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Effect of treating *Eragrostis curvula* hay with urea or nitrate on *in vitro* digestibility, fermentation and methane emission

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The need to reduce enteric methane in ruminants has stimulated further research in the use dietary nitrate as an alternative to urea. Nitrate can potentially serve as a source of rumen fermentable nitrogen and at the same time serve as an alternative hydrogen sink in the rumen, thereby improving poor quality roughage utilization and reduce methane emission. However, the ability of nitrate to replace urea in feeding systems is not much reported on. This study was undertaken with an objective of evaluating the effect of treating *Eragrostis curvula* hay with varying levels of urea or calcium nitrate on forage digestibility and *in vitro* fermentation. Grass hay was treated with urea or calcium nitrate at 0.5%, 1.0% and 1.5% DM. Each treatment had three replicates and was followed by 30days anaerobic storage in airtight glass bottles. Samples of supplemented (0 d) and treated (30 d) grass hay was dried, milled and evaluated for *in vitro* organic matter digestibility; methane and total gas production; while rumen fluid was analysed for pH, ammonia nitrogen and VFAs. For urea diets, *in vitro* organic matter digestibility (IVOMD) was highest in the treated group (30-day) compared to the supplemented group (0-day) across the levels of inclusion studied, while for nitrate treated diets, generally lower IVOMD were recorded. Nitrate significantly reduced methane production with increasing levels of inclusion of nitrate, while there was no significant reduction in the urea diets. While urea treatment seems to improve feed utilization, it did not confer additional benefits when compared to treatment with calcium nitrate that provided the additional benefit of methane reduction with an acceptable level of feed digestion and fermentation.

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Gender ownership and its impact on livestock productivity: A case study of small-holder farming system at Msinga

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The study aimed at evaluating goat and cattle ownership and how it impacts on productivity in the communal farming system, as well as discovering challenges militating against its commercialization. In each of the three communities, thirty (30) homesteads were selected based on their willingness to participate and possession of goats and cattle. Hence, a total of 90 homesteads were used for the questionnaire interview and focus group discussions were held in the three communities. Questionnaire data were sorted by gender of homestead head and analyzed using frequency procedure of SAS (2013). Homesteads headed by males had higher numbers of cattle and goats than those headed by females, in the ratio of 2.5 and 1.9, respectively. It was noted that cattle served more cultural purposes (42.3 %) compared to income (22.2%), prestige (18.2%), meat (12.5%) and milk (4.8%) purposes. Goats serve cultural (38.9%), prestige (29.9%), income (19.2%), meat (11.5%) and milk (2.5%) purposes. Farmers pointed out that livestock numbers increased due to reproduction (40%) and buying (30%). All respondents grazed livestock on communal land without due regard for watering. About 70% mortality was due to diseases, water and feed shortage which have prevented increased livestock production, followed by pilfering, dog attack and poor management practices. There is a need for profit-maximizing programmes that would encourage a perspective shift in the culture towards livestock farming with respect to routine management in feeding, common diseases and breeding. Also the establishment of pest and disease control, grazing lands and water availability for agricultural purposes will greatly enhance production performance.

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Effect of season on ruminant feeding behaviour and body weight changes

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This study was done to evaluate seasonal responses of ruminants based on roughage qualities, feeding behaviour, *in vitro* digestibility, gas production of fed forages and live body weight changes. Data from this study were captured over three seasonal periods (dry, early wet and late wet seasons). Observations were made for 48 hrs to determine feeding behaviour of cattle and goats at different seasons. Live weight changes were recorded at the start and end of each season. Selected livestock (three cattle and four goats) were dosed with a marker to determine the particle passage rate through the rumen and hind gut, and faecal samples were collected over seven days. *In vitro* digestibility was done to determine the dry matter digestibility and gas production of consumed forages. A total of 66 cattle and 132 goats were sampled for live weight change, heart girth and length with calibrated weight tape measurement over three seasons. Data showed that there were seasonal ($P<0.05$) effects on the length of time cattle and goats spent grazing, ruminating, walking and standing in dry to early wet and to late wet seasons. Live weight changes differed ($P<0.05$) in dry and early wet seasons compared to late wet seasons. Hearth girth was significant in goats across the seasons. Particle passage rate through the rumen and hind gut, digestion and retention times are different across seasons. Animal and season interaction affected ($P<0.001$) particle passage rate through the rumen and hindgut. *In vitro* gas production at 6 hrs and 44 hrs were different to 20 hrs. Adequate understanding of seasonal effects will help improve management practices towards ruminant production.

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Effects of duration of electrical stimulation and carcass weight on carcass pH, temperature profile and shear force of zilmax treated beef carcasses

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Electrical stimulation (ES), which helps to improve carcass and meat quality has become a routine practice in most of the commercial abattoirs in South Africa and beyond. However, there are still controversies about the amount and duration of optimally effective and efficient simulation. Carcass weight, on the other hand, is also increasingly posing challenges in terms of chilling and ES due to improved production practices and administration of growth enhancers like zilpaterol hydrochloride (zilmax).

In this study, low voltage ES (LVES) (110V) was used to evaluate the effects of duration of ES (30 sec, 60 sec and no stimulation (control)) on two extreme carcass weights (≤ 130kg & ≥ 145kg sides), according to the abattoir grading system. Attributes evaluated were carcass pH and temperature profile over 24hrs, and shear force (N) of *M. longissimus dorsi* meat samples. One hundred and sixty-two, mostly "A" grade, South African feedlot-type, zilmax treated cattle (mainly steers) were used.

Results revealed a significant difference in the initial carcass pH (45 min) between the 30sec and 60sec ES duration. No other differences in pH profiles were found. Also, apart from the 3hr pH, which showed a difference between the small and big carcass sides, there were no differences in terms of carcass pH between carcass weight categories. Carcass temperatures differed between 45min and 3hr post mortem due to ES duration. The effects of 6hr, 12hr and 24hr temperatures were not different in terms of ES duration. Also, in terms of carcass temperature, there were significant differences between the two carcass weights throughout the temperature profile, with the bigger carcasses displaying higher temperatures throughout. Regarding meat shear force, there were no significant differences in terms of ES duration both at 3 and 14 days post-mortem (p.m). Likewise, regarding carcass weight, there were no significant differences between the two weight categories in terms of shear force at 3 and 14 days p.m. However, at 3 days p.m, the bigger carcasses displayed a numerically smaller shear force (88.94N) compared to the smaller sides (92.12N) and this shows a high tendency to be significant (0.077).

These results show that LVES can be used to save costs and time by increasing productivity and line speed while minimising risks at abattoirs.

Motility of Boer buck spermatozoa stored fresh for 72 hours

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Spermatozoa are subjected to chemical, osmotic, thermal, and mechanical stresses during processing and storage. This is why semen extension is a tool used to enhance cervical and trans-cervical artificial insemination (AI) in species such as the goat. The present study was designed to assess the changes in the motion patterns of the Boer goat spermatozoa when stored fresh for 72 hours at ambient temperature (25 °C on a table), 5 °C, 12°C and 17 °C in programmable refrigerators. Fractions of ejaculates were collected six times from four (n = 4) Boer goat bucks aged 3.12 ±0.55, through an artificial vagina (AV). They were diluted in Biladyl® (Bi®) and Triladyl® (Tri®) extenders at a ratio of 1:5 v / v (semen to extender) at 37°C. The diluted ejaculates (four equal parts from each extender) were immediately subjected to rapid cooling by dropping each tube in a glass beaker of water from the tap (25 °C). The tubes were then immediately transferred into their respective storage conditions where they spent 72 hours.

At the end of every 12 hours, spermatozoa motility parameters were assessed using a computer assisted semen analyzer (Sperm Class Analyzer, S. C. A®, version 5.4, Microptic S.L. Barcelona, Spain). Total motility (TM), spermatozoa progression (PROG), curvilinear (VCL) and straight (VSL) velocity, linearity (LIN), amplitude of lateral head displacement (ALH), beat cross frequency (BCF) etc. were recorded. ANOVA analysis revealed that the extender type (E) affected ($P < 0.01$) most of the spermatozoa parameters from the interaction with storage time (S) in both of the extenders. The TM reduced ($P < 0.05$) from 96% to 69% ± 3.72 and 95% to 71% ± 3.72 in Bi® and Tri® respectively. The PROG reduced ($P < 0.05$) from 66 to 17% ±1.71, and 42% to 19% ± 1.71 in Bi® and Tri® (1.71) responsible. The extender E type also affected ($P < 0.01$) all spermatozoa kinematic features with S. After the 72 hour period of storage, VCL, VSL, VAP, LIN, STR, and WOB reduced ($P < 0.05$) drastically from 115 to 86 and 119 to 92 ± 4.81, 64 to 26 and 61 to 33 ± 2.52, 71 to 42 and 79 to 53 ± 3.03, 45 to 26 and 45 to 29 ± 3.08, 73 to 47 and 75 to 51 ± 3.31, and 69 to 46 ± 3.33 in Bi® and Tri® respectively. With suitable protocol put in place, both extenders can maintain the Boer goat spermatozoa motility at specific refrigerator temperatures.

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Effects of intense inbreeding on growth traits in *Oreochromis mossambicus*

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Tilapia species plays an important food security role in developing countries, but is often farmed by farmers with very little technical knowledge about breeding. When animals are kept in groups and depend on natural mating, inbreeding is inevitable, as inducing spawning by artificial means is impossible. Large amounts of inbreeding in these farming communities may reduce production efficiency. In as much as inbreeding is unavoidable, understanding its effects may aid in the decision making processes of breeding programmes, especially in developing countries. The extent of inbreeding in small-scale production systems farming with tilapia should be estimated to create awareness and alleviate the effects of inbreeding. Therefore, the objective of this study was to evaluate tilapia (*Oreochromis mossambicus*) productivity under the maximum possible inbreeding conditions. Full-sib matings were conducted on *O. mossambicus* for three generations at Welgevallen experimental farm at the University of Stellenbosch. A total of 25 males and 25 females were used as the parental stock, where a 14-day spawning period was followed by three generations of full-sib mating. Measurements of body weight (BW), standard length (SL) and specific growth rate (SGR) were recorded for each of the sixteen randomly sampled fish per replicate, at two weeks growth intervals for the period of 90 days at each generation. Regression analysis was used to determine the rate of phenotypic depression per unit increase in F and analysis of variance used to establish the difference between the means. The results show that BW, SL and SGR decreased with increase in inbreeding at each generation. Average inbreeding depression for BW ranged from 8.35 to 46.57%, while the average inbreeding depression per 10% increase of inbreeding ranged from -12.42 to -18.62%. For SL, the mean inbreeding depression was 18.15 and 17.95% at G2 and G3, respectively. Inbreeding depression coefficients for SL were -7.2 % at F = 0.250 and -4.79% at F = 0.375 per 10% increase of inbreeding. The inbreeding depression for SGR was 21.76 and 20.34% at F = 0.250 and F = 0.375, respectively. Per ten percent increase in inbreeding, inbreeding depression coefficient was -8.70% at F = 0.250 and -5.43% at F = 0.375 for SGR. These results show the extent of inbreeding that can be expected under extreme conditions where it is not controlled, especially where technical knowledge is lacking. They indicate that inbreeding reduces the performance of *O. mossambicus*; hence such decrease in performance may be addressed by minimizing inbreeding, which can be achieved by avoiding the mating of full-sibs. Therefore, if inbreeding is not checked in the small-scale production systems, production will decrease over time.

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Microbiological assessment of Suya Meat (an intermediate moisture meat) in Oyo State, South-Western Nigeria

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Suya (Hausa language for "roasted meat" or "fried meat") is an intermediate moisture meat that is easy to prepare from boneless meat and is highly relished in Nigeria. Its consumption cuts across all social classes and it is served at parties, clubs, and social outings. In an attempt to assess the influence of environment on its hygienic conditions and safety, this study was conducted to determine the bacteriological assessment of suya meat sold in Oyo state, Nigeria.

Sixty four (64) ready-to-eat suya samples were collected at various popular suya selling points across the four agricultural zones in the state. The agricultural zones are Ibadan-Ibarapa, Oyo, Ogbomoso and Saki. Sixteen (16) samples each were collected in 4 selected local governments in each zone. The swabs were taken to the laboratory where serial dilution, inoculation of diluents into a sterile nutrient agar for incubation and catalase test and gram staining for characterization and identification were conducted.

The results of the various isolates that were identified and their frequencies of occurrence showed that *Klebsiella pneumonia* (25%) was ranked highest, followed by *Staphylococcus aureus* (19%), and *Escherichia coli* (19%). *Bacillus subtilis* was next with 13% while other isolates observed were *Staphylococcus saprophyticus* (6%), *Klebsiella oxytoca* (6%), *Enterobacter cloaca* (6%), and *Citrobacter freundi* (6%).

This has revealed that the product (suya) constitutes a food safety risk to consumers as they are predisposed to food-borne infections and health challenges emanating from the environment. Improved hygienic practices during processing, handling and packaging are hereby advocated.

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Molecular characterization and polymorphism of three keratin associated protein genes in South African Angora goats

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South Africa is the largest producer of mohair world-wide, and keratin has long been known to influence the strength and characteristics of these hair fibres. Keratin associated proteins have been identified as the main component of keratin. Molecular research on Angora goats and mohair production previously focused on the use of DNA markers such as single nucleotide polymorphisms and microsatellites and the identification of quantitative trait loci. Direct DNA sequencing of genes known to affect fibre production, such as the keratin associated proteins, has not yet been investigated in Angora goats. Three keratin associated protein genes, namely *KAP 1.1*, *KAP8.1*, and *KAP 13.3*, were isolated from three different populations of goat, namely Angora, Boer goat, and AngoraXBoer goat (cashgora). Polymerase chain reaction was used to isolate and label the genes under inspection, which were then DNA sequenced to identify the basepair sequences. These sequences were analysed using CLC Bio sequence viewer, and polymorphisms identified. The alleles identified were further investigated for association with any of the three different production types. Eight new alleles were identified for KAP 1.1, based on a combination of five different SNP positions. Four alleles were identified for KAP 8.1, based on a combination of three SNP positions, of which one (allele D), was unique to the Boer goat population. KAP 13.3 was the most polymorph, with a total of 19 alleles identified, of which 11 were new variants. KAP 13.3 alleles were formed by a combination of 17 SNP positions, some of which were inherited as a haplotype. Preliminary results indicate specific allele associations for the different production types, with different secondary protein structures for different alleles. Angora goats were the most diverse for each gene investigated, and Boer goats the least diverse. Arlequin was used to generate an AMOVA for statistical evaluation of the allelic results. Investigation of the polymorphism and phenotypic associations of these genes can ease genetic improvement by allowing more accurate and earlier selection of animals.

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Effects of sex and stocking density on broiler performance in a subtropical environment

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The objective of every broiler producer is to maximize the kilograms of chicken produced per unit of floor space, while simultaneously reducing losses due to overcrowding, in order to attain optimum economic returns. The current study was conducted to investigate the effects of sex and stocking density and interaction between them, if any, on growth performance and carcass characteristics of broiler chickens in a semi-arid, sub-tropical environment. One thousand and eight day-old Cobb Avian, 48 chicks, 462 males and 546 females, were reared at stocking densities of 30, 35 and 40 kg body weight per square meter (BW/m^2) during a 42-day production period. The experiment was a 2×3 factorial in a completely randomized design and each sex-stocking density combination was replicated three times. After the initial weighing, the birds were individually weighed (in grams) weekly until 42 d. Carcass characteristics were also measured after slaughter, at day 42, and expressed as percentages of body weight. The data were analysed by analysis of variance using the general linear models (GLM) procedure of Minitab16 (Minitab, 2014) followed by standard means separation. Males gained more weight and were heavier at slaughter age (2649 ± 43.1) than females (2270 ± 43.1). There was a progressive reduction in feed intake with increasing stocking density ($P<0.05$), but neither sex nor stocking density influenced feed conversion ratio or mortality rate ($P>0.05$). There were significant sex effects on percentages of carcass, breast, neck, shank, heart and abdominal fat ($P<0.01$), and thigh, liver and gizzard ($P<0.05$). Stocking density influenced percentages of carcass, breast, thigh, drumstick, neck, shank, liver and gizzard ($P<0.01$).There were sex × stocking density interaction effects on percentages of thigh and liver ($P<0.05$). It is therefore recommended that, for profitable broiler production in the tropics and subtropics, for a 42-day production cycle, Cobb Avian48 males reared at the stocking density of 40 kg BW/m^2 be considered as the best option.

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The effect of indigenous chicken egg yolk concentration and temperature on short-term preservation of South African indigenous goat semen

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The aim of the study was to evaluate the indigenous chicken egg yolk concentration and temperature (5˚C or 25˚C) on short-term preservation of South African indigenous goat semen. Semen was collected from four mature bucks using an artificial vagina (AV) during the natural breeding season and pooled. Prior to allocation into groups for short-term preservation, semen samples were evaluated for micro- and macroscopic traits. The experiment was designed as a completely randomised block design with four egg yolk concentrations (0%, 5%, 10% and 20%) and two temperatures (5˚C or 25˚C) groups. The semen samples were then randomly allocated into Tris-based extender with 0%, 5%, 10% and 20% egg yolk respectively, and divided into eight groups and stored at 5˚C (4 groups) and 25˚C (4 groups) for 72 h. Sperm motility rates were evaluated at 3, 24, 48 and 72 h using a Computer Aided Sperm Analysis (CASA). Sperm cell viability and morphology was evaluated using a fluorescence microscope. Data was analysed using analysis of variance (ANOVA). Treatment means were separated using Fisher's protected t-test. The 0% group (Tris extender without egg yolk) maintained sperm motility rate and viability until 48 h at 5˚C. Addition of egg yolk into extender had no effect on short-term preservation of goat sperm cells morphology at 5˚C for 3 h. Semen extended with Tris without egg yolk and stored at 5˚C resulted in higher numbers of live, normal sperm than semen stored at 25˚C. Sperm motility rates declined with progress in storage time, irrespective of egg yolk concentrations. Semen samples stored at 25˚C for 24 h were not motile. In conclusion, goat semen extended with 20% egg yolk concentration had higher numbers of live, normal sperm when stored at 5˚C for 24 h. It is also not advisable to store semen at 25˚C for a short-time. However, more studies are required to validate the effectiveness of egg yolk for short-term goat semen preservation.

