Determining the Ideal Forage: Concentrate Ratio for Feedlot Lambs

Research Team

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Abstract

Grain-based diets are often fed to feedlot lambs to improve weight gain and reduce time to market, but some forage is required to maintain optimum rumen health. This project was designed to determine the ideal forage: concentrate ratio for market lambs by looking at indicators of growth performance and rumen health. Forty-eight Rideau-Arcott/Dorset ram lambs (~30 kg) were randomly assigned to one of six test diets (100%, 80%, 60%, 40%, 20%, and 0% chopped hay, with the remainder of the diet primarily ground corn [64.7% DM] and DDGS [31.8% DM]). Ram lambs were individually fed using Calan gate feeders. Lambs were fed once daily and feed refusals of hay and grain were weighed separately each morning. Lambs were weighed each Monday to record animal growth. On day 1 and 35, lambs received an indwelling pH data logger which recorded reticular-rumen pH every 5 minutes. After day 70, the lambs were slaughtered and pH probes recovered. Rumen health and liver abscess scores were recorded for each lamb and a spot rumen pH measurement was recorded. Preliminary results included average daily gain, average daily intake, feed: gain ratio, and final weights across diets.

Understanding how dietary fibre requirements impact rumen pH can result in more cost-efficient diets, while maintaining animal health and growth performance.

Bigger May Not Always Be Better: Optimizing Genetic Gain for Carcass Yield and Quality

Research Team

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Abstract

The competing demands of maximizing revenue while maintaining processor and customer satisfaction are an on-going challenge for Canadian sheep producers. Producer revenue from lambs sold through rail-graded marketing systems is often highly dependent on carcass yield in terms of the lamb's hot carcass weight (HCW). In contrast, carcass fatness (FATGR) and muscularity (CONF) are both important from processor and consumer perspectives as they impact saleable meat yield. Therefore, genetic selection for carcass traits must balance improvement of both yield and quality traits. In previous research, economic values of $6.81 per kilogram of HCW, -$1.25 per milimetre of FATGR and $2.93 per point of CONF were estimated, based on the price grid classification system utilized by Quebec's Heavy Lamb Sales Agency. Thus, it is currently more economically advantageous to select for lambs with increased carcass yield, rather than greater carcass quality. Furthermore, the inclusion of carcass traits in a terminal sire selection index was expected to increase carcass yield but have little impact on carcass quality. Optimally, however, proposed terminal sire selection indexes should balance genetic gain for carcass yield and quality traits, since it is likely that price grids will more stringently penalize poor quality carcasses in the future. Therefore, the objective of this research was to evaluate the influence of carcass trait economic values on expected selection response under proposed terminal sire selection indexes. The results of this research will indicate how selection indexes may need to adapt to meet changing market demands for increased carcass quality.

Identifying genetic resistance to Haemonchus contortus in Ontario grazing sheep

Research Team

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Abstract

Gastrointestinal nematode (GIN) infections are considered the most important disease of grazing sheep. Among the GINs found in Ontario sheep, Haemonchus contortus is the most pathogenic, attaching to the abomasum and ingesting blood and causing anemia, poor appetite and death. Control of this parasite relies heavily on anthelmintics, but alternatives must be explored due to H. contortus rapidly developing anthelmintic resistance, as well as increased consumer concerns about chemically treated animals for food consumption. Alternative tools, such as genetic selection for resistance to H. contortus infection, which can be used as part of a sustainable integrated parasite-management program.

The liver is an important participant in the host defense against GINs, due to its role in inflammation, pathogen clearance and stress. Therefore, liver tissue was collected from sheep naturally exposed to H. contortus for further transcriptomic analysis. The transcriptome refers to the full range of genes expressed in a tissue at a specific time point. These sheep were identified as HIGH and MEDIUM stress responding sheep (n=29), HIGH and LOW immune responding sheep (n=29), and control sheep (n=16). Based on abomasum worm count post-slaughter, 29 liver tissues were selected; HIGH stress responders (n=6), MEDIUM stress responders (n=6), HIGH immune responders (n=5), LOW immune responders (n=5), and control animals (n=7). Total RNA was isolated from these 29 tissues to perform RNA-Sequencing and differential gene expression analysis between groups. Transcriptomic analysis will identify a list

Risk Assessment for the Incursion and Establishment of Orbiviruses in Ontario, Canada

