Effects of growth enhancers on residues in lamb

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The effects of steroidal growth implants and β- adrenergic agonist, alone, or in combination on feedlot performance and residues in lamb

Industry Sector: Cattle And Small Stock

Research Focus Area: Animal Products, Quality And Value-Adding

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Aims Of The Project

- To investigate the feedlot performance of feedlot lambs treated with different steroidal growth implants, alone or in combination with oral beta-agonist supplementation
- To investigate the effects of different steroidal growth implants, alone or in combination with oral beta-agonist supplementation on the residues in the meat

- To investigate the effects of different steroidal growth implants, alone or in combination with oral beta-agonist supplementation on carcass and meat quality

Executive Summary

The objective of this study was to compare four commonly used growth promotants in a commercial sheep feedlot. The steroidal growth promotants chosen for this trial were Ralgro (zeranol), Revalor G (Rev G; TBA/oestrogen- 17β), Revalor H (Rev H; TBA/oestrogen- 17β) and Zilmax® (zilpaterol hydrochloride). The growth promotants were compared with one another and within three sex groups, namely ewe, ram and wether (castrates), to determine which molecule or combination of molecules, if any, had the most benefit and profitability when measured against a control group. Sheep were stratified based on initial weights and then randomly allocated to treatment groups in a completely randomised control study. All sheep originated from the same farm, and they were of similar age, breed, transport method, processing method, feed (the only difference being the groups receiving Zilmax® during the last 18 days of feeding, making provision for 3 days withdrawal), weather conditions, housing and time on feed. A time constant termination date was used in this study, in order to measure the performance of lambs in treatment groups over time.

The experimental groups were compared over a 10 weeks feeding period according to growth and carcass parameters. The parameters that were measured were gain, FI (feed intake), FCR (feed conversion ratio), ADG (average daily gain), WCM (warm carcass mass), DP (dressing percentage), CL (carcass length) and CC (carcass compactness). Data was recorded in an Excel spread sheet and checked for accuracy. The effect of experimental treatments on growth and production parameters were analysed by means of the GLM ANOVA procedure in SAS (2006). Differences between treatment means were tested at the $P<0,05$ level of significance by means of the Bonferroni multiple range test in order to correct for unbalanced data (missing values). Correlations between variables were analysed by means of the Pearson product moment procedure in SAS.

Data was analysed within weeks, treatment phases and also over the entire experimental period. Effects of sex, steroid treatment and beta-agonist treatment and interaction effects were calculated. In terms of growth and slaughter parameters the use of zilpaterol hydrochloride alone proved most effective. The latter can be explained by the repartitioning effect of the BAR which increased protein accretion as a result. Benefits gained were not always statistically significant, however taking cost of treatment into account, there is a definite financial significance when choosing which combination of growth promotants to use. Muscle and liver samples were collected for residue analyses, which indicated no significant residue's in any of the treatment groups. The current data indicate that the use of the various combinations of growth enhancing molecules in sheep pose no risk to consumers in terms of the presence of residue's, provided that the molecules are used according to prescribed procedures and dosages.

Popular Article

In South-Africa, the finishing of cattle in a feedlot, has, over many years, become part of the value chain of marketing beef. Huge amounts of money have been made available for research to find the most cost-effective ways of producing high-quality beef (Le Riche, 2014). Relatively little research in intensive, sheep production for South-African conditions has been done up to now, leaving a number of questions regarding the safe use of certain growth-promoting agents.

Traditionally sheep were finished extensively on the veld as this was thought to be the least expensive option. Alternatively, farmers bought in lambs from others who did not have enough grazing and finished them on harvested corn fields. This is also an inexpensive option as the corn residues are readily available after harvesting. These practises, however, give rise to seasonable availability of lambs with resultant huge fluctuations in lamb meat prices. Furthermore, the national sheep herd has decreased significantly over the last decade. There are various reasons for this. Drought and the resulting reduction in grazing, being one, and the substantial stock losses due to theft and predators, to name but two, being another (Mokolo, 2011).

Whenever a product is in short supply its price escalates. As a result of this, lamb has become an expensive. There, however, remains a HUGE demand for lamb as it constitutes a major source of protein for a significant part of South-Africa's population. The constant production of lamb, that meets market specifications has thus become more and more important (Buttry & Dawson, 1990). In an effort to make lamb more readily and constantly available and also more affordable, lamb feedlotting is increasingly being used as a method for increasing the amount of meat being produced. Due to the current high cost of feed and the labour intensive nature of such ventures, the profit margin of a sheep feedlot can be very small.