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Allelic diversity of the BoLA-DRB3.2 region in beef cattle in South Africa

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The major histocompatibility complex (MHC) in cattle, known as the bovine leukocyte antigen (BoLA), is an important component of the immune system. The class II genes are responsible for the expression of molecules that bind processed peptides from extracellular antigens, and have been associated with immune responsiveness in cattle. Indigenous cattle breeds occurring in regions where certain ticks are endemic tend to have a lower susceptability to tick-borne diseases compared to exotic breeds. The locally developed breeds' higher resistance to tick-borne diseases has been attributed to the smoother and shorter coats which prevent the attachment of ticks; furthermore resistance to ticks in general has been ascribed to various adaptive, i.e. acquired, and non-adaptive, i.e. innate, immune factors. The BoLA-DRB3.2 region has been associated with tick resistance in cattle. The aim of this study was to investigate the allelic variation found within the BoLA-DRB3.2 region in South African beef cattle. Preliminary results on 40 Bonsmara and 8 Hereford cattle genotyped with four microsatellites in the DRB3.2 region (DRB3, DRBP1, BM1815 and RM185) are presented. A higher average allele number was found in the Bonsmara than in the Hereford (7.75 vs 5.25), and 11 private alleles were identified for the Bonsmara, while only one was found in the Hereford. The polymorphic information content (PIC) of the four-microsatellite panel was 0.73. The difference between expected and observed heterozygosity was higher in the Hereford (0.816 vs 0.896) compared to the Bonsmara (0.758 vs 0.764). This study will also include Nguni genotypes, and the infection status of these animals, along with the genotyped Bonsmara and Hereford cattle, will be determined by amplifying protozoan and bacterial DNA in the blood with diagnostic primers. This method allows for the identification of sub-clinical infections. This will be combined with the allelic information in the BoLA-DRB3.2 region, and will allow the search for an association between specific alleles and tick-borne infections.

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Long term effect of dietary lipid saturation on eggshell quality and bone characteristics of laying hens

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This study was conducted to determine the long term exposure effects of dietary lipid saturation on eggshell quality and bone characteristics of hens at end-of-lay (58 – 74 weeks of age). Five iso-energetic (12.6 MJ AME/kg DM) and iso-nitrogenous (170 g CP/kg DM) diets were formulated using different lipid sources at a constant 30 g/kg inclusion level. The control n-3 diet was formulated using a blend (50:50) of linseed- and fish oil, while fish oil was used in the polyunsaturated n-3 (PUFA n-3) diet. In the polyunsaturated n-6 diet (PUFA n-6), sunflower oil was used, whereas in the mono-unsaturated n-9 diet (MUFA n-9) high oleic acid sunflower oil was used as supplementary lipid source. Lastly, tallow was used as lipid source in the saturated fatty acid (SFA) diet. Two hundred, individually caged, Hy-Line Silver-Brown hens (20 weeks of age) were randomly allocated to the five dietary treatments (n=40 replicates/treatment) and received the experimental diets for 54 weeks from 20 to 74 weeks of age. During weeks 58, 62, 66, 70 and 74 of age (end-of-lay period) twenty eggs/treatment/day (n=140 eggs/treatment/week) were selected for determining external eggshell quality parameters. At the end of the experimental period (74 weeks of age), ten birds per treatment (n=10/treatment) were randomly selected and slaughtered for the determination of bone quality characteristics. Data were statistically analysed ($P<0.05$) using a fully randomised one-way ANOVA procedure. Dietary treatment had no effect ($P>0.05$) on external eggshell quality parameters such as eggshell weight (5.90 g), eggshell thickness (356.2 µ), eggshell surface area (71.90 cm2), shell weight per unit surface area (82.10 mg/cm2), percentage eggshell (9.78%) and eggshell Ca content (2.20 g). The MUFA n-9 treatment resulted in the highest ($P<0.05$) humerus (5.65 g) and femur weight (10.34 g), as well as the highest tibia (51.07%) and femur ash content (52.99%). The mean humerus weight was the lowest ($P<0.05$) for the control treatment (4.88 g), while the SFA treatment had the lowest ($P<0.05$) tibia ash (46.15%), femur ash (46.56%) and percentage femur bone (0.52%). Percentage femur bone (0.57%) was the highest ($P<0.05$) for the PUFA n-3 treatment. Although some of the bone quality parameters were influenced ($P<0.05$) by dietary lipid saturation, results were variable and no clear tendency could be established. Results of this study suggested that the long term exposure (54 weeks) of laying hens to diets varying in their lipid saturation level (MUFA, PUFA & SFA) had no pronounced negative effects on eggshell and/or bone quality characteristics at end-of-lay.

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The characterisation of semen from Zulu rams raised under extensive management conditions in Kwazulu-Natal

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The Zulu sheep are an Nguni breed indigenous to the Kwa-Zulu Natal (KZN) Province in South Africa and are reported to be under threat. Studies on investigating some factors that may be the cause of the declining numbers are required for strategic planning of conservation programs. This study was designed to evaluate some of the factors viz. ram age, season and geographic location, that influence reproduction in Zulu sheep populations based on the virility of Zulu rams. Spermiogramic parameters used to assess quality were: scrotal circumference (cm); semen volume (ml); semen pH; sperm concentration ($x10^9$), progressive and mass motility (%), and percentages of live and abnormal spermatozoa. Semen samples were collected via electro-ejaculation and analyzed using a microscope, and scrotal circumference measured using a flexible measuring tape. All data was analyzed using the statistical software SPSS version 22. The average semen volume (ml) per ejaculate was 0.66, 1.11, 1.19, 0.82 and the sperm concentration ($x10^9$) 1.69, 2.79, 3.12, 3.07 for the summer, autumn, winter and spring (respectively). The effects of age on all parameters were significant except for pH. The results indicated that there is a positive correlation between age and semen volume, concentration and semen colour. The values of volume, concentration, motility and live sperm, increased linearly up to 3 years of age. It was observed that scrotal circumference and live spermatozoa were comparatively higher for rams at 3 years of age than at 4 years of age, while the values were almost similar at 1 and 2 years of age. The percentage of abnormal spermatozoa decreased progressively up to 3 years of age thereafter increasing from 4 years of age. The semen quality improved up to 3 years of age and thereafter decreased. The effects of season on semen quality were positively correlated in some of the geographic locations. These results show that it would be more efficient to select among the 3 year old rams for breeding during autumn and winter for conservation purposes.

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Effect of dietary energy level on performance of yearling male feedlot cattle during the summer

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This study was conducted to determine the effect of dietary energy on feed efficiency, cortisol level and body temperature of yearling male beef cattle during the summer. The experiment was conducted during summer months, daily ambient temperatures recorded ranged from 22 ± 1 to 29 ± 7 ^{o}C. These are considered high ambient temperatures. A complete randomized design was used. Cortisol was measured in serum samples and rectal temperature was also recorded. The dietary treatments were ME_{10} (10 MJ ME/kg DM), ME_{12} (12 MJ ME/kg DM) and ME_{13} (13 MJ ME/kg DM).

Dietary energy level had no effect (P>0.05) on body temperature of the cattle. Cortisol level was similar (P>0.05) in both Bonsmara and Nguni cattle fed diets differing in energy levels; however, dietary energy level had an effect (P<0.05) on cortisol level of Brahman cattle. Cortisol level was better (P<0.05) in Brahman cattle fed on diets low in energy (ME_{10} and ME_{12}) than those fed on a diet high in energy (ME_{13}). These results indicate that an increase in dietary energy improves (P<0.05) feed efficiency of the cattle and that cattle breeds differ in complex interactions of environmental conditions and physiological responses when fed different dietary energy diets.

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Blood metabolite profiles, body condition scores and growth performance of Nguni goats raised under traditional management systems

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The effect of traditional tethering and herding goat management systems was assessed through monitoring blood metabolite profiles, body condition score and fortnightly weights of forty eight Nguni goats. Twenty four of the goats were tethered for five hours every day from 0800- 1300 hours and the other 24 were herded during the same period on false Thornveld from January to May 2015, at University of Fort Hare, Honeydale Research Farm. The goats had an average age of six and half months at the beginning of the study. Initial live weights were 21.42 ± 1.12 kg and 21.39 ± 1.19 kg for goats that were tethered and those that were herded, respectively. Blood samples were collected fortnightly, in the morning before foraging, by jugular venipuncture using 18 ml gauge needles. There were significant interaction effect of management and fortnight of collection on urea, creatinine, BCS and creatine kinase levels. Urea levels were higher for goats that were tethered (5.38 ± 0.08 mmol) compared to those that were herded (4.78 ± 0.08 mmol/ L) from the 8th week to the end of the study period. Creatinine levels were higher in goats that were tethered (57.15 ± 0.59 µmol/L) compared to those that were herded (55.71 ± 0.62 µmol/L) for the first 17 weeks of the study. Creatine kinase levels averaged 241.49 ± 9.95 µmol/L and 218.85 ± 10.24 µmol/L for goats that were tethered and those that were herded, respectively. Fortnight of collection significantly affected glucose and albumin levels. Management had no effects on total protein levels which were 63.20 ± 0.71 g/Lfor tethered goats compared to 62.48 ± 0.74 g/L for herded goats. The live weights were significantly affected by type of management and fortnight of weight measurement and ranged from 20.29 ± 1.03 to 26.5 ± 1.05 kg compared to 21.32 ± 1.13 to 28.52 ± 1.05 kg for goats that were tethered and herded respectively. It was concluded that management system and fortnight of measurement jointly affected the level of blood metabolites and BCS. Further, live weights were affected by the management system which was higher for goats that were herded for the longer duration of the study period.

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Cortisol, rectal and skin temperatures as affected by body condition, hair-coat and skin traits in Nguni and nondescript cattle

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The study evaluated the effects of hair-coat traits, skin characteristics and body condition on cortisol, skin and rectal temperatures of Nguni and nondescript cattle reared extensively. Forty (40) clinically healthy steers (20 Nguni and 20 nondescript) were used in a study conducted from February to May 2015 at Honeydale Research Farm, Alice. Ages of steers ranged from 12 to 16 months at the beginning of the study, and they were slaughtered at the age of 17-21 months. Visual assessments of skin pigment and hair colour were done fortnightly. Coat score was assessed using the coat scoring system with scores ranging from 1 (extremely short) to 7 (woolly). Hair length was determined monthly in millimetres. Skinfold thickness was measured fortnightly on the mid-side area using a digital Vernier calliper. Body condition, rectal and skin temperatures were determined fortnightly, just before collection of blood by coccygeal veni-puncture to determine serum cortisol. The results showed significantly different five hair colours in Nguni and nondescript cattle, namely; yellow-fawn, black, brown, red and white. Hair length was affected by month and hair colour while genotype had no effect. Hair length ranged from 12.65 ± 0.83 mm to 18.75 ± 0.95 mm between March and May. Yellow-fawn hair was the shortest (16.28 ± 2.84), while brown hair was the longest (21.75 ± 3.28 mm) in May. Genotype and fortnight of sampling affected coat score without interaction. Coat scores increased from February to May in both genotypes. Nondescript cattle had higher coat scores than Nguni. Fortnight of sampling affected skin thickness which increased from 3.70 ± 0.18 to 5.25 ±0.18 mm, while genotype had no effect. Genotype had an effect on body condition scores. Scores ranged from 3.17 ± 0.29 to 4.17 ± 0.29 in Nguni and nondescript cattle, respectively. Higher variation was observed in serum cortisol with nondescript steers having the highest values (135.78 ± 12.92 nmol/L) recorded in March while Nguni steers had the lowest values (75.20 ± 11.98 nmol/L) in May. Genotype and fortnight of sampling had no effect on rectal temperature. Skin temperature was affected by fortnight of sampling while genotype had no effect. Body condition scores were positively correlated with genotype (r = 0.13), coat score (r = 0.47) and skin thickness (r = 0.80) but not correlated with cortisol levels (r = -0.09). Negative correlation was observed with rectal temperature (r = -0.87) and skin temperature (r = -0.68). Skin colour, rectal and skin temperatures were not correlated with genotype. Coat score was negatively correlated with rectal temperature (r = -0.39), cortisol (r = -0.14) and skin temperature (r = -0.49). Skin thickness was negatively correlated with rectal temperature (r = -0.78), skin temperature (r = -0.54) and cortisol (r = -0.17). There was a positive correlation between skin temperature and rectal temperature (r = 0.31). It was concluded that hair coat, skin traits and body condition affect cortisol, rectal and skin temperatures in cattle reared extensively.

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Blood metabolite concentrations, skin thickness and hide weights of Nguni and nondescript cattle reared on a sweetveld

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The study evaluated changes in blood metabolite concentrations, skin thickness and weights of hides from Nguni and nondescript cattle raised on a sweetveld. Forty (40) steers (20 Nguni and 20 nondescript) were reared on a sweetveld from February to May 2015 at University of Fort Hare Research Farm, Alice. The ages of the steers ranged between 12 to 16 months at the beginning of the study. Liveweights ranged from 152.74 ± 1.83 kg to 203.17 ± 1.88 kg for Nguni and nondescript cattle, respectively. A digital Vernier caliper was used to measure skinfold thickness on the mid-side area fortnightly, before blood collection. Blood collection was done by coccygeal veni-puncture with 18 mm gauge needles into 4ml vacutainer tubes with sodium fluoride and 5ml SST vacutainers tubes for glucose and serum metabolites, respectively. Vacutainers were kept on ice and centrifuged within two hours of collection. Blood plasma was immediately analysed for glucose and the serum for urea, creatinine, albumin, total protein and creatine kinase. At the end of May, the steers were slaughtered at a commercial abattoir using approved slaughter and flaying procedures. The order of the steers during slaughter was recorded for identification of hides during flaying and weighing. Relative hide weights were determined by expressing hide weights as a proportion of slaughter weights. The results showed that skin thickness varied with fortnight of sampling, increasing from 3.70 ± 0.18 to 5.25 ±0.18 mm, while genotype had no effect. Fortnight of sampling had an effect on glucose while genotype had no effect. It ranged between 3.69 ± 0.08 and 4.91 ± 0.09 mmol/L). Total proteins varied by genotype and fortnight of sampling. They were 75.71 ± 0.79 and 73.31 ± 0.79 g/L for Nguni and nondescript cattle respectively. Fortnightly, they ranged from 68.41 ± 1.64 to 82.00 ± 1.57). Genotype and fortnight of sampling had no effect on albumin and creatine kinase, but had effects on creatinine. Creatinine concentrations increased fortnightly throughout the study period. They were 69.92 ± 1.00 umol/L and 79.88 ± 1.00 umol/L for Nguni and nondescript cattle respectively. Genotype and fortnight of sampling had effects on urea. Concentrations were 4.81 ± 0.06 mmols/L and 4.57 ± 0.06 mmols/L for Nguni and nondescript cattle respectively and varied between 3.20 ± 0.12 to 5.23 ± 0.12 mmols/L fortnightly. Genotype had an effect on slaughter and hide weights, but not on relative hide weights. Skin thickness was not correlated to glucose and total protein and creatine kinase was negatively correlated to urea and albumin (r= -0.16 and r= 0.14, respectively) and positively correlated to creatinine (r= 0.21). Nguni cattle had lower slaughter and hide weights (232.6 ± 6.5 kg and 14.71 ± 0.54 kg) than nondescript cattle (285.85 ± 6.52 kg and 18.43 ± 0.54 kg). It was concluded that some blood metabolites which are positively or negatively correlated with skin thickness vary with time of sampling and genotype. Furthermore, hide weights of Nguni and nondescript cattle differ, while relative hide weights are similar.

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Consumer perceptions of pork quality in Alice rural community of the Eastern Cape, South Africa

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The objective of the study was to determine consumer perceptions of pork quality. A survey was conducted in six retail outlets of Alice town in the Eastern Cape Province, South Africa and 150 consumers were interviewed in the study. Consumers were interviewed directly at the point of purchase. Frequencies for consumers' profiles and perceptions were determined. The Chi-square test was done to test for associations between age, gender, level of education, religious denomination, source of income, race and consumer perceptions. Price was the most significant factor that affected consumer purchasing decision at the point of purchase. Pork meat was mostly preferred by consumers than any other source of protein, but some of the consumers did not consume pork due to religious reasons and allergies. Most consumers preferred pinkish coloured pork (45.33%) because they believed that it indicated good pork quality. Both male and female consumers agreed that they would never consume discoloured meat as it is an indication that the quality of meat has deteriorated. Consumers used place of purchase as the most important extrinsic quality cue. The majority of the respondents (54.67%) had tertiary level of education. This might have an impact on the responses because consumers were fully aware about the nutritional importance of an animal protein source. The results indicate that the most considered facts were price, pork colour and place of purchase.

