R&D in Agriculture
A Bulletin on Information Resources

Small Ruminants

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Theme: SMALL RUMINANTS

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PRODUCTION SYSTEMS

Cardisr Project on YouTube
Videos on Small Ruminants: Nutrition, Husbandry, Health, Artificial Insemination, Value-added products
https://www.youtube.com/channel/UCNMS38kDUfHyzoQxDktPnAg/about

The CARDI-NZ Small Ruminants project aims at helping farmers in the sheep and goat industry to increase productivity through the use of best practice husbandry and enterprise management techniques. To aid in this goal, the Caribbean Agriculture Research and Development Institute (CARDI) in collaboration with The University of the West Indies (UWI) AgriNeTT Team seek to implement a Web-Based E-Learning Platform. This video channel is part of the Platform where videos are to be stored.

Neonatal Survival in Sheep: Challenges in the Bahamas

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<u>Abstract</u>

Neonatal survival in sheep (Ovis aries) represents a significant loss of income to farmers. Despite significant research in this area, small ruminant production is still severely affected by neonatal mortality. More than 50% of lamb deaths occur on the day of birth. Poor maternal nutrition resulting in low birth weight, insufficient colostrums production by ewes and ingestion by lambs, birthing difficulty, litter size and poor postnatal management are all important contributors to pre-weaning mortality. The objective of this research was to identify the cause of neonatal mortalities at the livestock unit of The Bahamas Agriculture and Marine Sciences Institute in North Andros, Bahamas. A total of 183 births were recorded over an eight-week period in 125 local Bahama breed of sheep managed in an extensive or intensive system. A 40% mortality rate was recorded and could be attributed to improper housing, poor maternal nutrition during gestation, low birth weight and hypoxia from birthing difficulty. In the extensively managed system, 5% of the neonatal lambs succumbed to predators like vultures. It was concluded that prenatal management needed to be improved through the introduction of enriched feeds and mineral licks, thereby improving birth weight and colostrum production in ewes. Proper lambing pens were recommended to provide a more protective enclosure thereby preventing accidents from poor infrastructure. Vigilant observation of lambs born in the field was also recommended to guard against predators.

Keywords: Neonatal mortality, colostrum, Bahama breed, birthing
https://www.cfcs1963.org/s/CFCS_2017_Vol-53-San-Juan-PR.pdf

FEEDS AND FORAGES

Dichanthium hay combined with green cassava foliage or pelleted cassava foliage as fed for Black Belly rams

Nathalie Minatchy, Carine Marie-Magdeleine, Valériuse Calif, Yoan Félicité, Fred Periacarpin, Christian Deloumeau, Frederic Pommier & Harry Archimède

Abstract
Intake, digestion and nitrogen retention were measured in fifteen 1-year-old Black Belly rams that had an average weight of 35.3 (± 1.59) kg and that consumed mixed diets. Diets consisted of old _Dichanthium_ spp. hay distributed ad libitum, combined with 500 g (dry matter basis) of green or pelleted cassava foliage. Alfalfa pellets were used as a control for foliage supplement. The experiment was run in a 3 × 3 Latin square design. Total dry matter intake was lower ($P < 0.05$) with the green foliage cassava diet compared with the alfalfa pellet diet. Differences were not significant ($P < 0.12$) with the green cassava foliage diet compared with the cassava foliage pellet diet. Total tract digestion of organic matter, crude protein and cell wall components in cassava green foliage and cassava foliage pellet diets were significantly lower than in the alfalfa diet. Crude protein total tract digestion was similar for cassava green foliage and cassava foliage pellet diets, while fibre digestion was lower with cassava green foliage diets. Retained nitrogen was significantly higher with the alfalfa diet compared with cassava diets—between which there were no differences. Urinary nitrogen excretion was similar between all diets. In conclusion, pelleting does not decrease the feed value of cassava foliage, but this value is nevertheless lower than the feed value of alfalfa.

Effect of two agro-pedo-climatic zones, drying methods and pelleting processes on chemical composition of Manihot esculenta (sp.), Leucaena leucocephala and Cajanus cajan

Nathalie Minatchy, Harry Archimède, Dingamgoto Jesse Barde, Liza Dahome, Fernand Labirin, Brigitte Calif and Carine Marie-Magdeleine .