At the present time it costs about R 326.00 to FINISH a lamb that is market ready within 70 days, (cost of the lamb excluded) (Le Riche, 2014). The total profit made on such a lamb after all production costs have been deducted could be as little as R24 – 00. The profit margin is dependent on the meat: feed price ratio. In an article by Voermol Feeds (2010) it is stated that feed conversion ratio is considered to be the critical aspect of feedlot profitability. Any reduction in feed intake or increase in feed efficiency, without compromising carcass quality, is economically important (Snowder & Van Vleck, 2003) Thus the lamb that converts feed the best (in other words the lamb that produces the most kilograms of meat, per kilogram of feed consumed), is the most profitable lamb. One could say that , an increase in profits constitutes a decrease in input cost and/or an increase in production output. Cost of feed is an important input cost, whilst growth rate and carcass composition is an important production output (Buttry & Dawson, 1990; Snowder & Van Vleck, 2003).

There is a need to balance more efficient food production, with positive public perception. This has become a great challenge. Professionals in the industry have to determine which products and methods could be optimally used to the benefit of the producers, without gaining negative opinions from the public sector and it has to go hand in hand with maintaining a high level of consumer safety (Buttry & Dawson, 1990).

Optimal feeding conditions that promote high voluntary intake, added to a high quality, properly balanced ration should promote profitability. The high cost of quality feed is, however, making it even more important to research the responsible, effective use of different types of growth promoting agents, alone or in combination. These products have the potential to: 1) produce animals with a higher meat: fat ratio; 2) to keep the feeding time down to a minimum and to thus reduce the impact on the environment; 3) to increase the ability to supply the protein needs of an ever-growing population.

The use of BAR agonists in ruminant production animals as a growth ENHANCER has been the subject of many heated debates and much media publicity. The reason for this is the very real potential that some of these products, clenbuterol, to name one, can have serious toxic effects in human consumers. (Stachel *et al.*, 2003). BAR agonists used as growth promoting agents, work on the basis that they reduce body fat whilst increasing muscle hypertrophy, without causing significant alterations in organ and bone mass. They are therefore also known as repartitioning agents

(Beermann, 2002). Repartitioning literally means the channelling of energy away from storage cells in the liver and adipose tissue towards muscle tissue. The sensitivity of liver and adipose tissue towards insulin is lessened whilst it is increased in muscle tissue (Beermann, 2002).
Their pharmacological action leads to an improved ADG, improved gain efficiency (G: F) and increased hot carcass weight in both feedlot beef and lambs (Reeds, 1991; Beermann, 2002; Estrada-Angulo, *et al.,* 2008). This effect is seen with no SUBSTANTIAL increase in daily DMI.
When age comparison studies were carried out, maturity of muscle tissues proved to be a critical factor with regards to efficacy .It would then make sense that receptor presence and availability would be important in the physiological effect of this drug as mature muscle would have a higher density of receptors available (Beerman, 2002). The lack of response or reduced response in young animals would also act as proof that young muscle fibres lack enough Beta adrenergic receptors, according to Beerman, (2002).

BAR agonists, such as Zilmax® function by stimulating mainly β2- AR. This causes muscle hypertrophy and hyperplasia, lipolysis and reduced lypogenesis as well as the indirect effect of lowered insulin sensitivity. According to Baxa *et.al.* (2010), it does have beneficial effects to treat animals with anabolic steroid implants first, following with the oral application of ZH. Cattle that received this combination treatment showed additive improvements to lean carcass mass and performance, such as ADG and FCR.
Growth enhancers such as hormonal implants and repartitioning agents such as zilpaterol hydrochloride are used in intensive production systems to reduce the cost of production by decreasing the feeding time, improving feed conversion and increasing the carcass slaughter weight (Pritchard, 1998; Duckett & Andrae, 2001).This should prove to be true for both cattle and sheep feedlots. According to Casey (1998) the efficacy of β- receptor agonists are determined by the relationship between the chemical structure of the compound, the theoretical number of receptors that need to be stimulated to elicit a response and the resultant effect when the β2 receptors are stimulated.

Conclusions
In sheep the best reaction is obtained when Zilmax® is fed during the last 18 – 25 days (usually 21 days) of finishing, leaving time for a three day withdrawal period before slaughter. Previous studies indicate that a minimum of 48 hours was necessary in cattle, to reach a minimal residual level. It can be expected that sheep would generally react in the same manner. At present, the acceptable dosage for ruminants is 0.15 mg/kg/day which cconstitutesa dosage of 70 g/ ton of feed in sheep.

Please contact the Primary Researcher if you need a copy of the comprehensive report of this project – Prof Edward Webb on edward.webb@up.ac.za