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Non-genetic factors affecting the efficiency of lifetime performance of South African Holstein cows

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The lifetime performance of dairy cows affects herd profit margins. An earlier study, using a smaller data set, identified factors affecting lifetime performance. This study reports on the effect of number of lactations, year of birth and age in months at first calving on the lifetime and productive life efficiencies of Holstein cows using a total of 2 012 526 lactation records. Holstein cows born between 1980 and 2008, which calved down at least once, were included in the study. Age at first calving before 18 months of age, and herds with fewer than 30 records over the 1980 - 2008 year period were removed from the original data set. Productive live efficiency (PLE) was derived by dividing the total lifetime milk, fat and protein yield of cows by their total number of days in milk for each lactation. The Lifetime efficiency (LTE) for each cow was derived by dividing the total lifetime milk, fat and protein yield of cows by their total lifetime as indicated by the interval (number of days) between birth date and age at the end of the last lactation. Currently in South Africa these traits are not evaluated by the Milk Recording Scheme. Non-genetic factors investigated included number of lactations (1 - 12), year of birth (1980 - 2010) and age in months at first calving (18 - 43). Analysis of Variance (ANOVA) was performed on each factor separately using SAS software (Version 9.2; SAS Institute Inc, Cary, USA). All non-genetic factors had a significant effect on total milk, fat and protein yield and PLE and LTE. As expected, yields for milk, fat and protein increased with lactation number. PLE for milk, fat and protein yield increased up to lactation 3 and 4, after which it decreased. The reason for this is that the highest milk yields are produced in lactations 3 and 4, after which the lactation milk yield decreases. Longevity, as indicated by increasing lactation number had a positive effect on LTE for milk, fat and protein. This indicates a better efficiency for cows being maintained in the herd for more lactations. For birth year, PLE for milk, fat and protein increased for cows born up to 2005, after which it decreased. This is probably related to cows not having concluded their productive lives. First calving at 23 and 24 months of age produces the highest total lifetime milk, fat and protein and PLE and LTE. There is a decrease in production when cows calve down later than 23 and 24 months of age. Longevity is affected by reproduction performance of cows. Genetic parameters for PLE and LTE will be estimated for the Holstein breed in South Africa to be included in breeding programs.

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Runs of homozygosity in the Tankwa goat breed of South Africa

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Runs of homozygosity (ROH) are lengthy, continuous stretches of homozygous genotypes, which are without heterozygosity in the diploid state. These regions are present in different individuals of the same species due to parents passing on identical haplotypes to their progeny. These stretches allow accurate estimation of levels of inbreeding based on high-throughput, chip-based single nucleotide polymorphism (SNP) data. The Tankwa is a goat breed indigenous to South Africa at risk of extinction. A few Tankwa goats are under conservation at the Carnavon Research Station in the Northern Cape where the small, random mating and isolated population is kept under feral (semi-wild) conditions. In the present study, SNP genotype data generated using the Illumina goat SNP50K bead chip was used to scan and compare the distribution of ROHs on the genomes of the Tankwa and Boer goat breeds of South Africa. ROHs were identified using PLINK v1.07 and the SNP & Variation Suite (SVS) v8.1 software. The number of runs of homozygosity (ROHs) was greatest in the 2-5 Mb category for both breeds with all animals displaying at least one ROH. There were more ROHs in the 5-7 and 7-10 Mb categories for the Tankwa goats in comparison with the Boer goats. Strong correlation (r= 0.86179, P < 0.0001) existed between the inbreeding coefficients and runs of homozygosity in the 2-5 Mb length category. This correlation strongly suggests that genomic data and the distribution of ROHs can be used to analyze the goat population history, inbreeding levels and the impact of inbreeding on complex traits and inherited disorders in the absence of pedigree records.

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The application of advanced interactive Livestock Management Reports in INTERGIS, based on official milk performance recording

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The emphasis in reporting on results from official milk recording systems has shifted from the phenotypic performances of individual cows used in genetic evaluation programs, to focus more on information regarding the relationship between phenotypic values, health traits and nutritional requirements. Information on dairy performance recording captured in INTERGIS addresses the demands in herd production tendencies, milk composition and quality, as well as production efficiency. The intensive production systems in the dairy industry demand creative, dynamic and interactive reports to ensure economic sustainability in the dairy enterprise. Therefore it was necessary to develop more applicable and advanced functionalities in the management program, to assist the dairy farmer in management decisions which will improve cow efficiency. Involuntary culling due to udder health has an enormous influence on longevity. With the emphasis on health traits and nutritional needs and deficiencies, individual cows and/or groups of cows can easily be identified for early intervention and adjustment to enhance efficiency and productivity. An important and useful development revolves around the evaluation of groups of animals within similar health and/or feeding treatment in the herd. Trends for specific traits can be included in a range of graphs for certain periods based on years, months or seasons. Problem areas and production periods can be identified and properly planned for in future. This report offers the opportunity for animal scientists, feed consultants, veterinarians and extension officers to assist dairy farmers on aspects that influence herd efficiency and productivity.

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Characterisation of goat production in selected coastal areas of the Eastern Cape Province, South Africa

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The study was conducted to describe goat production systems, as well as to identify existing constraints in Port St Johns and Umquma local municipalities of the Eastern Cape Province. A hundred households from these municipalities were randomly selected with assistance from the agricultural extension staff. Data was collected through a questionnaire and was analysed using SPSS. The male household heads (75%) owned most of the goats, followed by female de-jure (16%) and de-facto (6%) heads. Goats were mainly used for ceremonies (38%) and generation of income (37%). The farmers kept mostly indigenous nondescript goats together with Boer breed and its crosses. The flocks mainly consisted of does (58%) followed by kids (19%), castrates (19%) and bucks (4%). A low reproductive performance of does was evidenced by a low birth rate (43%). Kid mortality was 22%, mainly attributed to pneumonia as a result of the weather extremes. Farmers made use of both traditional and conventional methods (dipping-47%, dosing-43%) in preventing and controlling diseases in their flocks. There was no controlled breeding system, resulting in high inbreeding possibilities. The housing consisted of unroofed wooden pens and kids were kept together with the mature goats in these structures. The goats were marketed through informal channels at an average price of R1500 per goat. Most farmers preferred selling castrated male goats (57%), with peak sales in winter and late summer. The major management constraints identified were poor nutrition, absence of market linkages and inadequate animal husbandry knowledge.

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Preliminary results on the utilization of sweet lupins by South African black ostriches during the starter phase

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Feed cost contributes approximately 75% of the total input costs of an intensive ostrich production unit. An increase in the price of traditional protein sources such as soybean oilcake meal necessitates producers to find cheaper alternatives to ensure the cost efficient production of slaughter ostriches. This study was performed to determine to what levels soybean oilcake meal may be replaced by locally produced sweet lupins (*Lupinus angustifolius*). In the trial, 141 African black ostriches were randomly divided into five dietary treatments with three replications each. The five diets varied in lupin content where soybean oilcake meal was gradually replaced to provide 0%, 5%, 10%, 15% and 20% inclusion levels of lupins in the diets. The diets were equally formulated in terms of metabolisable energy (13.6 MJ/kg), protein (15.7%), fat (6.0%), fibre (6.3%), calcium (1.5%), total phosphorus (0.7%), lysine (0.9%), methionine and cysteine (0.5%), threonine (0.6%) and tryptophan content (0.2%). The ostriches were reared in groups in outdoor camps for 10 weeks, where they received the experimental diets *ad libitum*. During this period, growth and feed intake were monitored every fortnight. The average initial body weight of the birds was 14.3 kg and after 10 weeks the body weights of the birds were respectively 43.5 kg (0% lupins), 38.1 kg (5% lupins), 41.2 kg (10% lupins), 45.4 kg (15% lupins) and 35.1 kg (20% lupins). The body weight of the birds on the 0% lupin diet was higher (P <0.05) than that of the birds on the 5% and 20% lupin diets. The ostriches receiving the 0% lupin diet attained the highest average daily gain (ADG) (363.5 g/bird/day), while ostriches on the 20% lupin diet had the lowest ADG (213.7 g/bird/day). Feed intake differed (P =0.01) between the five treatments. Ostriches on the 10% lupin diet had the highest dry matter intake (DMI) (1248.2 g/bird/day), which decreased with an increase in inclusion rate of lupins in the diet (1059.4 g/bird/day for 20% lupin diet). The feed conversion ratio (FCR) did not differ (P =0.37) between the five treatments. A mean FCR of 3.3 kg feed/kg weight gain was maintained by the birds. Regression analysis of the data revealed no specific tendency or effect of lupin inclusion rate on production parameters. The study revealed that soybean oilcake meal can thus be partly replaced with an inclusion rate of 15% lupins in the starter diet of ostriches without any significant detrimental effect on production. The hind-gut fermentation ability of ostriches probably enables them to utilise lupins efficiently, which had higher fibre content than soybean oilcake meal.

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Estimation of genetic parameters of type and production traits for Namibian Brahman beef cattle

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Data were recorded for 33 685 Namibian Brahman beef cattle from 1990 to 2012 by inspectors of the Namibian Brahman Breed Society. Ten visually scored type traits (size, sex character, capacity, front, rear, head, forequarter, middle, hindquarter and temperament) and five production traits (birth, weaning, yearly, final and mature cow weight), all with pedigree records, were analysed using mixed model methodology to obtain appropriate genetic parameters to assess the feasibility of including type traits in routine breeding value analyses for the Namibian Brahman cattle. Heritability estimates were low to moderate, ranging from 0.06 - 0.14 and 0.21 - 0.26 for type and production traits, respectively. The genetic correlations between type traits were from non-existent to high ranging (from 0 – 0.92). The effect of inspectors varied significantly, necessitating their inclusion in any model used for prediction or selection purposes. Genetic correlations between type and production traits ranged from - 0.21 to 0.64 and should thus be considered to ensure maximum results and avoid counterproductive selection responses due to antagonistic correlations. The type and production traits exhibited both variability and heritability indicating that response due to selection could be achieved to improve and maintain desired types. Further analyses of economically important reproduction traits, combined with type and production traits, should be performed to establish the possibility of combining type traits in routine analyses to improve accurate identification of superior animals for the Namibian Brahman cattle.

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Nematicidal activity of plant species possessing alkaloids and tannins

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Rapid development of resistance by livestock parasitic nematodes against all classes of chemical anthelmintics has become a global challenge that requires the exploration of alternative remedies. One of these is the use of plants possessing anthelmintic properties. The study was designed to determine the most effective of three doses per plant extract on isolated L3 nematode larvae. Seven plant species possessing anthelmintic activity were found to have alkaloids and tannins as anthelmintic properties. Dried leaf samples (40 g) of each species were Sohxlet extracted in 70 % ethanol, in portions of 10 g dry matter (DM) and concentrated to 100 ml. Half and one quarter of the original crude extract were both made to 100 ml with the same solvent; equivalent to 20 g and 10 g DM, respectively. The initial crude extract was 4×, the second 2× and the third 1×. Rectal faecal materials were collected from10 Merrino sheep and 25 Nguni goats, pooled within species and thoroughly hand-mixed. Dung samples, each of 5 g, were weighed into plates and cultured for 12 days at 27 °C. On day 13, some plates (4) were watered, and others (4) treated with 70% ethanol to correct the solvent effect on mortality. The experiment had two animal species, seven plant species and three extract concentrations: hence it can be described as having a 2 x 7 x 3 factorial design. In each run, three plates were treated with each plant species crude extract in three concentrations (4x, 2x and 1x). Surviving L3 larvae were isolated on day 14, larval counts done, and mortality (bases on a mean of three plates) became indices of dosed anthelmintic efficacy. The study was re-run three times. Data from nematode larval mortality were analysed using the General Linear Model of SAS (2000) to determine the effect of animal species, plant species, concentration (1×, 2× and 4×) and of various levels of interaction of animal species, plant species, and concentration on mortality.

Animal species (P= 0.0107) and concentration (P= 0.0005) both affected mortality; Wilks' Lambda statistics showed that a change in crude extract concentration from level 1, 2 and 4 resulted to mortalities of 71.2 ± 2.62 %, 88.0 ± 1.88 % and 97.9 ± 0.91 % for goats. The progression of mortality for sheep was 93.8 ± 2.62 %, 96.0 ± 1.88 % and 98.0 ± 0.91 %. Interaction of crude extract concentration and animal species affected mortality (P= 0.0127), while plant species, and interaction of animal and plant species had no effect. The crude extract efficacy of alkaloid and tannin containing plant species was different (P= 0.0049) for goats (71.2 ± 2.62 %) and sheep (93.8 ± 2.52) at concentrations 1. Additionally, the crude extract efficacy at concentration 2 was also different (P= 0.0446), with mean mortality of 88.0 ± 1.88 % for goats and 96.0 ± 1.88 % for sheep. The interaction of concentration, animal species and plant species had no effect on mortality.

Differences in specific anthelmintic activity exist in groups of plants possessing the two properties; suggesting that combined activity of any two plant species extract may have an enhanced anthelmintic activity.

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Effect of different levels of supplementation on the reproduction and profitability of a cow/calf production system in the south-eastern Free State

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In extensive studies using cow-herd standardized performance analysis (SPA) data to determine economic factors affecting cow-herd costs, production, and profitability, it was determined that feeding costs and total production (kilograms weaned) affected total cost significantly. Owing to the importance of feeding costs and calving percentage in the profit model of the cow-calf enterprise, the present study was an attempt to identify a cost effective supplementation regimen to offer cows in a cow/calf enterprise grazing Elionurus sour grassland without affecting production or, reproduction profitability. The study was conducted over a 3-year period using 150 Drakensberger cows that were stratified according to age and then randomly allocated to one of three supplementation treatment groups namely: Treatment 1 (T1), Treatment 2 (T2) and Treatment 3 (T3). Treatment groups were rotated between allocated camps fortnightly to minimize camp effect. The winter supplementation treatments consisted of a protein and mineral supplement with three levels of supplemental crude protein (CP), percentage protein derived from non-protein-nitrogen (NPN), metabolizible energy (ME) and phosphorus (P), namely: T1 (CP content of 36.7%, from NPN 77.5%, ME of 5.25 MJ/kg, 1.4% P and intake of 360 – 520 g/day), T2 (CP content of 46.6%, from NPN 88.7%, ME of 4.4 MJ/kg, 1.9 % P and intake of 280 – 400 g/day), T3 (CP content of 47.5%, from NPN 95.86%, ME of 2.4 MJ/kg, 2.57% P and intake of 280 – 400 g/day). The treatment groups were offered the same supplements during late winter as during the winter, however the amounts offered were increased by 20%, namely T1 (450 – 650 g/cow/day), T2 and T3 (350 – 500 g/cow/day).The summer treatments consisted of a mineral supplement (5% P) with 15 % CP offered to the T1 group and a mineral supplement (6% P) offered to the T2 and T3 groups. Reproduction data was not significantly affected by supplementation treatment. The slightly higher average conception rate of the T3 group (94%) compared to the T1 group (91%) and T2 group (90%) compensated for the lighter average weaning weight of the T3 group (216 kg) than the T1 (224 kg) and T2 (219 kg) groups. The treatments offered to the T3 group (R322/cow/year) had a cost advantage over those offered to the T1 group (R540/cow/year) and T2 group (R395/cow/year) and thus brought about the highest income above supplementation cost.

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Effect of different levels of supplementation on beef heifer development in the south-eastern Free State

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Replacement heifers are not generally mated before the age of 24 months because of the extensive nature of the majority of beef enterprises in South Africa. Due to the time factor and quantity of feed required when heifers are mated to calve down as three-year-olds, the economic implications of the enterprise become vitally important. The identification of an efficient supplementation regimen to rear replacement heifers in terms of livemass gains necessary to achieve acceptable conception rates at the lowest possible cost was therefore the objective of this study. It must be stressed that the levels of supplementation used in this study were chosen to be typical of the level used under practical farming conditions and often employed by farmers. Three heifer development trials were conducted over a 3-year period with respectively 36, 39 and 45 Drakensberger heifers. Heifers were randomly assigned to one of three supplementation treatment groups after weaning (ca 7 months old). Treatment groups were rotated between allocated camps fortnightly to minimize camp effect. Treatment 1 (T1) was offered a winter production supplement in late winter {crude protein (CP) 30.6%, from non-nitrogen-protein (NPN) 47.4 % and metabolizible energy (ME) 7.4 MJ/kg}, summer production supplement (CP, 16.4 %, from NPN 37.0 % and ME 9.0 MJ/kg) in summer and a urea based protein supplement in winter (CP 47.5 %, from NPN 95.9 % and ME 2.4 MJ/kg). Treatment 2 (T2) was offered a cotton oil cake and urea based protein supplement (CP 32.9 %, from NPN 70.7 % and ME 6.89 MJ/kg) in late winter, a mineral supplement with 15% protein and 5 % phosphate (P) in summer and a urea based protein supplement in winter (CP 47.5 %, from NPN 95.9 % and ME 2.4 MJ/kg). Treatment 3 (T3) was offered a urea based supplement in late winter (CP 47.5 %, from NPN 95.9 % and ME 2.4 MJ/kg), a mineral supplement with 6 % P in summer and a urea based supplement (CP 47.5 %, from NPN 95.9 % and ME 2.4 MJ/kg) in winter. No treatment differences occurred in year 1. In year 2 T1 heifers (361 ± 43 kg) and T2 heifers (351 ± 27 kg) weighed significantly ($P < 0.05$) heavier than the T3 heifers (328 ± 27 kg). In year 3 the T1 heifers (356 ± 22 kg) weighed significantly ($P < 0.05$) more than T2 heifers (334 ± 23 kg) and the T3 heifers (328 ± 19 kg). Even though significant ($P < 0.05$) differences in final weight between treatment groups were measured, all the treatment groups were able to reach target breeding mass (60% of mature weight) 8 months prior to the breeding season. The three year average cost incurred in supplying supplements to the T1 heifers was R466.00 per animal, the T2 heifers R 228.28 per animal and the T3 heifers R145.30 per animal. A saving of 221% at the current (2011 to 2014) prices can be made by developing beef heifers on the supplements offered to the T3 heifer group.

