattle in their ability to chew their food, impacting starch digestibility. Armstrong and Beever (1969), showed that when rolled barley, or ground corn, is fed to sheep, the total starch digestibility was 99,9%, and the proportion of starch disappearance before the small intestine was 91,8%, while when fed to cattle, the total starch digestibility was 98,5%, with 68% of the starch disappearing before the small intestine.

According to Nording and Capling (1979), the differences in the apparent digestibility of grains between species may be related to the physical size of the reticulo-omasal orifice, which is considerably greater in cattle than in sheep or goats. In cattle, unmasticated whole grains, which are those still resistant to enzyme attacks, can pass from the reticulo-rumen into the abomasum. Whereas in sheep or goats, similar grains are retained within the reticulo-rumen and subjected to further mastication during rumination, which results in rupture of the seed coat of most of the cereal grains so enzyme degradation can occur. This makes lambs more susceptible to rumen acidosis since they will have a higher amount of starch fermentation.

Affected lambs usually show a lack of appetite, depression, weakness, and a soft or watery scour. All these symptoms have a direct effect on performance, and animals with acidosis will have a lower average daily gain and a higher feed conversion rate. Furthermore, too much degradable starch in the rumen produces more propionate leading to less biohydrogenation of fats and more iso-fatty acids, which can impact the fat composition of the carcass (soft fat, taste alteration on the meat, etc.).

Sub-acute rumen acidosis is a common situation in lamb feedlots with an impact on the health of the animals, their performance, and carcass quality.



PHYTOGENIC FEED SOLUTIONS IN LAMB PRODUCTION

Besides good management and a well-balanced diet, one of the best methods to optimize intake, reduce feed costs, and improve feed efficiency of feedlot lambs is through the use of phytogenic feed additives. Substances like saponins, essential oils, and spices have been shown to improve feed efficiency and, therefore, performance in lambs.

In our research, Actifor™ Power ingredients have been shown to reduce starch concentration in feces when compared to the control diet (Table 1), which suggests optimized intestinal starch digestion and improved bypass starch utilization. This can result in improved energy efficiency of lamb diets.

The unique formulation of Actifor™ Power has been shown to help reduce starch degradation rate in the rumen (Delacon internal *in vivo* trial) and stimulate saliva production (INRA trial 2016). These two actions combined may contribute to stabilizing the physiological conditions of the rumen (Table 2).

Table 1. *Observed effects of feeding Actifor™ Power on fiber and starch digestibility (Delacon in vivo trial, Germany 2015)*

	Control	Actifor® Power
Feces consistency score[(1)]	3.3	2.8
Fibers presence score[(2)]	3.8	3.6
Sieve residue (%)	37.5	29.0
Starch in feces (g/kg DM)	1.99	1.82

[(1)]1 liquid à 5 hard [(2)]1 short à 5 long

Table 2. *Effect of Acifor™ Power on rumen pH (Delacon internal in vivo trial, NED 2020)*

	Control group	Actifor™Power group	Actifor™Power effect	P – value
pH average	5.85	5.86	+0.01	NS
pH min	4.94	5.25	+0.31	P<0.1
Time spent < 5.6 (min)	416.5	379.8	-36.7	P<0.1

Delacon™

ACTIFOR™ POWER

Phytogenic power to support profit:

Optimize your lambs' performance naturally!

High growth performance, along with enhanced feed efficiency, are key to profitability for livestock producers. The unique phytogenic substance formulation of **Actifor™ Power** supports feed intake, therefore increasing growth and performance.