Abstract
In tropical and subtropical countries, livestock productivity may be affected by the availability of food resources and the high prevalence of gastrointestinal pathogenic nematodes. The classical method of control using anthelmintic drugs is becoming decreasingly efficient because of a generalised resistance of the gastrointestinal nematodes suppress (GIN) to most of the drugs. In small farms, protein-rich biomasses with significant amounts of condensed tannins (CT), which are known to have anthelminbtic properties, might be good candidates to produce nutraceuticals. This experiment was conducted to determine the feasibility of producing nutraceutical pellets from Manihot esculenta sp., Cajanus cajan and Leucaena leucocephala, considering the influence of agro-pedo-climatic conditions plant species and technological factors, such as drying and pelleting. The samples were harvested in two different agro-pedo-climatic zones and sundried under shelter (at 25 to 35°C) or in a ventilated oven (45°C) before pelleting. Chemical analysis on crude protein and condensed tannins were conducted. The chemical composition of the plants did not vary significantly with agro-pedo-climatic conditions. Sun-drying and oven-drying decreased the CT content of the plants. No effect of pelleting was recorded on crude protein and CT contents, except for C. cajan, for which a small decrease in CT content was

observed. Protein-rich foliage types with CT contents above 50 g/kg of dry matter are potentially good candidates to produce nutraceutical pellets if they are dried using mild drying conditions, like sun-drying under shelter.

Sustainable sheep and goat production through strategic nutritional management and advanced technologies
Susan A. McCoard, David R. Stevens, Travis R. Whitney
2020.
IN Editor(s): Fuller W. Bazer, G. Cliff Lamb, Guoyao Wu. **Animal Agriculture:** *Sustainability, Challenges and Innovations*, Academic Press, 2020. Chapter 13
ISBN 9780128170526

Abstract
A sustainable future for sheep and goat production throughout the world is that derived from pastures and forages, grazed *in situ*, utilizing resources such as hill lands that are unable to support other productive enterprises. Providing appropriate nutrition, especially from non-human edible supplemental ingredients, to achieve production and profitability goals of the landholder can be challenging in these situations. This chapter uses case studies from New Zealand and the United States of America to highlight productivity and efficiency improvements over the past 30 years, and challenges associated with balancing the needs of production, biodiversity and urbanization, as a template to highlight the practical changes of forage use, management techniques and nutritional practices that have underpinned those changes. The principles highlighted may act as a blueprint for future efficiency gains and reduction of the environmental footprint of animal agriculture systems using pasture and forage-based nutrition systems.

BREEDING / REPRODUCTION

Genetics and breeding of sheep and goats
Elisha Gootwine
2020.
IN Editor(s): Fuller W. Bazer, G. Cliff Lamb, Guoyao Wu. **Animal Agriculture:** *Sustainability, Challenges and Innovations,* Academic Press, 2020. Chapter 10
ISBN 9780128170526

Abstract
Sheep and goats comprise some 1,155 and 576 breeds respectively. Traditionally, genetic breeding in small ruminants for efficient meat, milk and fiber production involved introgression of new breeds and strains, within-breed selection and crossbreeding. Sequencing of the ovine and goat genomes, and the development of high-throughput SNP arrays have revolutionized animal breeding work. However, our current knowledge on causative mutations that affect reproduction, production and health traits in

sheep and goats remain limited. New constraints are posing challenges for breeders of small ruminants including climate change, increased awareness of the environment and of animal welfare and increasing consumer demand for high-quality meat and milk products. Modern breeding tools such as cloning, transgenesis, gene-editing and microbiome genotyping may expand the genetic variation in each species, leading to breeding for new traits and new products.