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Understanding mitochondrial DNA haplotypes and maternal origins of South African indigenous cattle in the genomics era

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The analysis of cattle mitochondrial DNA (mtDNA) allows the differentiation of cattle into their maternal lineage haplotypes (Paneto et al., 2008). The origin and maternal lineages of mammals can be traced through the next generation sequencing (NGS) of the mtDNA genome as this technology enables breakthroughs in genetic diversity studies (Bai et al., 2012). In an attempt to investigate the distribution of polymorphisms, whole mtDNA that was isolated from 29 South African indigenous cattle was sequenced on the Illumina HighScan sequencer. Sequence reads were mapped to whole mtDNA reference sequences of *B. taurus* and *B. indicus* at an average of 0.33 %. Analysis of mtDNA sequences revealed an average of 69 *B. taurus* SNPs, with the highest numbers observed on the D-loop region of the mtDNA. Significant amounts of polymorphisms were observed in the ND5, CO1 regions while ND6 harbored the least number of polymorphisms. In order to elucidate origins of the cattle, whole mtDNA consensus sequences of 29 South African indigenous cattle were aligned and a phylogenetic analysis revealed South African haplotypes of these cattle. Plentiful phylogenetic information was successfully retrieved from mtDNA data, revealing the origin of Nguni cattle that are known to be indigenous to South Africa.

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Effect of crossbreeding on beef production of a Jersey herd using Fleckvieh sires

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Jersey (J) bull calves and steers produce high quality meat. However, the growth rate of Jersey bull calves for veal and beef is slow in comparison to other dairy breeds. This could be improved by crossbreeding with beef breeds. In the current study, the veal and beef production of Jersey and Fleckvieh x Jersey (F×J) bull calves and steers were compared. Bull calves were reared intensively for veal up to a carcass weight not exceeding 100 kg, or as steers for beef to 21 months of age. In both veal and steer production systems, the mean birth weight of F×J bull calves was higher (P<0.001) than Jersey bull calves, i.e. 33.5±1.2 kg vs. 27.9±1.2 kg and (33.4±0.9 kg vs. 26.9±0.9 kg, respectively. The body weight of Jersey and F×J veal calves at 6 months of age differed (P<0.01) being 163.5±3.9 and 180.6±4.0 kg respectively. This can be attributed to a higher (P<0.01) average daily gain (ADG) of 0.82±0.02 kg/day for F×J compared to 0.73±0.02 kg/day for Jersey bull calves. Marketing age in the veal production system differed (P<0.001) with Jersey and F×J bull calves marketed at 7.1±0.1 and 6.3±0.1 months of age, respectively. End live weight at 21 months of age of Jersey and F×J differed (P<0.01) being 322.6±13.4 and 441.4±14.9 kg respectively. This was due to a higher (P<0.01) average daily gain in F×J vs. Jersey steers, i.e. 0.64±0.02 and 0.46±0.0 kg/day, respectively. Fleckvieh x Jersey steers had a higher (P<0.01) carcass weight at 21 months of age being 206.5±8.9 kg vs. 157.9±8.6 kg respectively. These results indicate the potential of improving beef production characteristics of the Jersey cattle through crossbreeding.

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Effect of β-carotene supplementation and oestrous synchronization on ovarian activity and fertility of Saanen does

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The present study evaluated the effect of β-carotene supplementation and synchronization protocols on ovarian activity and conception rate of Saanen does. A total of 60 Saanen does aged 1-6 years were used. The factors in the design were supplementation (β-carotene supplemented versus non-supplemented) and synchronization protocol (PMSG versus male effect) in 2*2 factorial design. The supplemented groups were dosed with β-carotene 100 mg/goat/day for sixty days starting from 28 days before oestrous synchronization. For the synchronization protocols, all animals were inserted with CIDRs for 12 days and were injected intramuscularly with prostaglandin at CIDR withdrawal. In one group, does were injected with 300 IU PMSG, while for the other group, bucks wearing aprons were introduced at CIDR removal. Cervical artificial inseminations were performed twice at 48h and 60h after CIDR withdrawal with fresh, undiluted semen. The interaction of β-carotene supplementation and synchronization protocol had no effect on body weight, response to oestrous, conception rate, onset and duration of oestrus. The synchronization protocol however, had a significant effect on conception rate. The male effect group had a higher conception rate (97%) than the PMSG (72%) group. Supplementation and synchronization protocol did not have a significant effect on number of follicles, size of largest follicle and size of corpus luteum. In conclusion, β-carotene supplementation had no effect on ovarian activity and conception rate. Addition of the male effect in progesterone synchronised oestrus improved the conception rate.

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Methane yield of young beef bulls on an intensive feeding system

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Agriculture is responsible for 5% to 10% of the global methane (CH_4) production of which 80% to 90% emanates from livestock production. The challenge faced by the livestock sector is to produce enough animal protein for the expanding global human population while reducing greenhouse gas emissions to decrease the environmental impact. The livestock population, or more specifically ruminants, is responsible for emitting 16-20% of the methane to the atmosphere by means of methanogenesis or biomethanation due to anaerobic fermentation of feed in the rumen and large intestine. Techniques monitoring CH_4 at individual animal level are crucial to better monitor methane mitigation alternatives, while improving cattle production efficiency. Although still under evaluation in livestock systems, the Laser Methane Detector (LMD) has demonstrated its viability to be utilized in enteric methane monitoring in ruminants. The current study was aimed at measuring the methane yield of young Simbra, Pinzgauer and PinZ^{2}yl bulls on an intensive feeding system. The animals were fed a total mixed ration for 9 weeks where after methane measurements commenced. All measurements were taken late afternoon (18:00) as it proved to be difficult to see the laser beam in direct sunlight and no or very little wind is experienced at this time of day. Gas column density was measured in parts per million per meter (ppm-m) on individual animals by directing the auxiliary LMD targeting laser beam at the nostrils of the bulls. The measurements for each individual bull were taken every 5 seconds over a period of 60 seconds to include different stages of the respiratory tidal cycle. Four 60 second repeated measurements were taken twice a week for 3 consecutive weeks. The LMD does account for the plume effect, assuming that the plume density in the animal's breath has a 1m radius from the point source giving a concentration in ppm-m (ml/m^3). The methane concentration (ppm-m) was converted to methane production (g/day) by making use of the currently available deterministic model (Chagunda *et a*l, 2009). Methane yield was calculated by dividing methane production (g/day) with daily feed intake (g/day). Results from the study showed variation in methane production (g/day) between individual animals within the different breeds: Pinzgauer 7.49 ± 1.73, PinZ^{2}yl 7.41 ± 0.47 and Simbra 7.10 ± 1.37. There was no correlation between methane yield and either end weight, feed efficiency, average daily gain or daily feed intake. A correlation was found however, at the 10% level, between methane production (g/day) and end weight (P = 0.08) as well as daily feed intake (P=0.07).

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Allelic variation of α_{s2}-casein in South African dairy goats

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The South African dairy goat industry is small and mainly serves a niche market of goat milk and goats' cheese. The differences in α_{s2}-casein content in milk are associated with the unique physicochemical characteristics of goat caseins and influences technological behaviour of goat milk during processing of cheese. Increased amounts of α_{s2}-casein in goat milk results in increased protein content, as well as increased casein content, which leads to improved cheese yield and cheese processing characteristics of goat milk. The α_{s2}-casein gene has seven alleles associated with three levels of synthesis. The A, B, C, E and F alleles are associated with a normal level of α_{s2}-casein in milk. Allele D is a rare defective allele associated with a reduction in α_{s2}-casein content, while allele O results in an absence of α_{s2}-casein in milk. The aim of this study was to investigate the allelic variation of the α_{s2}-casein gene in three South African dairy goat breeds, by making use of DNA sequencing technology. A total of 70 goats, consisting of 20 Saanens, 20 British Alpine, 20 Toggenburgs and 10 Boer goats (as control group), were sequenced with four primers to distinguish between the seven different alleles for α_{s2}-casein. Out of the possible seven alleles, four alleles associated with normal levels of α_{s2}-casein were detected in South African goats (allele A, B, C and F). An analysis of molecular variance (AMOVA) indicated 5.7% variation between the four different breeds and a variation of 88.6% within populations. No rare alleles were detected in the South African goat population. This study indicates that the South African dairy goat population have similar alleles for α_{s2}-casein to goat populations studied in Italy and France.

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Identification of homozygous polled beef cattle based on the Celtic allele

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In commercial beef production systems, polled animals are preferred above horned animals. Polled animals are easier to manage, take up less feeding space in feedlots and the risk of injury, bruising and potential carcass damage is decreased, thereby also decreasing economic losses. It is common practice to dehorn calves at a young age, but this has welfare implications. Breeding for polled cattle by making use of genetic selection would be a welfare friendly alternative and a permanent solution. The polled gene is autosomal dominant and, if present, will suppress the expression of the horned phenotype. Dominance creates the problem that there is no distinction between the homozygous and heterozygous polled phenotype. The aim of this study was to test the suitability of the Celtic allele (P_C) in South African beef cattle breeds for identification of polledness in South African beef cattle. Twenty Bonsmara, 20 Drakensberger and 20 Tuli animals were tested using a PCR with the Celtic primer (CELT-F: GAA GTG TGG CCG GTA GAA AA and CELT-R: ATC AAG GAC ACC TCC CAC AC) developed for the Celtic allele (Allais-Bonnet *et al.*, 2013). There is a 202 bp difference between the Celtic allele (P_C) and the wildtype allele. The PCR products ran on an agarose gel and clearly indicated one vs two fragments to distinguish between the homozygous and heterozygous polled animals. Hence, the Celtic allele (P_C) is suitable for genetic testing of polledness for the studied South African beef cattle breeds.

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The current state, role and the future of goat commercialization in communal areas of KwaZulu-Natal

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Goats are the most important livestock species for many poor, rural families of KwaZulu-Natal (KZN). Goat-keeping contributes between 10 and 30 per cent to total household income and plays a substantial role in resource-poor households. Goats provide rural people with meat, milk, skins and manure (Peacock *et al.,* 2005). KwaZulu-Natal Department of Agriculture and Rural Development (KZNDARD) have a vision which is optimum agricultural land use, sustainable food security, and comprehensive, integrated rural development. This study looked at the goat projects funded by KZNDARD in eight municipalities both in South and North Regions of the KZN Province.

A cross-sectional survey, using a structured questionnaire was used in the study to collect data from rural goat projects. The interviews were aimed at obtaining information from the farmers themselves to give a clear understanding of the state of goat production management practices, level of productivity and challenges encountered. The questionnaire dealt with a number of variables, which included demographic questions about the goat farmer, social and economic contribution of goats to households, goat numbers, nutrition and different production systems.

The average price of a goat according to respondents was R700. There is no specific continuous market and most farmers sell their goats once a year, depending on the availability of stock. All goats graze in the communal veld. Supplementation is practiced by (61%) of respondents during winter. Maize stalks, licks, lucerne, hay bales and calf meal are examples of supplements used. The number of project members available for interviews were very low. In most co-ops, membership is declining. Few youth were part of the study and the majority of the respondents were above 45 years of age (76%), with 52% of respondents being pensioners. The majority of project members were males (59%). When questioned about the main source of income it was revealed that 92% of the families surveyed survive through Government social grants. The majority of goats kept were indigenous (89%) and most of these goats are herded (59%). Most goat farmers (83%) do vaccinate their goats and only (7%) do not.

All projects visited were not successful according to the respondents. The reasons cited by respondents were decline in goat numbers and membership of all the goat projects with internal conflicts being the major contributor. The low involvement of youth is a problem and seems to create dependency especially on Government grants. Most respondents did not keep records of the herd (production & financial). This therefore meant that respondents estimate the cost of production and profits. Respondents need to be equipped with the necessary skills beforehand to allow them to run these projects successfully.

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Management practises and contribution of village chickens to livelihoods of rural farmers: the case of Centane and Mount Frere in Eastern Cape, South Africa

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This study was conducted to determine village chicken production practises and their contribution to the livelihoods of farmers in rural households of the Eastern Cape Province. Data were gathered using a questionnaire survey of 150 households, which were identified by use of snowball sampling. Village chickens were the most common livestock species (45.15% and 52.61%) kept by farmers. Mostly owned by women (79.61% and 81.06%) and kept for household food requirements in Centane and Mount Frere, respectively. Some farmers (21.92% and 25.31%) also occasionally sold their chickens at an average of R80 ($7.22) per bird. Most (93.13% and 76.44%) chicken flocks were provided with maize grain. The majority of farmers (80.31% and 88.33%) provided shelters for their chickens. The causes of chicken losses were reported to be diseases, predators, parasites and theft. The most cited disease problem was Newcastle Disease (50.32% and 66.02%) while major predators were eagles (84.91% and 81.82%). The most common internal parasites were round worms and tape worms, whilst the most reported external parasites were poultry lice and mites. The majority of farmers (94.51% and 92.21%) reported using chicken manure to improve the fertility of soils in their gardens. Most of the farmers (61.63% and 68.82%) donated chickens to neighbours and relatives. The majority of farmers (84.90%) in Centane didn't use chickens for cultural ceremonies whilst the majority (55.85%) in Mount Frere used chickens for cultural purposes. The present study showed that village chickens contribute to the livelihoods of rural households.

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Feed intake and growth performance of growing pigs fed on *Acacia tortilis* leaf meal treated with polyethylene glycol

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The objective of the study was to determine the response in feed intake and performance of pigs fed on incremental levels of polyethylene glycol (PEG). Forty-eighty clinically healthy male F1 hybrid pigs were randomly allotted to six diets containing 0, 5, 10, 15, 20 and 25 g/kg of PEG, respectively. *Acacia tortilis* leaf meal was included at a rate of 150 g/kg. Each diet was offered *ad libitum* to eight pigs in individual pens. Average daily feed intake (ADFI), scaled feed intake (SFI), average daily gain (ADG), body weight (BWT), and gain to feed ratio (G: F) were determined weekly. The ADG showed a linear response to PEG ($P < 0.01$). The linear regression equation was y = 0.0061x + 0.6052 ($R^{2 =}$ 0.64). There was a quadratic response to PEG on ADFI, BWT and SFI *(P < 0.01*) and G: F (*P > 0.05)*. The regression equations and R^2 values were: ADFI y = $0.0008x^2$ – 00086x + 1.2339 (R^2 = 0.96); SFI y = $0.0147x^2$ – 0.2349x + 40.096 (R^2 = 0.95) and G: F ratio y = $0.0002x^2$ – 0.017x + 0.5168 (R^2 =0.52). The ADFI, SFI and ADG increased as weeks of feeding progressed (*P < 0.01*), but the G: F ratio decreased as weeks increased. It can be concluded that the relationship between PEG inclusion and performance of growing pigs fed on *A. tortilis* is exponential, rather than linear.

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Preliminary investigations into trace mineral levels in horses in KZN

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Analyses show South African horse feeds and forages contain levels of Fe far in excess of horse requirements, while Cu, Mn and Zn are often deficient compared to recommended intakes set by NRC (2007). Conflict exists over the safety of excess Fe in horse diets with some researchers stating it has low availability and no negative impact on the horse, while others say it can be detrimental to the health and performance of horses and should not be oversupplied. Stomach contents from 34 euthenased horses were analysed for trace mineral (TM) content in an attempt to evaluate TM intake of horses, together with matched liver analyses to ascertain long term absorption of TM's.

Stomach contents reflected similar trends to feeds and forages in respect of TM content with 100% having Fe_{STOM} higher than the 50ppm NRC (2007) recommendations, 41% of the horses had elevated, Cu_{STOM}, 62% had elevated Zn_{STOM} and 56% elevated Mn_{STOM} values, compared to the NRC recommendations of 12.5ppm for Cu & 50ppm for Zn and Mn.

A mean Fe_{LIV} content of 2468ppm DM was far in excess of the 900ppm upper norm, with 82.4% of horses showing excess Fe_{LIV}, 55% of the horses had Cu_{LIV} slightly higher than 25ppm upper norm, with a mean Cu_{LIV} of 23.6ppm. Mean Zn content was 160ppm, with 41% of horses having low Zn_{LIV} and 56 % normal with levels between 120-360ppm. Mn levels were within normal levels with only 3% either high or low. These findings indicate Fe is well absorbed from a variety of equine feedstuffs and accumulates in the liver. Its provision in horse diets may need to be re-evaluated and attempts made to reduce Fe intakes. In comparison, the under provision of Zn in feedstuffs results in low uptake and storage which could also result from competitive absorption between Fe and Zn.

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Comparative seasonal haematology of *Scotophilus heathii* and *Pipistrellus pipistrellus* in a subtropical area of Pakistan

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Various haematological parameters of two bat species belonging to the family Vespertilionidae (*Scotophilus heathii and Pipistrellus pipistrellus*) were examined on a seasonal basis. Blood samples were taken from 47 bats (23 *S. heathii* and 24 *P. pipistrellus*) obtained from Potohar region. Results showed that *P. pipistrellus* exhibited significantly ($P<0.05$) higher mean counts of red blood cells (RBCs), white blood cells (WBCs), platelets, haemoglobin (Hb), and packed cell volume (PCV) as compared to *S. heathii.* However, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) levels were significantly ($P<0.05$) higher in *S. heathii* as compared to *P. pipistrellus.* Seasonal comparisons in both the species depicted lowest levels of RBCs, WBCs, MCV, MCH and PCV in spring, when bats are least active just after hibernation. Highest mean estimates of RBCs, Hb, and PCV were observed in summer (bats are most active) in male and female bats belonging to both species. However, WBCs levels were at peak during autumn when bats are preparing to go into hibernation.