Research Team

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Abstract

Epizootic hemorrhagic disease (EHDV) and bluetongue viruses (BTV) are midge-borne orbiviruses presenting imminent threats to Ontario's wildlife and livestock populations. Spreading northward in North America, they may be facilitated by changing climatic conditions. Recent detection of BTV-seropositive cattle and documentation of *Culicoides sonorensis* mi in the province suggest that Ontario is at risk for the incursion and establishment of EHDV and BTV. Ontario ruminants ar immunologically naïve to these viruses; their introduction may lead to negative impacts on wild cervid populations and li stock (farmed cattle, sheep and deer) through morbidity, mortality and production loss. We sought to character- ize *Culicoides* vector biology and assess for recent and/or ongoing transmission of EHDV and BTV in wild cervids and lives in Ontario for two spring-summer field seasons (2017-2018). During the 2017 field season, CDC-type LED light traps were placed on farms and in natural areas across southern Ontario, and *Culicoides* vectors were taxonomically and molecularl identified. Blood from wild cervids and livestock were screened for antibodies to EHDV and BTV by ELISA and confirmed virus neutralization assay. Data will be statistically analyzed to investigate regional and temporal patterns in vector distri tion and disease associations with age, sex, seasonality, and weather. During the 2017 season, we identified two white-t deer that died of EHDV (serotype 2) and 15 seropositive cattle (serotype 2); these represent the first EHDV cases reporte Ontario, Canada. These results will help improve current policies and practices for safeguarding Ontario livestock and wil cervid populations.

Potential Effect of Different Fecal Egg Counting Procedures on Genetic Evaluations for *Haemonchus* Resistance in Sheep

Research Team

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Abstract

The purpose of this study was to evaluate the difference in measurements between two different methodologies used to perform parasite fecal egg counting (FEC) in sheep, “Cornell McMaster” and “Triple Chamber McMaster”. Fecal samples were collected from a total of 114 sheep from Breezy Ridge Farm (Ontario) and each sample was evaluated using two different egg counting procedures: 1) “Cornell McMaster”; which has a lower detection limit of 50 fecal eggs per gram; and 2) “Triple Chamber McMaster”; which is more sensitive, having a lower detection limit of 8 fecal eggs per gram. Both procedures are highly correlated, 0.78, and 0.90, for Pearson, and Spearman correlations. However, the estimated mean difference between the procedures was significant ($P < 0.0001$), indicating that data from both FEC procedures need an adjustment to be comparable. When records for Triple Chamber McMaster were normalized to Cornell McMaster, by converting mean and standard deviation, the mean difference under log scale between the adjusted data and the original Cornell McMaster data did not significantly differ from zero ($P > 0.05$). Therefore, records from both methodologies can be pre-adjusted to be combined. It is recommended to include the FEC procedure used along with FEC records in the database used for sheep national genetic evaluation, to allow for adjustment, or ideally using as standard procedure the most sensitive methodology to achieve a better accuracy in

Optimizing Food Rations for Prolific Ewes at the End of the Pregnancy Period and New Born Lamb Management to Reduce Neonatal Mortality Rate.

Research Team

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Abstract

The end of pregnancy is a critical period in sheep production. If food rations do not meet energy demand, ewes must convert fat in energy, which produce ketone bodies. The accumulation of these metabolite wastes cause pregnancy toxemia. Some affected ewes will die while others will present lambing difficulty, placental retention, decrease in quality and quantity of colostrum and poor lactation.

This project aimed to study the effects of food rations in order to optimize zootechnical performances and colostrum production, reduce ewes' metabolic problems and lambs' mortality and identify the best time to detect pregnancy toxemia.

One hundred and two prolific females at the end of pregnancy were divided into three treatments [Control: NRC 2007; T-Adjusted: NRC 2007, adjusted according to the actual DMI); Energy: NRC 2007, adjusted to real DMI and energy increased by 15%].

As a result, the recommendations for food rations at the end of pregnancy must be revised. NRC 2007 overestimates the prolific ewes' dry matter intake during pregnancy and forage under 30% ADF seems desirable during the transition period. Also, energy within the ration must be limited for ewes in late pregnancy and additional energy input is not desirable. An interesting fact: BHB (using pharmaceutical strips in barn) is a fast and reliable measure for detecting sub-clinical cases of toxemia. It is highly correlated with metabolic profiles done in laboratory. Finally, colostrum quality could be evaluated using a Brix refractometer. It is a simple technique to measure antibodies concentration.