Proportional hazard models associated with the survival of dairy goats reared in a tropical environment

Talita A. Ferreira, Paulo G.M.A. Martins, Gabriela C. Gouveia, Luíza R.A. Abreu, Aurora M.G. Gouveia, Olivardo Facó, Enrico A. Colosimo, Iraides F. Furusho-Garcia, Idalmo G. Pereira,

Abstract

Increasing the functional life of a doe in order to keep the most productive females in the herd as long as possible can result in a reduction of replacement costs because of the better utilization of the animal in the production system. Thus, the objective was to evaluate the influence of environment effect, and morphometric and type traits on the culling that limits the stay of a doe of an exotic dairy goat breed reared in a tropical climate in the herd (stayability). The data utilized in the present study had information of 1439 **Saanen** does, born between 2000 and 2015, from 17 herds. The stay in the herd for longer than 28 months of age (STAY28), that is lack of culling, was defined as successful; the does' records were then not censored (C = 1). On the other hand, does kept in the herd for less than 28 months had their records censored (C = 0), once we considered that she still would kid. Does sold to other farmers were considered censored. Information regarding birth year, birth season, herd, six morphometric traits, and 12 visual appraisal-scored traits were evaluated. The Cox proportional hazard rate and the Kaplan-Meier models were fitted to analyze the data. Birth year, body length, rump width, feet and legs soundness, udder, and teat conformation were the traits that affected STAY28. For each birth year, body length, and rump width, reductions of 4 %, 2 %, and 5 % were observed on the culling hazard of a doe, respectively. Does with great scores for traits related to the mammary system were prematurely culled from the herd. In conclusion, STAY28 can be used as a selection criterion based on the aforementioned morphological and type traits, since it is effective to early detect individuals that will stay longer and more productive in a herd. Therefore, these traits should be considered in breeding programs.

Reproductive physiology of sheep (Ovis aries) and goats (Capra aegagrus hircus)

Fuller W. Bazer

Abstract

Sheep and goats are considered small ruminants that play a key role in provision of meat, wool, mohair, and milk to humans. Sheep and goats can graze grasslands and other marginal lands that are not arable to make a significant economic impact on the quality of life for humans. Further, a combination of sound management practices and genetic selection can increase prolificacy of ewes and does to reduce

numbers of ewes and does required to meet demands from products of small ruminants, i.e., meat, milk and fiber. This chapter will review some history of the roles of sheep and goats, their reproductive system, the estrous cycle and the physiology of pregnancy.

Reproductive management of sheep and goats
Reid Redden, Jacob W. Thorne
Abstract
Proper reproductive management is a critical factor for the sustainability of the sheep and goat industry worldwide. Does and ewes can produce two or more offspring annually, yet routinely fall short of this benchmark. Refined management, strategic genetic selection, and consistent supply (Constant supply of what?) are priorities for sustainable small ruminant production globally. Sheep and goats are capable of survival in a wide variety of climates and environments and enhance agriculture production in both developed and underdeveloped regions of the world. Producer application of best management practices often limits sheep and goat production efficiency and proper reproductive management being paramount among these factors. This chapter outlines the tools and strategies to improve reproductive management across varied production settings.

Genes for resilience to heat stress in small ruminants: A review
V. Sejian, M. Bagath, G. Krishnan, V.P. Rashamol, P. Pragna, C. Devaraj, R. Bhatta,
Abstract
Small ruminants have several advantages for being an integral part of the pastoral production system because of their short gestation period, high prolificacy, rapid growth rate, high feed conversion efficiency, high diseases resistance capacity as well as easy marketability. Among the various weather variables, heat stress was reported to be the most detrimental factor for the economy of small ruminant production. There are a number of candidate genes that are highly associated with adaptation of small ruminants to heat stress. The genes encoding growth hormone (GH), growth hormone receptor (GHR), insulin like growth factor-1 (IGF-1), leptin (LEP), leptin receptor (LEPR) and thyroid hormone receptor (THR) are associated with the impact of heat stress on the physiological growth pathways in small ruminants. Further, GnRH, follicle stimulating hormone receptor (FSHR), luteinizing hormone receptor (LHR), inhibin, progesterone receptor and estradiol receptor (ESTR) are important reproductive genes which reflect the impact of heat stress on the reproductive performance of small ruminants. In addition, toll-like receptor 2 (TLR2), TLR3, TLR8, TLR10, interleukin 2 (IL2) and IL10 are considered as immunological markers during heat stress exposure in small ruminants. Heat shock factor 1 (HSF1), heat shock protein 60 (HSP60), HSP70, HSP90 and ubiquitin are found to be associated with resilience capacity of small ruminants to heat stress challenges. Among these thermo-tolerant genes, HSP70 was established to be the ideal genetic marker for thermo-tolerance in small ruminants. Further, the

advanced molecular biological techniques are used to validate the data obtained using chip based microarray or the next generation sequencing (NGS) data to identify the various genes associated with heat stress pathways. Thus, the identification of cellular and molecular markers may pave way for development of climate resilient breeds using marker assisted breeding programs.