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Evaluating impact of non-genetic factors on functional longevity of South African Holsteins with a Weibull PH model

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This study was carried out to establish the factors that influence functional longevity in South African Holsteins. Data obtained from the INTERGIS included 3 409 277 lactation records of Holstein cows born between 1955 and 2013. Edits restricted analysis to records of cows born between 1985 and 2002. Initial data edits with SAS removed records of animals with missing sire, birth date, calving date, production, lactation beyond nine and herd code. Further edits with Fortran 90 calculated annual herd size change at 1 January of every year, classified milk yield, butterfat and milk protein yield. Herds with less than five cows were deleted. There were 2 299 706 elementary records from 161 222 records after edits and data preparation. The final data set were analysed using the Survival Kit Version 6 with a Weibull proportional hazard model. The statistical model included the fixed effects of stage of lactation within parity; effects of milk, fat and protein yields calculated within year-season; milk within parity; annual change in herd size; effect of year within region; age at first calving and the random effects of year of calving. The maximum within lactation failure times were 904 and 800 days with averages of 261 and 258 days for uncensored and censored records respectively. All the covariates fitted in the model had a significant effect on functional longevity of the cows. There were no significant differences in relative risk for cows in Western Cape, Eastern Cape, Northern Cape, Gauteng/North West, KwaZulu-Natal, Northern Cape and the Free State post 2002. However, in 1995, the relative risk for cows in the other regions were as high as 5.0 to 8.3 times that of animals in Eastern Cape, the reference class. Relative risk decreased with time across all regions. Annual change in herd size had the greatest influence on survival (4.53), whilst fat yield within year-season had the least relative risk (0.765). Relative risk was high in shrinking herds when compared with stable herds. The risk of culling was higher for cows in lactation beyond two than for those in lactation one. Within lactation, relative risk increased with a decrease in milk production when compared to the reference class. Heifers calving at an older age had a relatively higher risk of being culled. There is a need to adjust for these non-genetic factors in the genetic evaluation of Holsteins for functional longevity.

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Prevalence and seasonal changes in the population of gastrointestinal parasites of ovines and caprines on three different veld types in communal farming areas of the Eastern Cape

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This study investigated the prevalence and seasonal changes in the population of gastrointestinal parasites (GI) of communal sheep and goats in humid, semi-humid and arid zones of the Eastern Cape. The objectives were to establish the seasonal occurrence of GI on three different veld types, to develop a health management guide to control internal parasite infestation in small stock and to compare the prevalence of GI in sheep and goats. The study was conducted at Wartburg (humid), Allenwater (semi humid) and the commonage areas in Cradock, Siviwe and Phambili (arid) in the Eastern Cape Province. On each study site, three farmers were selected to contribute 10 female sheep and 10 female goats (2-tooth) per kraal. Animals were tagged for identification. Faecal samples were taken monthly from January 2012 until December 2013 in order to determine GI levels. At the beginning of the trial all sheep and goats were drenched with a broad spectrum remedy to standardize the egg count of internal parasites. Sheep and goats per site were only dosed when the faecal internal parasite egg per gram (e.p.g) counts exceeded the levels of 3000 e.p.g for roundworms and 10000 e.p.g for coccidia. An epidemiological questionnaire was used to ascertain from farmers regarding animal health practices, the type of supplementary feeding used and what veld management practices were applied. The roundworm and coccidia levels of sheep and goats on three different veld types for 2012 and 2013 were subsequently analyzed using SAS 2003. Significantly higher levels of roundworms (1326±96) and coccidia (1046±118) levels were found at Allenwater than at Wartburg (roundworms -1235±86), (coccidia -531±84) and Cradock (roundworms -107±103), (coccidia1142±155) communal areas. Average roundworms (1690±83) and coccidia (1031±138) e.p.g levels of goats were found to be the highest at the semi-humid area (Allenwater) followed by Cradock (roundworms-1431±85), (coccidia 2043.05±36) and Wartburg with the lowest average levels over the two year period (roundworms-833±90), (coccidia 978±109). Season and management per communal area affected the e.p.g levels of both sheep and goats over the two year period.

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Comparing enteric methane emission and total rumen microbial count from three beef breeds receiving feedlot diets with different fibre and energy contents

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Methanogens reduce enteric carbon dioxide using hydrogen, thus producing methane. The amount of methane produced depends on the amount and quality of feed consumed. Methane produced by cattle contributes to global warming and wastes dietary energy. This study compared enteric methane emission and rumen microbial counts from 3 beef breeds receiving feedlot diets differing in fibre and energy. Twenty seven steers, comprising nine Bonsmara, nine Nguni and nine Brahman, were used. Animals were fed; diet 1 with 22 % fibre and 12 MJ/kg energy, diet 2 with 16 % fibre and 13 MJ/kg energy or diet 3 with 11 % fibre and 14 MJ/kg energy, in a completely randomized design. Animals received *ad libitum* feeding and fresh drinking water in singe pens. A laser methane detector was used to measure methane emitted from the muzzle of the steers. Rumen fluid was collected through a stomach tube to determine total microbial count and correlate the quantities with methane produced. Steers fed diet 2 showed higher methane emissions compared to diets 1 and 3. Rumen microbial count was 2.7×10^6, 9.4×10^6 and 5.1×10^7 for diet 1, 2 and 3 respectively. Steers fed on diet 3 showed lower methane emissions even when total rumen microbial count was high. The low methane concentration of animals fed on diet 1 correlates with the rumen microbial count observed. There was no significant difference among breeds on methane emission measured by laser methane reader and rumen microbial count.

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Serum metabolite profiles, liver histometry and proteomic analysis of South African Windsnyer-type indigenous pigs (SAWIP) and Large White x Landrace (LW x LR) crosses fed diets containing ensiled maize cobs

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A study to compare serum metabolite and liver histometry responses in indigenous pigs and commercial pigs fed diets containing ensiled maize cobs was undertaken. In addition, proof of principle on the use of sodium dodecyl sulphate polyacrylamide gel electrophoresis matrix-assisted laser desorption ionization mass spectrometry (SDS-PAGE /MALDI MS) workflow to determine differences in serum and liver protein profiles of pigs fed high fibre diets was established. Twenty-four Large White × Landrace crossbred pigs (LW x LR) and 15 South African Windsnyer-type Indigenous pigs (SAWIP) were assessed in the study. They were fed a control diet (CON), a low ensiled maize cob inclusion (LMC) and a high ensiled maize cob inclusion (HMC) diet in a completely randomized block design. Blood urea nitrogen concentration was greater ($P < 0.05$) in the SAWIP than LW x LR. Creatinine, phosphorus, alkaline phosphatase (ALP), cholesterol and serum α-amylase (AMYL) values were greater ($P < 0.05$) in LW x LR than in the SAWIP. There were breed x diet interactions ($P < 0.05$) for alanine aminotransferase (ALT) and AMYL. The LW x LR had greater values of ALP and AMYL than the SAWIP. Intensity of 22 kDa protein bands in LW x LR on the HMC diets was greater ($P < 0.05$) than in SAWIP on HMC diet. Protein bands of molecular weight (MW) 22 kDa were present in SAWIP on CON and HMC diets and absent from LW x LR on HMC diets. A 24 kDa MW protein band was observed more consistently in the LW x LR on the CON diets and in SAWIP on the HMC diet than in the LW x LR on the HMC diet. Protein bands of MW 36 kDa were present in SAWIP on HMC diets and absent from LW x LR on HMC diets. Two proteins, *guanidinoacetate N-methyltransferase*-like isoform 1 associated with creatine biosynthetic and *catalase*, which is involved in cholesterol metabolic processes, were identified. There were differences in serum and liver proteins and in serum metabolite levels that were diet and breed related. This suggests that proteomics could play a role in evaluating the performance of pigs under different feeding regimes. A proof of principle to assess serum and liver protein profiles of pigs fed a high fibre diet using a sodium dodecyl sulphate polyacrylamide gel electrophoresis matrix-assisted laser desorption ionization mass spectrometry (SDS-PAGE /MALDI MS) workflow was established.

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Milk production on emerging dairy farms of Eastern Free State Province: A case study of Maluti a Phofung area 114

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The objectives of the study were to evaluate dairy milk production on emerging farms in the prime district of Maluti a Phofung, Free State Province. Area114 was developed as a component of the national and emerging dairy development program. All 20 emerging dairy farms practising mixed farming in Thabo Mofutsanyane district were selected and subdivided into two groups based on milk harvesting methods and prices: low quality (<R2.99/L: LQ) or high quality (>R3.0/L: HQ). Data on farm characteristics, management, environment, productivity and milk marketing were collected using a structured questionnaire. Land size averaged 500 ha (range was 70 ha to 2379 ha). About 20% of the farmers rented additional land, averaging 60 ha/farmer. Dairy farming was intensive, semi-intensive, extensive systems or neglected. Dryland pasture was 41 to 53 % for LQ and HQ. Dairy breeds included the Holstein (64%), Ayrshire (28%), Shorthorn 14%), and Jersey (7%) which were naturally bred throughout the year. Between 21 and 30% cows in herds were in milk, with few replacement heifers. Calving rates were low, 65 vs. 70% in LQ and HQ. About 50% of HQ farms use total mixed rations or commercial calf starter feeds, whilst the other producers rely mostly on natural pasture. Maize, dry bean and soya residues and natural pasture constitute the diets of cows in LQ. There was no planted pasture due to lack of resources, pasture production skills and knowledge. Feed composition fluctuated daily as meals were not formulated, except on 2 of the HQ farms; cows mostly consumed high fibre and low protein forage. Daily mean milk yield on LQ was poor, 6.8 vs 8.5 L/cow on HQ (P>0.001). Regular mastitis tests were performed by 70% of the HQ producers whilst the majority of LQ did not test the milk and were not affiliated with milk recording schemes. There was a high prevalence of mastitis in the LQ group resulting in deregistration of some members as milk suppliers. About 65% of HQ farms had access to veterinary services compared to 28% of LQ that had emergency support only. Only 1/5th of the farms kept complete records on the dairy business. There is a need to facilitate rehabilitation of emerging dairy farms in Maluti a Phofung to harness the high milk potential, market and processing opportunities in the Eastern Free State region. Human capacity development and support through animal and forage production interventions are required.

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Productivity of small ruminants in various farm systems under livestock improvement program in Mpumalanga Province

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The farmer participatory research study was conducted to determine the performance of Dohne Merino sheep that were distributed from the departmental research nucleus flock to Land Reform farms through the livestock improvement Program (Masibuyele Esibayeni) in the Mpumalanga Province. The trial was conducted on the Highveld grassland where 25 Ewes and one ram were randomly selected from the Departmental experimental research nucleus flock. The flocks were allocated to Departmental, Cooperative, Youth and Individual family owned projects of Athole, Mooihoek, Rouxland and Tweefontein farms respectively. The farms are respectively situated in Msukaligwa, Mkhondo, Pixley kaseme and Likwa local municipalities. Each sheep in a flock was identified by properly numbered steel/plastic ear tags and the flocks branded by the tattoo brand of each farm. There were minor alterations on the management program systems implemented by the small stock beneficiaries at the trial sites. The health management programs were implemented according to the ecological sites and local veterinary services specifications. Data on economically important traits, like the reproduction efficiency traits, was collected from the various flocks and analysed using excel standard error bars (SE). The results showed that standard error bars overlapped for lambing and weaning rate averages of Athole, Rouxland, Tweefontein flocks across 2012-2014 years and only in 2013 for Mooihoek flock which means the lambing and weaning rate averages were not statistically significant ($P>0.05$). Whilst there was no overlap in lambing and weaning rate averages within Mooihoek flock during 2012 and weaning rate average during 2014, the average for that period was statistically significant ($P<0.05$). Therefore in 2012 and 2014 the Mooihoek flock, with the exception of year 2013, had a lower lambing rate than Tweefontein, Rouxland, Athole flocks over time. In 2012 Mooihoek flock had a lower weaning rate than Tweefontein, Rouxland, Athole flocks. The study demonstrated that the change from seasonal breeding system in the original parent flock to continuous breeding system in Mooihoek beneficiaries flock might have influenced the negative performance on reproduction efficiency traits during some periods. This can be attributed to the group dynamics conflicts within the Cooperative owned Mooihoek flock project.

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Molecular characterization of three indigenous Southern African cattle breeds

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Indigenous breeds play an important role in the socio-economic and cultural lives of people. Most of these indigenous breeds in Southern Africa are of the Sanga type and are mainly reared by communal or small to medium scale producers. They are well adapted to the local harsh conditions and perform better than exotic breeds under this environment. The objective of the current study was to assess the genetic variation of three indigenous cattle breeds of Southern Africa using DNA microsatellite markers. Hair samples were collected from 113 animals, comprising of Landim (35), Nguni (40) and Bonsmara (38) breeds. Samples for Nguni and Bonsmara were collected from South African farms and those for the Landim were collected from Chobela Research Station in Mozambique. Genetic diversity microsatellite marker panels recommended by the FAO/ISAG advisory committee were used to amplify the DNA regions. The markers studied showed a high level of polymorphism among the three breeds, with an average of 6.2 alleles per locus. The number of alleles ranged between 2 to 9, with the BM1824 having the lowest and TGLA53 and TGLA227 the largest number per locus. A total of 55 alleles were identified in the Bonsmara, 66 in the Nguni and 67 in the Landim breed. The Landim breed showed greater heterozygosity (0.736) than Nguni and Bonsmara, (0.686). The genetic distances of Nei (1978) were estimated and ranged from 0.122 to 0.377. Short genetic distance was observed between Landim and Nguni breeds. These findings provide an insight into some of the cattle genetic resources that can be conserved, in order to avoid the loss of genetic diversity, in Southern Africa.

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The influence of superovulation protocol on yield and developmental competence of oocytes obtained from Holstein cattle

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The dairy industry is considered an important contributor to the South African agricultural industry, providing up to R 11 billion income, which represents 6.5% of the agricultural economic income generated in 2012. Dairy producers are under pressure to produce milk cost-effectively, and the incorporation of assisted reproductive techniques such as *in vitro* embryo production (IVEP) in dairy herd management programs can potentially contribute to shortening the generation interval from 5 years to 3.5 years, and optimizing the number of offspring from a genetically superior dairy cow. European breeds such as the Holstein are not considered as excellent candidates for IVEP programs, for due to genetic selection and lactation stress, these breeds tend to produce fewer ova, as well as ova of poor quality. The quality and quantity of ova play an integral role in determining the economic viability of implementing IVEP in dairy management systems. The study investigated the influence of superstimulation protocol (SP) on the yield and developmental competence of oocytes collected by means of transvaginal ultrasound-guided ovum pick-up from Holstein cattle. The different SP's consisted of 3 treatment regimes, i.e. a low FSH dosage (7.5mL), medium FSH dosage (9.0mL), and high FSH dosage (12.0mL), which were administered according to a 7-day treatment programme. Superstimulation protocol did not influence the oocyte yield, developmental competence or number of embryos produced. No interaction of SP with donor age or lactation category, was reported. Preliminary results indicate that the efficacy of SP's is complex in nature, and that factors such as nutrition, and genetic selection can influence the outcome of IVEP programmes.

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Effects of bacterial inoculants on the chemical composition and fermentation dynamics of maize silage

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The study investigated the effect of bacterial inoculants on the chemical and fermentation characteristics of maize silage. Maize (*Zea mays* L.) is the most important grain crop in South Africa grown for human and animal consumption. Approximately 8.0 million tons of maize grain is produced in South Africa annually, on approximately 3.1 million hectares of land. Maize is the most popular cereal which is conserved as silage and large areas are grown for this purpose in many parts of the world. Maize is, however, essentially a tropical crop and in the United Kingdom (UK) it can only be grown satisfactorily for ensilage in the south of the country. Maize was ensiled in 24, 1.5l ensiling jars and left at room temperature to follow the fermentation dynamics. Maize silage was treated with Emsilage (bacterial inoculant) and without inoculants. Emsilage was applied at a rate of 2.25ml Emsilage diluted in 27.75ml water to treat 30kg fresh material. To get the same moisture content the control was also sprayed with the same water content. Fresh samples were taken and analysed for crude protein (CP), gross energy (GR), ether extract (EE), neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL), dry matter (DM), pH, and water-soluble carbohydrates (WSC). Inoculant did not improve ($P<0.05$) the concentration of CP. There was no significant difference in the concentration of GE across treatments. However, inoculants improved ($P>0.05$) the concentration of fibre in Emsilage treatment. The production of WSC was slightly improved with inoculant (119.52g/kg DM). The DM of the silage indicated that the forage was harvested at its earliest stage of maturity which could affect the fermentation process and causes secondary/clostridial fermentation. The pH of the silage over 90 days post ensiling was slightly higher than recommended by other researchers for efficient fermentation. It is therefore concluded that bacterial inoculant did not yield positive results mainly due to the high concentration of the moisture content of the ensiled forage.

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Characterization of the genetic diversity of Kalahari Red goats in the rural areas of Northern Cape Province

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Indigenous small ruminant breeds are crucial for subsistence farmers. The Kalahari Red is recognized as an indigenous goat breed in South Africa. It originated in the Northern Cape Province of South Africa and is believed to be an admixture goat breed. The breed is among the top three meat-producing goat breeds in the country. Little attention is given to animal genetic resources management and maintenance in rural areas. The genetic diversity of meat producing goats has previously been assessed. However, there is no information regarding the genetic variation of Kalahari Red goats in the rural areas of the Northern Cape. The aim of this study was to evaluate the genetic structure of the Kalahari Red populations in rural areas in Northern Cape. Sixty-four blood samples were collected from various rural goats in the Northern Cape Province. Three indigenous reference population goat breeds (Boer, Unimproved Indigenous and Kalahari Red) were sampled from the Agricultural Research Council's bio-bank to quantify the gene flow. The DNA was extracted and genotyped using 15 microsatellite markers. These markers were selected according to the FAO/ISAG recommendations. The results revealed a total of 146 alleles with a mean value of six. The gene diversity values across the populations were high and ranged between Boer (0.6) and Indigenous (0.7). The observed heterozygosity varied from Boer (0.4) and rural Kalahari Red population (0.6). The structure analysis revealed a close genetic relationship between the Northern Cape rural population and the Kalahari Red reference population.