A Better Understanding of the Effect of Climate on *Haemonchus Contortus* Parasite Load in Rideau-Arcott Sheep

Research Team

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Abstract

Haemonchus contortus (*H. contortus*) is a gastrointestinal nematode prevalent in Canadian sheep that often causes haemonchosis, a disease difficult to detect because it bears few symptoms besides blood loss anemia, thereby resulting in sporadic deaths and substantial financial losses to producers. The goal of this research is to propose strategies for predicting parasite burden in sheep based on climate data and FAMACHA© scoring. Data from 570 Rideau-Arcott sheep between 2012 and 2017 including fecal egg count (FEC) and FAMACHA© score (method used to measure level of anemia) was collected from Breezy Ridge Farm (Ontario). Climate data including maximum temperature-humidity index (THI), minimum THI, average THI, total precipitation, number days precipitation >1mm, number days precipitation >5mm, mean temperature, and mean relative humidity over 4 and 8 week periods, 3 weeks prior to fecal sampling was collected. LogFEC1 values (FEC1=first fecal egg count of the season) was found to be significantly correlated to minimum THI (P=0.04), number days precipitation >1mm (P=4.2e-0.5), number days precipitation >5mm (P=0.01), and mean relative humidity (P=5.8e-0.4) at 4 weeks, and number days precipitation >1mm (P=8.1e-12) and number days precipitation >5mm (P=4.7e-0.6) at 8 weeks. However, these factors explain little of the variance observed among the data (R^2=0.11). LogFEC1 and FAMACHA1 values were adjusted for variables having significant effect (year of sampling for FAMACHA1 (P=0.02; R^2=0.03)). The correlation between FEC1 and FAMACHA1 was low (r=0.12). This may be due to the limited number of records for FAMACHA1. Further analyses

Fecal egg count trends in progeny of Rideau-Arcott sires selected for genetic resistance to Haemonchus contortus

Research Team

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Abstract

Haemonchus contortus (H. contortus) is a gastrointestinal nematode prevalent in Canadian sheep. It often causes haemonchosis, a disease that causes few detectable symptoms besides blood loss anemia, and results in sporadic deaths and substantial financial losses to producers. The overall goal of the broader research is to evaluate sheep traits possibly indicative of genetic resistance to H. contortus. In this study, fecal egg count (FEC) was evaluated as an indicator of severity of H. contortus burden, where a lower FEC indicates a lower parasite burden. FEC from 531 progeny of 30 Rideau-Arcott sires was measured from 2012 to 2017. Management practices were kept similar through the years of sampling; ram lambs were confined to one paddock to increase parasite load. Progeny tested in 2012 and 2013 were bred by sires without FEC. Each year thereafter, progeny sires were selected to breed if they had the lowest FEC on the basis of a two-sample average FEC. Results showed an average decrease of 65 eggs per gram (epg) per year ($P<0.0001$) in sire progeny over a 5-year period with 95% confidence that FEC decreased between 44 and 86 epg per year. This breeding strategy explained 6% of the variance in FEC ($R2=0.06$). This might be a reasonable amount given that FEC heritability ranges from 20 to 40%. Longer-term study is warranted to verify the effect of sire selection on reducing H. contortus FEC.

Assessing in Vitro Thermal Resilience of Stress-Phenotyped Sheep

Research Team

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Abstract

Climate change is predicted to increase the incidence of heat waves and temperature extremes. This may exert stress on livestock, which could have negative implications for their health and production. Thermal stress for example, is well-documented to increase livestock susceptibility to disease and reduce overall animal performance. Since the stress response varies among individuals and is moderately to highly heritable, genetics likely contributes to variation in tolerance to thermal stress; and this could be improved with selective breeding. Intravenous challenge with lipopolysaccharide (LPS) endotoxin (400 ng/kg) is a well-documented model of bacterial endotoxemia. This can occur during an acute Gram-negative bacterial infection and during heat stress due to increased gut permeability. Therefore, LPS inflammatory challenge was used to stress phenotype 94 female sheep and classify them into high (H), middle (M) and low
(L) responding groups. Cortisol levels were measured 0 and 4 hours post LPS challenge, and rectal temperature was recorded at one-hour intervals to monitor the fever response. Peripheral blood mononuclear cells (PBMC) will be isolated from 9 H, M, and L stress responding sheep and subjected in vitro to heat (42°C) and cold (4°C) treatment for one hour. PBMC thermal stress resilience will be functionally characterized by measuring viability, proliferation, nitric oxide production, and heat shock protein 70 expression. Identifying the optimal stress response for thermal tolerance will help to establish breeding strategies to develop animals that will be healthier and more productive in a destabilizing climate