A mini-atlas of gene expression for the domestic goat (Capra hircus)

C Muriuki, S.J Bush, M. Salavati, M.E.B. McCulloch, Z.M Lisowski, , M Agaba, A Djikeng, D.A. Hume and E.L. Clark

Abstract

Goats (*Capra hircus*) are an economically important livestock species providing meat and milk across the globe. They are of particular importance in tropical agri-systems contributing to sustainable agriculture, alleviation of poverty, social cohesion, and utilisation of marginal grazing. There are excellent genetic and genomic resources available for goats, including a highly contiguous reference genome (ARS1). However, gene expression information is limited in comparison to other ruminants. To support functional annotation of the genome and comparative transcriptomics, we created a mini-atlas of gene expression for the domestic goat. RNA-Seq analysis of 17 transcriptionally rich tissues and 3 cell-types detected the majority (90%) of predicted protein-coding transcripts and assigned informative gene names to more than 1000 previously unannotated protein-coding genes in the current reference genome for goat (ARS1). Using network-based cluster analysis, we grouped genes according to their expression patterns and assigned those groups of coexpressed genes to specific cell populations or pathways. We describe clusters of genes expressed in the gastro-intestinal tract and provide the expression profiles across tissues of a subset of genes associated with functional traits. Comparative analysis of the goat atlas with the larger sheep gene expression atlas dataset revealed transcriptional similarities between macrophage associated signatures in the sheep and goats sampled in this study. The goat transcriptomic resource complements the large gene expression dataset we have generated for sheep and contributes to the available genomic resources for interpretation of the relationship between genotype and phenotype in small ruminants.

Recent advances in goat artificial insemination in Brazil

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Abstract

This review reports the advances of goat Artificial Insemination (AI) in Brazil in the last two decades. These advances were based primarily on the study and knowledge of the reproductive events of goats subjected to different methods of control of the estrous cycle and ovulation. These approaches are mainly related to the development and precise characterization of protocols of estrus induction and synchronization in goats during either the natural breeding or nonbreeding season. In parallel, the Embrapa Technique of cervical AI through cervical immobilization in goats was developed. In association, the studies characterized the cervical mucus and the ideal moment for AI execution with different types of semen. Prototypes and an AI kit were developed and tested at both laboratory and field conditions in the national dairy goat breeding program - CapraGene®. Factors affectingthe pregnancy rate after AI were identified and classified. Studies based on transrectal ultrasonography have revealed the prevalence of reproductive disorders characterizing the major problems associated with subfertility or infertility in the goat. All these studies allowed to consolidate one of the most productive and applied collections of AI knowledge in goats of the last 20 years in Brazil.

Keywords: artificial insemination, estrous cycle control, goat.

https://ainfo.cnptia.embrapa.br/digital/bitstream/item/199402/1/cnpc-2019-Recent.pdf

https://www.embrapa.br/busca-de-publicacoes/-/publicacao/1110546/recent-advances-in-goat-artificial-insemination-in-brazil

Establishment of small ruminants breeding certification system in Belize through the technical cooperation with Taiwan

Pin-Nan Lee

2018. Caribbean Food Crops Society, pp.33

Proceedings of the 54th Annual Meeting Caribbean Food Crops Society, 8-13 July 2018, Ramada Belize City Princess Hotel, Belize City, Belize. Edited by Wilfredo Colón and Ina Sanchez

Abstract

Belize launched the breeding certification system through the technical cooperation with Taiwan to start the breed's genetic improvement program for small ruminant's development in the country. In order to provide quality purebred breeding stock with three generation pedigree, the certification categorizes into blood registration and certification. The blood registration includes basal registration for the local breeding sheep and goats (gene purification is un-known), confirm registration, which is second generation bred between dam with basal registration and certified breeding sire (gene purification stands for at least 50%) and re-confirm registration, which is the third generation upgraded by the certified sire (gene purification stands for at least 75%).