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Oocyte retrieval techniques and the influence of cumulus cells on fertilization and subsequent embryonic development

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The availability of sufficient oocytes is the pre-requisite to any research for the improvement and optimization of reproduction techniques. The objective of this study was to find the most effective technique of retrieving oocytes and the effect of cumulus cells on embryonic development of cattle oocytes. Oocytes were retrieved from abattoir-derived ovaries by the aspiration and slicing techniques. A total number of 375 oocytes from aspiration and 485 from slicing were recovered. Oocytes were further exposed to brilliant cresyl blue (BCB) staining to determine their quality. The exposed oocytes were classed as BCB+ (stained oocytes) and BCB- (unstained oocytes). The data was analysed using ANOVA with 4 replicates per treatment. The aspiration technique was used to recover oocytes for further embryonic development. Only Cumulus Oophurus Complexes (COCs) were used for *in vitro* maturation. The COCs were matured in tissue culture medium 199 + 10% foetal bovine serum, supplemented with FSH, LH and E_2 and incubated for 24h at 39°C in 5% CO_2 humidified air. The COCs were fertilized using frozen thawed capacited bull semen and co-incubated together for 6h at 39°C in 5% CO_2 humidified air. Thereafter, the oocytes were randomly divided into two groups, in group one, oocytes were vortexed to remove cumulus cells prior to *in vitro* culture and the second group was cultured with cumulus cells. Both groups were cultured in SOF-BSA for 48h at 39°C in a modular chamber containing 5% CO_2, 5% O_2. 48h after culture, cleavage rate was assessed and the oocytes were further cultured in SOF-FBS until day 7 for blastocyst formation. Data was analysed using ANOVA with 4 replicates per treatment. The slicing technique yielded a higher number of oocytes (121.25 ± 3.54) compared to aspiration (93.75 ± 3.41). Furthermore, the completely covered oocytes obtained higher BCB+ oocytes for both aspiration (99%) and slicing (97%), whereas the denuded oocytes had higher BCB- oocytes for both aspiration (97%) and slicing (92%). The oocytes cultured with cumulus cells yielded better 2-4 (29%) and 8 (5%) cell embryos when compared with 2-4 (20%) and 8 (2%) cell stage of the denuded oocytes group. However there was no difference in the development of morula at day 5 of culture between the two treatment groups. Blastocyst formation was better in oocytes cultured with cumulus cells (9.2%) compared to the oocytes that were denuded (3.7%) before culture. In conclusion, oocytes with layers of cumulus cells following in vitro fertilisation yielded better cleavage rate and blastocyst formation. However, the rate of blastocyst formation is still low. The BCB stain was found to be useful in selecting good quality oocytes irrespective of the collection technique used.

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Post lambing management practices by communal farmers in Gaga village in the Eastern Cape

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The objective of the study was to determine post lambing management practices by communal farmers in a rural area in the Eastern Cape Province of South Africa .The study was conducted in Gaga village, which is located in Alice under Nkonkobe municipality. Post lambing management practices were assessed through the use of a structured questionnaire from a total of 46 farmers. Selection of farmers was done through the snowballing technique. Assessment focused mainly on finding out challenges faced by farmers, feeding, navel dipping, castration, tail docking and health management of the newly born lambs. Other parameters, like housing, were not included in the questionnaire but observations were made during the visit to the farms. PROC FREQ of SAS (2007) was used to analyse data. Most of the farmers practiced post lambing management, but not all of them practiced navel dipping. The farmers are currently experiencing high (40%) lamb mortalities. The numerous incidences of diarrhoea and early lamb mortalities reported may be linked to navel infections, therefore farmers need to start practicing navel dipping of lambs. About 37% of the farmers perceived mismothering as the main cause of lamb deaths. The study revealed that at least 1-5 lambs are lost by each farmer in a breeding season. Gall sickness, red water and diarrhoea are the most problematic diseases/conditions in newly born lambs. Farmers were reported to use both ethno-veterinary and conventional methods to treat the above mentioned conditions. *Teucrium africanum* Thumb. commonly known as Ubuhlungu is the widely used plant in treating the above mentioned conditions. Most farmers interviewed reported to have received little attention from the government, despite their contribution to the wool industry. Further studies should be done to monitor management practices that influence the survivability of lambs from birth to weaning.

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Evaluation of breeding practices of emerging Bapedi sheep farmers in Sekhukhune District, Limpopo Province

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There are efforts by a group of organised sheep farmers in the Sekhukhune to register their native Bapedi sheep breed. The process of registration will set certain breed standards which will require that defined breeding objectives, developed selection criteria and structured breeding programs be put in place for management of this breed. A survey was conducted to evaluate the breeding practices, breeding objectives and selection criteria used by the Bapedi sheep farmers in the Sekhukhune district. A structured questionnaire was used to collect data from 71 households keeping the Bapedi sheep. The farmers were purposely sampled based on distribution of sheep population and presence of Bapedi sheep in the area. Frequencies for occurrence of breeding practices, breeding objectives and selection criteria among farmers were calculated. It was established that all the farmers practiced continuous breeding. The majority of farmers (81.43%) selected for a breeding ram and castrated inferior rams. There was a very limited exchange of rams (15.49%), which meant many of the rams were either selected from the herds or bought from other farmers. Most Bapedi sheep farmers reported that in cases of bought rams, most of them (62.32%) were of a different breed in an effort to cross for improving productivity, but some owners (29.51%) didn't know why they practiced crossbreeding. The most prevalent breeding objective among Bapedi sheep farmers is high mature weight (63.4%) followed by improved reproduction (14.1%). Size (74.93%), colour (47.84%), masculinity (29%), conformation (27.55%) and growth rate (17.4%) were the most preferred traits in selection of a breeding ram. For breeding ewes, size (67.63%), conformation (33.82%), growth rate (23.96%), colour (16.9%) and fertility (12.69%) were preferred traits for selection. The breeding practices indicated that there is an understanding among farmers on the need for efficient breeding management and utilization of the Bapedi sheep, however the prevalence of crossbreeding means the practices are not in line with keeping the breed pure. The selection criteria used by the majority of farmers are simplistic and seem to be in line with the farmers' general breeding objectives.

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The effects of breed and parity on the number of days open amongst multiparous dairy cows.

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This study aimed at investigating associations between parity, breed and number of days open (days from calving to conception). A randomized completely blocked design of a total of five hundred and seventy two (n = 572) dairy cows was used. Data was collected concerning Holstein-Friesland (HO), Jersey (JO) and Cross breed (XO) (192 of each breed) of which 32 cows from each breed were of the same parity during the study period (October 2012-September 2013). The parity of interest ranged from second to sixth lactations. The number of days open were calculated and recorded from the raw data obtained from the Dairy Records Management Systems (DRMS) of the Fort Hare Dairy Trust. A two way ANOVA was used to test the significance (SAS, 2010) and Tukey's test was used to separate the means. The means for both parity and breed on milk yield and days open were significantly different ($P<0.05$). There was no interaction between breed and parity. It was then concluded that the Holstein-Friesland (DO = 109.292) breed has got the highest number of days open, whilst the Jersey breed has got the least (DO = 104.458) as well as days open decreasing as parity increases.

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Nutrient digestion and production between indigenous and dual-purpose chickens for their future use in integrated fish farming

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This study evaluated the effects of chicken breed on dietary digestibility, excretion and production for use in integrated fish farming. This was essential for identifying the breed most suitable to be used in integrated fish farming. A complete randomized block design was used. Excreta samples of 48 chickens (12 Black Australorp, 12 New Hampshire, 12 Ovambo and 12 Potchefstroom Koekoek) were collected over seven days. Production traits were evaluated from 80 chickens (six breeds, 20 hens/breed). Potchefstroom Koekoek had higher dry matter, calcium, phosphorus and potassium digestibility and lower nutrient excretion than Ovambo, Black Australorp and New Hampshire. No significant differences were observed in nitrogen digestibility and excretion. Highly significant breed effects were observed for phosphorus and potassium excreta content with OV recording the highest mean while Potchefstroom Koekoek showed the lowest mean. Black Australorp presented higher body weight than other breeds, whereas New Hampshire and Ovambo showed lower feed intake. Breeds differed significantly in feed conversion ratio, egg production and egg size distribution. Egg production was lower for New Hampshire, Ovambo and Black Australorp and higher for Potchefstroom Koekoek. Higher numbers of large eggs were also observed in Potchefstroom Koekoek, Ovambo and Black Australorp than in New Hampshire, whereas New Hampshire did not differ from Black Australorp and Ovambo. A significant higher concentration in the distribution of medium sized eggs was observed in Potchefstroom Koekoek compared to Black Australorp and New Hampshire breeds. However, the number of medium eggs observed in Ovambo did not differ from that of Potchefstroom Koekoek, Black Australorp and New Hampshire. In conclusion, it is recommended that indigenous breeds are selected for integrated fish and chicken farming due to the promising results of Potchefstroom Koekoek in egg production and size, as well as the nutrient dense manure of Ovambo breed.

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Transcriptome response of small intestine of *Ascaridia galli* infested and non-infested village chickens derived from two agro-ecological zones of South Africa

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Nematodes of the genus Ascaridia are known to infect many species of birds and cause fatal diseases. *Ascaridia galli* damages the intestinal mucosa of chickens leading to blood loss and secondary infection, and occasionally the obstruction of the small intestines due to the high worm burden. Analysis of differences in gene expression profiles associated with infestation or pathology status can provide an understanding into the molecular genetic architecture of host immune response. Very little information is available on the genetic resistance to gastrointestinal parasites, particularly in village chicken populations. This study was aimed at investigating the gene expression profiles in chickens from two different agro-ecological zones of South Africa that were infected by the *Ascaridia galli* parasite. The small intestine from non-infected chickens did not show any presence of parasite and did not display any detectable histological changes whereas the naturally *A. galli* infected intestines displayed hypertrophy of the intestinal villi with accumulation of inflammatory cells and necrosis of the crypt of Lieberkühn gland. Total RNA was isolated from small intestines of infected and non-infected village chickens. High-quality RNA of the small intestine was sequenced using Illumina HiSeq 2500 and generated between 3908924 and 3994946 reads. Using the open-access Tophat program, an average of 83.50% of trimmed and quality controlled reads were mapped to the reference chicken genome (*gallus.galgal4.74*). Cuffdiff was then used to analyze differentially expressed genes (DEG) in infected vs non-infected chickens. A total of 16383 DEG were detected between any two-way comparisons of the intestines. Of the 3061 detected in Limpopo chickens, 1608 were up-regulated while 1452 were down regulated Of the 130 from KwaZulu-Natal Province, 11 were up-regulated and 119 down-regulated. Gene ontology analysis of DEG revealed an enrichment of immune response, defense response, inflammatory response and cell signaling genes. Phosphatidylinositol signaling system pathway and T cell receptor signaling pathway were among the most significantly impacted pathways. The identification and functional annotation of differentially expressed genes open a major step towards understanding the molecular network underlying resistance of chickens to *Ascaridia galli* parasites.

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A comparison of the proximate, mineral, amino acid and fatty acid content of industrially processed *Sclerocarya birrea caffra* seed meals and Soyabean meal

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Soyabean meal (SBM), the major dietary protein source in livestock feeds is in short supply in sub-Saharan Africa. The seeds of *Sclerocarya birrea caffra* (Amarula), an indigenous fruit bearing tree, are used for oil extraction. The residue from the oil extraction could be a potential source of dietary protein. This study characterised and compared the nutritional potential of Amarula seed meal (ASM) to SBM by determining their proximate, amino acid, mineral and fatty acid composition. Two differently processed ASMs, ASM 1 (hydraulic filter press) and ASM 2 (cold press) were evaluated. The crude protein (CP) and ether extract (EE) content of SBM, ASM 1 and ASM 2 were significantly different ($P<0.0001$). The CP content was highest ($P = 0.0001$; 51.18±0.07 %) in SBM compared to that in ASM 1 (32.47±1.68 %) and ASM 2 (39.10±0.50 %). The EE was lowest in SBM (1.98±0.00 %) compared to the EE in ASM 1 (49.85±0.36 %) and ASM 2 (41.13±1.44 %). There were no significant differences ($P>0.05$) in the NDF and ADF content of the meals. While the DM, ash and gross energy (GE) content of ASM 1 and ASM 2 were similar ($P>0.05$), the DM and GE content of both the ASM 1 and ASM 2 were significantly higher ($P<0.05$) compared to those of SBM. Ash was highest in SBM. There was no significant difference in the amino acid (AA) composition of ASM 1 and ASM 2. However, the AA composition of SBM was significantly higher except for arginine whose concentration was highest in ASM 2. Cobalt, molybdenum, sodium and sulphur were similar across the meals, but the other macro- and micro-minerals differed significantly. There was no significant difference in SFAs profile of the meals. The MUFA content was higher ($P<0.05$) in the ASMs compared to SBM, but the PUFA content of SBM was higher ($P<0.05$) compared to that of Amarula meals. Oleic acid (OA) was the predominant fatty acid across the meals. Although the Amarula seed meals had a lower CP and AA content compared to SBM, their CP content is comparable to other plant-derived dietary protein sources. Due to the relatively lower CP and AA content, the potential of the high-energy and high-OA content Amarula seed meals as dietary protein sources needs to be evaluated in ruminant animals.

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Population structure of Swakara sheep using genome wide SNP data

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Selection and domestication determine the genetic structures of populations. High-density SNP panels make possible determination of genetic diversity, population stratification and history in a number of livestock species including sheep. This study used the OvineSNP50 beadchip to genotype 96 unrelated animals of the Swakara sheep breed collected from four locations of Halle (Germany), Northern Cape (South Africa), Gellap-Ost and two other private farms (Namibia). The animals belonged to four different coat colour subgroups of white-vital (n =41); white sub-vital (n =17); grey (n =22) and black (n =16). Population genetic structure was determined using ADMIXTURE, principal component analysis (PCA) implemented in Golden Helix's SVS genome suite and Weir & Cockerham F statistics from ARLEQUIN. Expected heterozygosity averaged 0.37 ± 0.13 and heterozygotes deficiency was observed in all subpopulations. The grey subpopulation was the least inbred (F_{IS} = 0.028) whilst the white-vital subpopulation was the most inbred (F_{IS} =0.099). The level of population differentiation (F_{ST} by genetic markers) was greatest between the white-vital and black population and the SNP with the highest F_{ST}=0.68 was on chromosome 5. Lowest F_{ST} of 0.01 was observed between the white-vital and grey subpopulation. The overall population F_{ST} was 0.29 for a SNP on chromosome 13. The same SNP had a high F_{ST} of 0.62 between the white and black subpopulations. PCA and ADMIXTURE analyses revealed significant sharing of genetic diversity amongst the different subpopulations. The present Swakara population is a result of years of intensive selective breeding that resulted in high inbreeding levels.

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Lucerne leaf-meal nutrition for Holstein heifer neonates and calves

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A study was conducted i) to determine *in vitro* degradability and carbohydrate and energy fractions supply of lucerne leaf-meal (LLM) and composite diets of LLM with calf concentrate feeds and also ii) to determine the effects of substituting calf concentrate feed with LLM on the intake, % ruminal nitrogen balance (RNB) and growth of the pre-weaned (21 to 42 days old) and transition (43 to 56 days old) Holstein heifer calves. The study comprised of two experiments: pre-weaning (Experiment 1) and transition (Experiment 2) phases. A total of 48 Holstein heifer calves were used in the study. Animals (n=24) in each study were randomly assigned to three different dietary treatments in a complete randomized design (CRD) of: (A) pelleted concentrate (PEL), (B) 65% pelleted concentrate: 35% LLM ($P_{65}L_{35}$); (C) and 50% pelleted concentrate: 50% LLM ($P_{50}L_{50}$). Neonates were each provided with 4L while transition calves had 2L of milk on a daily basis, and all had *ad libitum* access to fresh, clean water throughout the experimental period. Calves were weaned at the age of 56 days. *In vitro* rumen degradability for dry (IVDMD) and organic matter (IVOMD) were estimated at 0, 4, 10, 18, 24 and 48 hours, whereas neutral detergent fibre (IVNDFD) and crude protein (IVCPD) were estimated at 24 and 48 hours using Daisy^{II} incubator. Rumen fluid was obtained from calves < 50 days old. Large Ruminant Nutrition System (LRNS) was used to predict %RNB and energy density of the diets during pre-weaning and transition phases. Energy and CP contents of diets were similar. LLM had GE and CP of 16.2 MJ/kg and 25% DM, respectively. Higher mean Ca levels were found with LLM inclusions while P level tended to decrease with LLM inclusion in the diets. The IVDMD did not vary at 0, 4 and 10 hours, but diets with LLM had higher disappearance post 18 hours, with effective degradability of 88.0 and 92.0% for $P_{65}L_{35}$ and $P_{50}L_{50}$, respectively. Diet A had higher starch content than Diets B and C. However, Diet A had greater bound fibre than other diets. Neonates on Diet C had higher daily DM and CP intakes, %RNB, TDN, NEm and NEg during pre-weaning but intakes were similar across diets during transition phase. Performance of calves was similar during the transition phase. Lucerne leaf-meal should be considered as a complementary proteinaceous forage concentrate in diets of neonates and calves.