Coccidiosis on Ontario Sheep Farms: Combining Field Prevalence of *Eimeria* Species with Producer Surveys to Maximize Coccidiosis Management

Research Team

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Abstract

Coccidiosis is caused by pathogenic *Eimeria* species. Both clinical and subclinical disease can cause weight loss and diarrhea sometimes associated with high morbidity and mortality makes coccidiosis an economic burden on the small ruminant industry. From this group of host specific species that infect sheep, only certain *Eimeria* species are considered to be highly pathogenic. Less pathogenic species can be excreted at large numbers without causing any clinical effects and pathogenic species can cause intestinal damage that reduces oocyst shedding; consequently, conventional enumeration methods can be unreliable for assessing the health impact of infections. Therefore identification of individual species, particularly those that are the most pathogenic, is crucial information for effective and targeted anticoccidial treatment. There are many methods for prevention and treatment of coccidiosis critical for minimizing the impact of this disease on sheep herd. Prevention methods including environmental sanitation, decreasing overcrowding, maintaining herd health and reducing stress; these can help prevent disease outbreaks. Minimal exposure to the organism can aid in developing immunity. When environmental control is not adequate, multiple anticoccidial drugs (e.g. Baycox[Symbol]) can be used for both treatment and prevention. There has been minimal investigation on how producers manage and treat coccidiosis on their farms and there have been no systematic prevalence studies of *Eimeria* species in Ontario sheep since 1984. The goal of this project is to: (1) gather information on coccidiosis management practices on Ontario sheep farms through producer surveys; and, (2) identify *Eimeria* species causing coccidiosis on Ontario sheep farms.

Immune and Climate-Stress Assessment of Sheep to Identify a Resilient Phenotype

Research Team

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Abstract

Livestock is affected by bacterial pathogens that negatively impact their health, growth, production and reproduction ability. The impact of these bacterial stressors on sheep is supposed to increase due to the forecasted climate change, imposing a significant economic burden worldwide. The innate immune response to different types of bacterial stressors varies across species, breed, and individuals, and its influence by genetics and environmental factors is well-documented. Hence, it is imperative to develop breeding strategies taking the innate immune response into consideration so that genetic and epigenetic resilience of sheep can be enhanced. The present study will categorize the animals based on their innate immune response against immune and thermal challenge. Induction of inflammatory response in sheep using intravenously injected lipopolysaccharide (LPS) (400ng/kg) will categorize the animals into high (H), middle (M) and low (L) innate immune responders based on their interleukin (IL-1β and IL-10) responses at pre (0h) and post (4h) challenge stages. Further, peripheral blood mononuclear cells (PBMCs) will be isolated from representative animals from each category to assess the effect of heat and cold stressors. *In vitro* exposure of PBMCs to heat shock at 42°C and cold shock at 4°C for 1h will be further characterized using cellular assays (viability, proliferation, cytotoxicity, apoptosis), ROS production and changes in genes expression of heat shock proteins (*HSP70, 90, 60*). Association of innate immune response with heat stress will help to enhance the understanding of innate immunity and help to identify the stress- resilient phenotype in sheep that could be further used to improve breeding strategies.

M3[1] Parasite Monitoring – A Proposal

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Abstract

Internal parasites are one of the greatest costs to sheep producers in flock mortality, morbidity and lost production. Overuse of anthelmintics has resulted in widespread resistance to these products. Current best practices to reduce development of resistance includes leaving a refugia and uses monitoring techniques such as fecal egg counts (FECs) and FAMACHA. The problem is how to use FECs in large flocks where individual counts are not practical. This method proposes using a statistically valid subsample to accurately predict the parasite profile of the flock and estimate the size of refugia that could be left untreated. Pooled samples do not provide sufficient information in either of these areas. The proposed sampling times allows the shepherd to evaluate their management practices during a set period and the associated environmental conditions. End of season analysis allows the shepherd to make some decisions on management failures and successes. Finally, a combination of production and treatment history allows the producer to determine which animals to retain or cull and breeding directions. These allow for increasing flock resistance to parasites without losing ground on production.

Maus Monitoring Method

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