The breeding stock certificate (gene purification stands for above 85%) will be granted to the stocks successively upgraded up through blood registration or those which were certificated before importing. Preparation and submission of breeding and parturition record, blood certificate (if any) and application forms , meeting the candidates' age limit (above 3 months) and evaluation should be taken through the visual appraisal criteria are the main protocol to register or certify the breeding stocks. The breeding certification committee, comprises by the representatives from MOA (Ministry of Agriculture), BAHA (Belize Agricultural Health Authority), BLPA (Belize Livestock Productive Association), UB (University of Belize) and the Genetic Improvement in Sheep and Goat Project, aims to gather power of the authority concerns to assist the sheep and goat business, genetic improvement, and increase added-value of breeding stock, market differentiation and farmers' income in Belize.

https://www.cfcs1963.org/s/Proceedings-54th-CFCS-Belize-City-Belize-2018.pdf

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Longevity, an adaptation trait of Creole goats to tropical climate

Zsuppan, Z., Arquet, R., Mahieu, M. and Mandonnet, N.

Abstract

The importance of longevity as an economically trait gives a picture of the flock efficiency and adaptation in a particular environment. A study was conducted in the experimental herd of Creole goats at INRA in Guadeloupe in order to test environmental (year and season at first kidding, age at first kidding and weight at first mating as well as genetic (index of resistance, sire) factors that affect longevity of does. Lifetime data set of 387 Creole does, reared at pasture all year long, was recorded over a period of 11 years (2001-2012). Does were bred for reproduction at 11months of age. Three mating periods were organized per year, corresponding to 3 climatic seasons, using buck effect. Data were analyzed using survival models (Survival Kit 6.1). The average age for culling was 5.03 years. The culling rate was higher for goats between 2 and 3 years (17 and 24%) and then gradually decreased. Year and season at first kidding did not have a long term influence on does' longevity; neither does age at first kidding. In contrast, weight at first mating had a significant effect and it can be recommended to farmers to mate primiparous goats heavier than 17 kg. Heritability was estimated to 0.16 allowing some genetic progress. No significant correlation was shown with the genetic breeding value of resistance to gastrointestinal parasitism. This study gave indications to breeders to improve their female flock management and increase does' longevity.

Keywords: local breed, adaptation, tropical, longevity, goat

https://www.cfcs1963.org/s/CFCS_2016_Vol-52-Le-Gosier-GuadeloupeLR.pdf

GOAT MEAT QUALITY

A review of factors affecting goat meat quality and mitigating strategies

Pamela Pophiwa, Edward Cottington Webb, Lorinda Frylinck

Abstract

Goat meat is increasing in popularity worldwide due to a growing demand for lean and nutritious meat. It is important to have an understanding of factors affecting goat meat quality in order to ensure the best possible quality acceptable to consumers. This paper reviews current knowledge on key factors and strategies for improving goat meat quality. Among animal factors, the breed/genetics and age at slaughter are key to goat meat quality. Conditioning of goats destined for slaughter can improve the quality of meat through more desirable carcass fat content. It has been established that goat carcasses have low glycolytic potential and consequently yield higher pH meat, therefore, minimising ante-mortem stress is important for goat meat quality. Goat carcasses are very small and lean, therefore, chilling conditions should be carefully monitored in order to minimise the risk of cold shortening. Electrical stimulation of carcasses has been reported to improve goat meat tenderness. Pelvic suspension of goat carcasses may result in improved meat tenderness compared to Achilles-hung carcasses. Post-slaughter ageing can further improve the tenderness of goat meat. Several efforts have been made to address the concerns pertaining to goat meat quality, but the challenge now is to promote the consumption of goat meat among diverse consumers and establish it as a dietetically acceptable red meat source.

Keywords: Ageing, Goat meat quality, Slaughter conditions, Stress

https://www.sciencedirect.com/science/article/abs/pii/S0921448819302445

STATISTICS

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