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The influence of cereal type on performance and gut development of indigenous chickens aged 1-7 weeks

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A study was conducted to examine the effects of feeding whole sorghum and maize grain on performance and gut development of indigenous chickens aged 1-7 weeks. A total of 120 indigenous chickens were assigned to a complete randomized design with 4 treatments replicated 5 times with 6 birds per replicate. Four diets were formulated to contain 100% ground maize, 25%, 50% and 100% of whole sorghum to meet the major nutrient requirements of indigenous chickens. Data on feed intake, weight gain, feed efficiency and gastrointestinal morphometrics were collected. The results were analysed using statistical analysis of variance. Feed intake, weight gain and feed efficiency were not affected ($P<0.05$) by the treatment effects. The small intestine and gizzard of chickens fed 100% whole sorghum were longer and heavier ($P<0.05$), than those on other treatments. The villi height, crypt depth and villi/crypt ratio were also higher ($P<0.05$) for chickens on 100% whole sorghum. Feeding whole sorghum did not affect performance of indigenous chickens. It has, however, improved gut morphology of indigenous chickens at ages 1-7 weeks.

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Phenotypic characterisation of Pedi sheep

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On-station characterisation of the indigenous Pedi sheep breed (44 ewes and 15 rams) was undertaken at the Agricultural Research Council-Animal Production Institute (ARC-API) as an essential step towards the development of a sustainable conservation and improvement programme. The objective was to achieve a preliminary assessment of type and function of the breed, based on zoometrical indices produced from combinations of different morphometric values. Body weights (BW), linear body parameters, and reproductive traits of both rams and ewes were measured. The traits that were measured included live body weights (LWT), body length (BL), heart girth (HG), height at withers (WH), pelvic width (PW), chest depth (CD), length between the teats (LT), scrotal circumference (SC), testicular diameter (TD), testicular length (TL), and semen parameters. Pedi sheep used were 12, 24, and 36 months of age. Semen was collected with the aid of an electro-ejaculator from 15 rams. The semen was collected directly into 15ml tubes, and immediately placed in a thermos flask at 37°C and transported to the laboratory for microscopic and macroscopic semen evaluation within an hour. Motility rates were evaluated using a Computer Aided Sperm Analysis (CASA). The average parameters measured were (BW) 49.85kg and 39.62kg, (BL) 123.8cm and 61.45cm, for rams and ewes respectively. Length between the teats (7.5cm on the ewes) and average (SC) 29.1cm, (TL) 10.4cm. The average semen volume of 0.7ml, total motility 84%, live sperm 77%, dead 23% with concentration 0.695 x 106ml, and pH 7. The results indicate that rams are heavier and longer in length than ewes. Knowledge of these identities represents a crucial step towards the comprehension of how in depth characterisation of Pedi sheep relates to the improvement and sustainability of the indigenous breed.

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Growth and feed efficiency of range performance tested beef bulls in the arid sweet bushveld of South Africa

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Data consisting of test performance records of 725 bulls was analysed to evaluate trends for growth and feed efficiency, and to determine environmental factors that influence growth of range performance tested bulls in the arid sweet bushveld of South Africa. Performance data was subjected to regression procedures to estimate parameters of the slope (β) and intercept (α) for average daily gain (ADG) and Kleiber ratio (KR). Mixed procedures were applied to test for sources of variation in ADG and KR. There was an increase of 3.481 g/day/year and 0.528 g/day/year in ADG for Nguni and Bonsmara bulls, respectively. The ADG trends' respective feed efficiency as reflected by KR was 0.093 and 0.059. Herd of origin and test-year were the sources of variation for ADG while the variation in KR was due to herd of origin, test-year, start-age and start-weight. Results indicated a steady increase in ADG and KR for range performance tested bulls in the arid sweet bushveld.

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Genetics of ewe reproduction, body weight and scrotal traits in the Elsenburg merino flock

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Successful lamb production is influenced by fertility of and efficient reproduction of males as well as females. Ewe productivity (expressed as number of lambs weaned per lambing opportunity) in particular is believed to contribute significantly to successful lamb production on farms. The objective of this study was to estimate the heritability of, and correlations between ewe reproduction with body weight and scrotal traits in South African Merino sheep. The data consisted of 4 905 animals, the progeny of 241 sires and 1 502 dams born between 1986 and 2012. Ewe reproduction traits were (direct heritability estimates): number of lambs born (NLB1-0.10), number of lambs weaned (NLW1-0.07), and total weight weaned (TWW1-0.10) per ewe at her first parity; number of lambs born (NLB3-0.25), number of lambs weaned (NLW3-0.12) and total weight weaned (TWW3-0.18) per ewe over three lambing opportunities. Body weight traits were: birth weight (BW-0.17) measured within 24 hours of birth, weaning weight (WW-0.16) at approximately 100 days and hogget live weight (LW-0.36) at approximately 16 month of age after shearing, without fasting. Scrotal traits included: scrotal circumference (SC-0.32) and testicular diameter (TD-0.23). Standard errors of all traits ranged between 0.03 and 0.07. The genetic correlations (r_g) of WW and LW with ewe reproduction ranged from 0.41±0.15 between LW and NLW3 to 0.86±0.17 between WW and TWW1. Positive r_g were evident for NLB1 and NLB3 with both scrotal traits, suggesting that, rams with higher measurements of SC and TD are likely to father daughters with an improved lambing rate. Rams with higher measurements of scrotal traits are likely to sire daughters that wean more lambs as suggested by high r_g of NLW1 and NLW3 with scrotal traits. The results from this investigation also indicated positive r_g of SC with TWW1 and TWW3. It is therefore concluded that selection for ewe reproduction will not result into unfavourable correlated responses in body weight.

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Non-genetic factors influencing reproductive performance of Bapedi sheep reared under extensive production system at Mara Research Station, Limpopo Province

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The study was aimed at investigating the influence of non-genetic factors on reproductive performance of Bapedi sheep under extensive production system. Data on reproductive performance of Bapedi sheep at Mara Research Station from 2006 to 2014 consisting of 447 records of litter size, 105 records of age at first lambing, 68 records of lambing interval between first and second lambing and 44 records of lambing interval between second and third lambing was used to determine the effect of sex, parity, type of birth, birth year, season of birth and ewe age on reproductive performance. Reproductive traits included age at first kidding, litter size and kidding interval. General Linear Model (GLM) procedure of SAS was used to determine the effect of non-genetic factors on reproductive performance of Bapedi sheep. Age at first lambing, lambing interval and litter size were influenced by year of birth and season of birth. Litter size was also influenced by age of the ewe. The lowest age at first lambing (413.28 days) and kidding interval between second and third lambing (293.86 days); and kidding interval between first and second lambing (304.00 days) were observed in 2006 and 2007 respectively. The highest litter size of 1.5 was obtained in ewes aged 7 years and beyond. Type of birth had no influence on age at first lambing. Parity and ewe age had no influence on lambing interval. Parity did not influence litter size as well. The study has shown that non-genetic factors have a crucial role to play in the reproductive performance of Bapedi sheep and should be taken into consideration when planning breeding programs of these genetic resources.

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Analyses of the impacts of bacteriological seepage emanating from pig farming on the natural environment

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Modern pig farming production may over-burden the environment with organic substances, exposure to bacterial pathogens and introduction of a resistance gene. This may be caused by the pig's droppings, lack of seepage management or accidental spillage of seepage which may impact on the environment and its physicochemical parameters. The objective of this study is to determine and assess the level of bacteriological pollution emanating from the pig farm and its impact on the physicochemical parameters of soil and water, as well as to identify the presence of an antibiotic resistance gene of the prevailing bacteria. Soil and water samples were collected monthly for a period of six months (March- August 2013). Samples were collected at pig enclosures, soil 20m away from pig enclosures, constructed wetland used for treating pig farm wastewater, soil 20m and 100m away from constructed wetland. Procedure followed for analysing samples includes viable cell counts of 10^1 to 10^8 dilutions, physicochemical analyses, antibiotic susceptibility test, identification of bacteria using API 20E test kit and identification of resistant gene using molecular procedures. The viable cells in soil samples from 30cm depth ranged from 0 cfu/ml to 2.44 x 10^{10}cfu/ml, in soil from 5cm depth ranged from 1.00 x 10^1 cfu/ml to 1.91 x 10^{10} cfu/ml, and in water samples viable cells ranged from 5.00 x 10^1 to 5.05 x 10^9. Physicochemical parameters of water showed unacceptably high levels of analysed parameters for BOD (163 mg/L to 3350 mg/L), TDS (0.77 g/L to 6.48 mg/L), COD (210 mg/L to 9400 mg/L), NO_3 (55 mg/L to 1680 mg/L), NO_2 (37.5 mg/L to 2730 mg/L), and PO_4^{3-} (50 mg/L to 1427), which were higher than the maximum permissible limits set by the Department of Water Affairs and Forestry (DWAF) . For soil samples, TDS (0.01g/L to 0.88 g/L), COD (40 mg/L to 304 mg/L), NO_3 (32.5 mg/L to 475 mg/L), and NO_2 (7.35 mg/L to 255 mg/L) were observed to be higher than recommended limits set by Federal Ministry for the Environment (FME). *Salmonella spp, Proteus spp, E.coli1, Pseudomonas aeruginosa, Klebsiella pneumonia, Enterobacter aerogenus* etc. were isolated from soil and water samples from the pig farm. Isolates were highly resistant to penicillin G, sulphamethaxazole, vancomycin, tilmocozin, oxytetracycline, spectinomycin, lincomycin, and trimethoprim. The most resistance genes detected in most isolates were *aa (6')-Ie-aph (2")-Ia, aph (2")-Ib, aph (3")-IIIa, Van A, Van B, Otr A* and *Otr B*. Pig farm seepage is causing bacterial pollution which is impacting negatively on the natural environment in the vicinity of the pig farm by introducing bacterial pathogens that have an antibiotic resistance gene and is increasing the physicochemical parameters for soil and water in the natural environment at the pig farm.

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Medicinal plants used by resource-limited farmers to treat tick-borne diseases in cattle in Eastern Cape Province, South Africa

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Ticks are the most common external parasites of economic importance in cattle. Ticks cause fleece and hide damage, tick worry and anaemia, and are vectors which transmit tick-borne diseases such as gallsickness, redwater and heartwater. Conventional medicines are used to control and treat tick-borne diseases, but are expensive and not readily available to resource-limited farmers. This results in many resource-limited farmers resorting to the use of medicinal plants as alternative remedies to treat tick-borne diseases. The medicinal plants used to control tick-borne diseases in cattle were documented by conducting a structured questionnaire survey. A total of 53 farmers from Chris Hani District Municipality, Eastern Cape Province of South Africa were interviewed using the snowball technique. From the study, 51% of the respondents indicated that they used medicinal plants to treat tick-borne diseases. The study revealed that *Aloe ferox* (27%) and *Aloe arborescens* (4%) of Asphodelaceae family and *Elephantorrhiza elephantina* (6%) of the Fabaceae family were the commonly used plant remedies to treat tick-borne diseases. The farmers used different parts of the plants for the herbal preparations with, 45% using leaves, 28% used the bark, 15% used other parts (trunk, bark of stem and root bark), 8% used the whole plant and 4% used roots and tubers. The farmers claimed that they used decoctions (56%) and infusions (29%), whilst 15% used both preparation methods. From the study 79% of the respondents reported that they drenched their animals, whilst 21% dosed their cattle. The results of this study have reflected fair knowledge on plant use to treat tick-borne diseases, thereby forming an alternative cost effective strategy in managing tick-borne diseases in the Province. However, there is great need to document and validate information on the use of these medicinal plants in controlling tick-borne diseases before they are recommended for use.

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Medicinal plants used to control internal parasites in sheep and goats in the Eastern Cape Province of South Africa

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Commercial drugs are becoming more expensive and resource-limited farmers cannot afford, hence they seek cheaper alternatives such as medicinal plants. A survey was conducted in order to document plants used in the control of internal parasites in small ruminants in the Eastern Cape Province of South Africa. Information was collected from local small ruminant farmers and herbalists using questionnaires. A total of 9 plants belonging to 8 families are frequently used in the treatment of internal parasites in small ruminants. *Aloe ferox* was the most used plant (65%) and leaves were the most used part of plants (46.15%). Decoction is the most used method of preparation (53.85%). Some plants are mostly used in combination, while others are not, such as *Aloe ferox, Albuca setosa* and *Acokanthera oppositifolia.* The plant remedies are mostly administered orally in 750 ml bottles and mostly done twice in summer and once in winter. Some of these plants recorded have been reported to have some other activities such as anti-inflammatory, antimicrobial, anti-oedema amongst others. There is a need to conduct further studies so as to validate the efficacy of these plants as they can provide cheap alternative ways of controlling internal parasites.

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Chemical composition and *in vitro* ruminal fermentation of selected cowpeas varieties grown in Limpopo Province, South Africa

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The objective of this study was to determine the nutritive value of twelve cowpea varieties using chemical composition and *in vitro* gas production techniques. Twelve different cowpea varieties were evaluated in this study. These were as follows: TX 08-30-1, GEC, IT98K-598-2, TX08-49-1, IT 86D 1010, PAN 311, IT 97K-499-35, IT98K-205-8, IAR 48, IT 98K-491-4, IT 98K-391-2 and Bechuana White. The 12 varieties were replicated 4 times in a completely randomized block design (CRBD). All in all, there were a total of 48 experimental units. Individual plots were allocated randomly to experimental treatments. The plot size was 4m * 4m and inter-row spacing was 0.75m. Dual (Metachlor) was applied at the rate of 0.5 litres per hectare as a pre-emergent herbicide. Chemical composition (organic matter, neutral detergent fibre (NDF), acid detergent fibre (ADF), crude protein (CP) and minerals) and *in vitro* rumin fermentation were determined on the cowpea varieties after they were dried and milled so as to pass through a 1mm sieve. The experimental result revealed that values of TX 08-30-1, GEC and IAR 48 had higher CP values and the differences were statistically significant ($p < 0.05$). Varieties IT 86D 1010, IT98K-205-8 and IT98K-598-2 had higher NDF and ADF values and these values statistically differ (($p < 0.05$) to the rest of the cowpea varieties tested. These varieties also showed higher cumulative gas production as a result of low digestible organic matter (DOM). The results of the experiment confirm that TX 08-30-1, GEC and IAR 48 can potentially be used to supplement poor quality roughages to improve animal production and productivity in South Africa.

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Factors influencing water scarcity for goats in resource-limited communal farming environments

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The objective of the study was to determine factors affecting water scarcity for goats kept under smallholder resource-limited communal farming systems. Data were collected using structured questionnaires (n = 285) administered to randomly selected farmers from semi-arid and sub-humid regions of Nongoma area in KwaZulu-Natal South Africa. Water scarcity was ranked the major constraint to goat production in the semi-arid region when compared to the sub-humid region ($P < 0.05$). More than 40 % of respondents reported dams as the major water source for goat drinking in the semi-arid region. About 8 and 30 % of interviewees reported increased incidences of water scarcity during the rainy season due to negative effects of climate change and rainfall decrease during the dry seasons over the past 30 years, respectively. The risk of water scarcity for goat drinking was highest for goat farmers in the semi-arid region ($P < 0.05$) compared to household goat farmers in the sub-humid regions. Household goat farmers with small flock sizes, and located close to the nearest water source for goat drinking ($P < 0.05$), also had higher chances of reporting water as a scarce resource for goat drinking. It was concluded that water source, season, climate change, goat flock size, region and distance to the nearest water source were factors which caused water scarcity for goat drinking in resource-limited communal farming environments.

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Evaluating two different exogenous 6-phytase enzymes on broiler production

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The objective of the study was to investigate the efficiency of two thermostable 6-phytase enzymes on broiler production. Nine-hundred (n=900) as-hatched day-old Arbor Acres broiler birds were obtained from a commercial hatchery and divided (n=300/treatment) between the three treatments. Each treatment was further subdivided into ten replicate groups of thirty birds each (n=30 birds/replication) according to a completely randomized design. Birds were housed (13.51 birds/m2) in a semi-environmentally controlled broiler house using a lighting program of 18 hours light and 6 hours dark (18L:6D) for the duration of the 35-day trial period. Treatments A and B contained two different phytase enzyme products that are commercially sold in South Africa, while no phytase enzyme was included in treatment C that serves as the negative control treatment. A three phase feeding program was used (Starter: D0-14, Grower: D15-28 and Finisher D29-35), while all diets were formulated to be iso-nutrient according to the broiler nutrition specification guide of the Arbor Acres plus genotype. All three diets of treatment A contained a 6-phytase enzyme derived from *Buttiauxella* spp. and expressed in the fungus *Trichoderma reesei*. The three diets of treatment B were identical to those of treatment A, except that the original phytase enzyme of treatment A (*Buttiauxella* spp) was replaced with a phytase enzyme derived from *E.coli* on a 1:1 phytase unit basis (FTU). No dietary nutrient matrix adjustment was made between the two different phytase enzymes of treatments A and B – considering that their nutrient contribution were to be equal. The *E.coli* phytase is produced via the expression of r-AppA that involves getting the appA gene from the *E.coli* BL-21 strain that was transformed by an expression vector and is overexpressed in the yeast *Pichia pastoris*. The three diets of the control treatment C contained no phytase enzymes while additional monocalcium phosphate and energy sources were used during formulation to ensure the same nutrient specifications of treatments A and B. Body weight and feed intake of each replicate group were determined on a weekly basis, while mortalities were recorded twice daily. Data for the production period (D0-35) were statistically analysed using the GLM procedure of SAS. No differences (P>0.05) were recorded for total body weight gain (2324.90±13.17 g/b), total feed intake (3519.98±32.80 g/b) or FCR (1.51±0.02) between treatments during the 35 day experimental period. Results of the present study seem to indicate that there is no difference (P>0.05) between the two exogenous 6-phytase enzymes in terms of their efficiency as illustrated by the broiler performance indicators. It further suggests that these enzymes could replace each other on a 1:1 FTU basis in broiler diets, without any detrimental effect on the production performance of the birds, given the usage of iso-nutrient diets.