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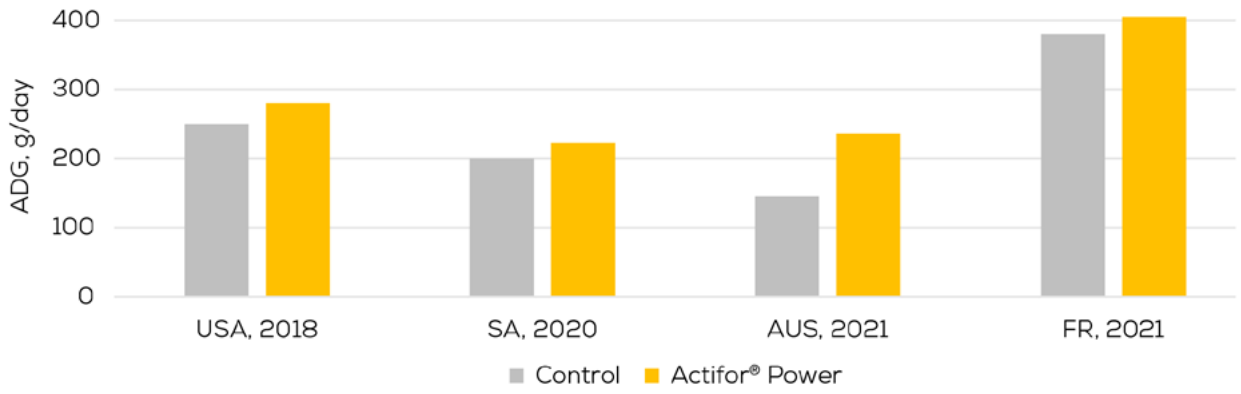

Figure 1. *Actifor™ Power trial results on Average Daily Gain with lambs in different countries (USA2018, Katadhim ram with BWinicial= 24.0kg; SA2020, Merinos/Dohne Merinos with BWinicial 28.8kg; AUS2021, Crossbreed x Merino with BWinital 44.3kg; FR2021, Romanov x Berricho with BWinitial 29.6kg).*

Tested in research facilities as well as in commercial farms, Actifor™ Power has shown to:

- improve average daily gain (reduce fattening time)(Delacon in vivo trials USA 2018, SA 2020, AUS 2021, FR2021);
- increase dry matter intake (Delacom in vivo trial, USA 2018);
- improve feed efficiency (Delacon in vivo trials, USA 2018, AUS 2021);
- support the maintenance of physiological pH levels (Delacon in vivo trial, NED 2020).

The conversion of feed energy to the final product is an essential determinant of the profitability of meat production. One of the significant sources of variation in the transformation of feed energy to net energy in lambs is the extent and rate of feed digestibility. Thus, phytogenic feed additives such as Actifor™ Power have improved feed efficiency, positively impacting rumen function and animal health.

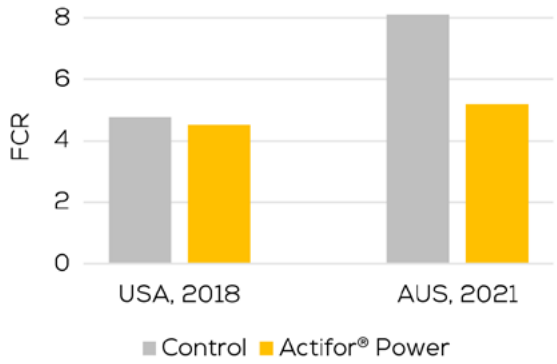

Figure 2. *Actifor™ Power trial results on Feed Conversion Rate with lambs in different countries (USA2018, Katadhim ram with BWinicial= 24.0kg; AUS2021, Crossbreed x Merino with BWinital 44.3kg.*

References are available upon request.

About Gonçalo Martins

Gonçalo Martins graduated in 2003 as veterinary at the University of Trás-os-Montes e Alto Douro (UTAD), Portugal. After his graduation, he started working as a practitioner in dairy and beef farms, where he was responsible for reproduction, internal medicine, and surgery.

Since 2005, Martins has been working in the animal nutrition business, with a focus on feed additives, as a Ruminant Technical Manager, giving technical assistance to dairy and beef farms, and as a Product Manager, where he was responsible for the technical support of the portfolio, assisting the sales teams.

Gonçalo Martins had already experienced working with phytogenic feed additives and to deepen his knowledge he joined Delacon, as Global Technical Manager Ruminant in December of 2018.