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The use of microsatellite marker set to detect hybridisation between Lechwe (*Kobus leche*) and Waterbuck (*Kobus ellipsiprymnus*)

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Hybridization is viewed as a threat to natural populations as it can lead to loss of genetic diversity within a population. Hybridisation between the Lechwe (*Kobus leche Kafuensis)* and the Waterbuck (*Kobus ellipsiprymnus*) result in hybrid offspring that are known to be sterile. The objectives of the study were to compare the level and distribution of genetic variation and the maternal lineages of the hybrid individuals between Lechwe and Waterbuck using microsatellites markers and mtDNA sequences. Pure Lechwe and Waterbuck, two putative hybrids and four unknown population were genotyped with 17 autosomal microsatellite loci. All markers were polymorphic. AMOVA analysis displayed considerable genetic variability between the Lechwe and Waterbuck populations with Fst = 0.318 (P=0.001). STRUCTURE software was used to cluster individuals to a pre-defined number of $2 \leq K \leq 4$ clusters. The most probable clustering was found at K = 3 (95% identical runs). At this level of differentiation, the population separated as three independent clusters, indicated a clear sub-division of purebred Lechwe, purebred Waterbuck and putative hybrids forming an intermediate between the two purebred populations with coefficient of member's hybrids (Q1) at 0.90. The two antelope mtDNA diversity showed that hybrids are maternally linked to the Waterbuck.

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Effect of bacterial and enzyme additives on the fermentation characteristics of lucerne (*Medicago sativa*) silage

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This study was conducted to determine the effect of fibrolytic enzyme (Viscozyme) additive, either alone or in combination with lactic acid bacteria inoculant (Sil-All), on the fermentation characteristics of ensiled lucerne. Third-cut lucerne was harvested at full bloom, wilted to 450g/kg DM and chopped to a theoretical length of 1 cm. Treatments were arranged in a 4 × 4 factorial design, and the treatments were: (1) control (no additive), (2) Sil-All at 1.25 × 10^5 cfu/g fresh matter (FM), (3) Sil-All at 2.5 × 10^5 cfu/g FM, (4) Sil-All at 5.0 × 10^5 cfu/g FM, (5) Viscozyme at 0.19 ml/kg FM. (6) Viscozyme at 0.19 ml/kg FM + Sil-All at 1.25 × 10^5 cfu/g FM, (7) Viscozyme at 0.19 ml/kg FM + Sil-All at 2.5 × 10^5 cfu/g FM, (8) Viscozyme 0.19 ml/kg FM + Sil-All at 5.0 × 10^5 cfu/g FM, (9) Viscozyme at 0.38 ml/kg FM, (10) Viscozyme at 0.38 ml/kg FM + Sil-All at 1.25 × 10^5 cfu/g FM , (11) Viscozyme at 0.38 ml/kg FM + Sil-All at 2.5 × 10^5 cfu/g FM, (12) Viscozyme at 0.38 ml/kg FM + Sil-All at 5.0 × 10^5 , (13) Viscozyme at 0.57 ml/kg FM, (14) Viscozyme at 0.57 ml/kg FM + Sil-All at 1.25 × 10^5 cfu/g FM, (15) Viscozyme at 0.57 ml/kg FM + Sil-All at 2.5 × 10^5 cfu/g FM, (16) Viscozyme at 0.57 ml/kg FM + Sil-All at 5.0 × 10^5 cfu /g FM. The treatments were ensiled in 1.5 L anaerobic glass jars that were kept at 24 to 28 ^{0}C for 90 days. Triplicate samples per treatment were collected on Day 0 for analyses of chemical composition and that of Day 90 were analyzed for fermentation characteristics. Increasing the enzyme to 0.57 ml/kg FM reduced ($P<0.05$) silage pH compared to other enzyme levels. Similarly, increasing inoculant to > 2.5 × 10^5 cfu/g FM reduced ($P<0.05$) silage pH compared to other levels. Increasing enzyme to 0.38 ml/kg FM ($P<0.05$) increased WSC of silage compared to other treatments. The combination of Viscozyme at 0.38 ml/kg FM with Sil-All at 1.25×10^5 cfu/g FM increased ($P<0.05$) the lactic acid of silage compared to other combinations. Further work to determine the aerobic stability of these silages treatments is needed.

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Assessing the quality of banked ovine blood samples through DNA analysis

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Blood provides one of the most common sources of both high-quality and high-quantity DNA for molecular studies. Collection of blood samples from livestock offers a good accessible resource for DNA extraction for research and forensic purposes. Blood require appropriate preservation from collection, processing and banking for short- and long-term use. For long term storage, blood should be stored at 4°C or –80°C, where good quality DNA can be obtained from blood stored at –80°C. The thawing temperature can also have an effect on DNA quality. Reliable measurement of DNA concentration and purity is important for many applications in molecular biology, especially in array comparative genomic hybridisation (aCGH) where accurate determination of DNA concentration is critical. This project was aimed at assessing the quality of banked ovine blood samples through DNA analysis of previously and currently banked samples. This was done to verify if the quality of DNA has been maintained over a long period. Samples should be maintained reliably with minimal deterioration over time, and must be protected from physical damage. Forty blood samples that were banked between year 1997 and 2008 were obtained from the ARC Biobank, alliqoted and extracted using commercial DNA extraction kit. Recently banked samples (samples that were banked in 2015) were used as the reference samples. DNA was quantified using a Nanodrop and verified using a Qubit Fluorometer. Quantified DNA was subjected to PCR using 12 ovine microsatellites markers. DNA profiling was done using ABI3130xl Genetic Analyzer, and the genotypes were analyzed to assess the quality of samples stored in the Biobank. DNA quality from samples banked between 1997 and 2008 and currently banked (2015) samples remained constant, with the highest stutter peak range of ≥1600. The lowest peak heights were below 100. This was observed from the samples that were labelled 'bad' from the Biobank database, with the DNA concentration below 0.5ng/µl. We expected a slight compromise on DNA quality from the samples that have been subjected to freeze-thaw during sample processing and sample requests. Reasonable amount of DNA was recovered. Overall DNA quality observed was sufficient for use in downstream applications with minor poor DNA quality observed in compromised samples. This indicates that quality control measures on banked samples must always be in place. Developing reliable systems will improve biobanking methods, ensure the quality of samples banked and guarantees the quality and quantity of DNA maintained in banked samples.

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Whole-genome sequence and genetic variant analysis of the Tankwa feral goat of South Africa

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The sequencing and assembly of the goat (*Capra hircus*) genome was a milestone in goat genomics considering multiple potential applications of availed data to goat performance improvement and herd-health breeding programs. Other applications include feasibility to distinguish between different goat breeds and increased accuracy for genomic identification of individual goats carrying favourable alleles in improvement programs. The Tankwa feral goat, kept as a conservation flock at the Carnavon Research Station in the Northern Cape Province, is regarded as a suitable candidate for novel genetic variants for the South African goat population. The Tankwa's physical differences to the common goat breeds and its ability to thrive with minimal human veterinary and nutritional intervention bear testament to its genetic worth. The purpose of the study was to identify genetic variants including single nucleotide polymorphism (SNPs), insertions/deletions polymorphisms (INDELs), and copy number variants (CNVs) in the Tankwa feral goat genome using Illumina HiSeq2500 paired-end sequence data. Approximately 53.49 Gb OF DNA sequence from single a Tankwa animal, amounting to 133 million reads with an average 10X sequence coverage, was generated. Trimming and other quality control edits resulted in a total of 114.5 million reads with an of average length of 109.18 bp with about 90.46 % of the reads mapping to the reference goat genome (*CHIR1.0*). A probabilistic variant detection method (CLCGenomics Workbench 7.5) set at minimum coverage of 10, minimum frequency of 2.0 %, forward/reverse balance ratio of 0.05 and average base score quality of 20 as filtering options identified 167998 genetic variants consisting of 147,756 (87.95 %) SNPs, 11,094 (6.60 %) INDELs and 9,148 (5.45 %) CNVs were identified. The impact of these genetic variants on gene structure and function is yet to be determined and analysis of their potential role in goat performance, diseases and adaptation traits is underway. Results from this study will provide new genomic tools for goat selection programs and help unravel the goat genome architecture.

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Effect of garlic supplementation on *in vitro* gas production, protein degradability and volatile fatty acids

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Garlic has secondary metabolites with antimicrobial properties against a wide range of bacteria and can alter rumen fermentation. The objectives of the study were to evaluate the effects of garlic powder (GP) and juice (GJ) on nutrient digestibility, rumen fermentation and gas production *in vitro*. The dietary treatments were control (C) - no additives, 53 mg/100 ml (GP), 0.5 mL/100 ml (GJ1) and 1 mL/100 ml (GJ2). The digestibility of dry matter (DM), crude protein (CP) and neutral detergent fibre (NDF) was determined after 48 h incubation. Rumen ammonia nitrogen and volatile fatty acids (VFAs) were determined at 12 and 24 h incubation. Cumulative gas production was recorded at 0, 4, 8, 16, 24, 36, 40, and 48 hours. Supplementation with 1 ml of garlic juice decreased ($p<0.05$) DM disappearance. The CP degradability at 48 h was lowest ($p<0.05$) in GJ1 compared to the rest of the treatments. The digestibility of NDF did not differ ($p>0.05$) between treatments. Ammonia-N was lower ($p<0.05$) for GP and GJ1 compared to control. All additives increased ($p<0.05$) total VFAs. Dietary supplementation with garlic juice (GJ1 and GJ2) decreased C2: C3 ratio. Cumulative gas production was lower in GP and higher in GJ1 and GJ2 treatments compared to control ($p<0.05$). In conclusion, GP and GJ reduced CP degradability, but fermentation was improved with 0.5 mL GJ, resulting in enhanced propionate production and reduced ammonia concentration and C2: C3 ratio.

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Creatine kinase profiles in broiler chicken fed *Lippia Javanica*: Responses to pre-slaughter transportation

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The objective of the study was to establish whether feeding powdered *Lippia javanica* can have stress relieving effects when broilers are transported to the abattoir for slaughter. Two hundred and forty, day old broiler chicks were randomly assigned to 4 treatment groups (1. basal diet (negative control); 2) basal diet + coccidiostat (positive control); 3) basal diet + 5g *L. javanica* and 4) basal diet + 12g *L. javanica*) with 3 replicates in a completely randomised design. Each replicate pen consisted of 15 birds. The broilers were reared for 42 days then sent for slaughter. At day 43, blood samples were collected from the brachial vein before transportation and at exsanguination using disposable vacutainer tubes for CK analysis. The highest CK activity was observed in chickens fed basal diet only (2064.74^{c}±57.55) while the lowest CK activity (985.93^{a} ±57.55) was observed in broilers receiving basal diet + *Lippia javanica*. No difference in CK activity was observed in treatment groups that received *L. javanica* in their diets. Elevated CK activity in broilers that did not receive *L. javanica* was seen as an indicator of stress due to transportation before slaughter. It was therefore concluded that supplementation of *L. javanica* can have a stabilising effect on broilers being transported for slaughter.

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Effects of virginiamycin and live yeast on productivity, rumen volatile fatty acids and plasma β-hydroxybutyrate of Holstein cows

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The objectives of this study were to investigate the effect of combinations of virginiamycin (V) and live yeast (*Saccharomyces cerevisiae*) (LY) on the performance of dairy cows. Four ruminally cannulated Holstein cows were used in 4 x 4 Latin Square Design to evaluate effects of virginiamycin, live yeast and their combination on production, milk composition, rumen fermentation and plasma βeta-hydroxybutyrate. Periods included 14d of adaptation and 7d for sampling. Treatments were 1) Control diet, no additive (C); 2) 20 ppm Virginiamycin (V); 3) 0.25g live yeast per kg DM (LY) and 4) 0.25 g live yeast per kg DM and 20 ppm Virginiamycin (V+LY). Milk yield and dry matter intake were determined daily. Daily milk samples were collected for analysis. Rumen fluid was sampled on d2 and d4 of sampling period for analysis. Dry matter intake averaged 17.2 kg/d and was not affected by additives. Milk yield and milk component, ECM and feed efficiency were not affected ($P>0.05$) by V. Supplementation with LY and V+LY increased ($P<0.05$) milk yield by 1.6 and 1.4 kg/d respectively. Milk Fat (% and kg) was increased ($P<0.05$) by LY and not by V+LY. Milk protein (% and kg) was increased by both LY and V+LY. The energy corrected milk and feed efficiency were not affected by V, but were increased ($P<0.05$) by LY and V+LY. Supplementation with V and V+LY increased and decreased ($P<0.05$) total rumen VFA respectively, and both tended ($P<0.10$) to decrease rumen acetate and increase propionate. LY-treatment decreased ($P<0.05$) acetate and tended ($P<0.10$) to decrease iso-butyrate. All treatments tended ($P<0.10$) to decrease Acetic:propionic ratio. Serum BHBA was not affected by treatments. Results suggest no complementary effects between virginiamycin and LY. In conclusion, these results indicated that the addition of V, live yeast and V+LY stimulated ruminal fermentation, but production response was more pronounced with live yeast.

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Wool production in Hewu District of the Eastern Cape Province, South Africa: Management practices and constraints

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The objective of this study was to determine management practices and identify constraints faced by rural wool farmers in the Hewu district of the Eastern Cape Province, South Africa. A total of 43 structured questionnaires were administered to identify constraints and opportunities of wool sheep production in this region. A formal questionnaire was used to collect information on demographic parameters, management practices and constraints faced by rural sheep farmers of the region. An average flock size of 92.60±82.16 (mean ± SD) was observed in the Hewu district. Sheep were ranked as the most important livestock species and were mainly used for wool production and to sell to raise incomes. Semi-extensive production was the most common management system practiced by 88.4% farmers. No significant difference (P>0.05) was observed between villages in importance ranking of sheep, with 87.6% farmers ranking sheep as the most important livestock species they keep. Observed major infrastructural constraints to sheep farmers in Hewu were shortage of water (dams), housing facilities (shelter), fences and re-fencing of camps. It can be concluded that removing constraints faced by sheep farmers and implementing correct managerial practices could improve efficiency in wool production in the communal areas.

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Effect of dietary inclusion levels of diatomaceous earth on production and carcass characteristics of broilers

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This study was done to investigate the effect of diatomaceous earth (DE) inclusion levels on the growth performances and carcass quality characteristics of broilers. A total of 625 as-hatched day-old Arbour Acres broiler chicks were randomly allocated to five experimental treatments (n=125 birds/treatment). A standard commercial broiler diet consisting of a three phase feeding regime (Starter: D0-16, Grower: D17-35 & Finisher: D36-42) was used during the experimental period as the control diet (Treatment 1). All birds received the control diet (Treatment 1) for the starter period (first 16 days) without any additional DE. From D17 onwards (25 day period), birds received their respective experimental diets whereby the DE was included into the control diet (Treatment 1) at a 0.5% (Treatment 2), 1.0% (Treatment 3), 1.5% (Treatment 4) and 2.0% (Treatment 5) level. Feed and water provision was on an *ad libitum* basis throughout the experimental period, whereas a photoperiodic period of 23hr light and 1hr of darkness (23L:1D) was implemented for the first 5-days. Thereafter, the photoperiodic schedule was reduced to 18hr light and 6hr darkness (18H:6D) for the remainder of the study. Brooding temperature was gradually decreased from 33 ˚C (D0) to 24 ˚C on D21 of age. Birds were housed on pine wood shavings at a floor density of 11.5 birds/m2. Body weight and feed intake of each replicate group of birds were determined on a weekly basis, whereas mortalities were recorded twice daily. At D42 of age, 24 birds/treatment (n=12♂ & 12♀/treatment) were weighed and slaughtered, before the carcasses were cut into 8 portions (breast, drumstick, thigh and wing). Additionally, internal organs such as the heart, gizzard and liver weights were recorded after evisceration of the carcasses. Data were statistically analysed ($P<0.05$) using a fully randomised one-way ANOVA procedure. Although treatment 5 (2.0% DE inclusion) resulted in the highest ($P<0.05$) FCR (2.07) and the lowest ($P<0.05$) PEF (272), no clear trends could be established regarding the DE inclusion level on production performances of the birds. In general, it can be concluded that dietary DE inclusion levels have no effect ($P>0.05$) on most of the production and carcass quality. Results of the present study suggest that the inclusion of up to 1.5% DE in broiler diets during the growing and finishing phases will not have ($P>0.05$) a negative effect on broiler production parameters and carcass quality characteristics.

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Influence of water deprivation on intake and growth performance of Nguni goats

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The objective of the study was to determine the influence of varying levels of water deprivation on intake and growth performance of Nguni goats. A total of 36 Nguni does (initial weight (18±3.2 kg) were used in the study. The goats were housed in individual cages and subjected to varying periods of water deprivation (0; 24; 48 h), with *ad libitum* access to *Medicago sativa* hay. Average daily water intake (ADWI), average daily feed intake (ADFI), water to feed ratio (WFR), average daily gain (ADG) and feed conversion ratio (FCR) were determined weekly. The average daily water intake (ADWI) was largest from goats deprived of water for 48 h compared to those deprived of water for 24 h and 0 h (P <0.05). The ADWI was the same amongst goats deprived of water for 0 h and 24 h (P <0.05). The average daily feed intake (ADFI) was largest for goats deprived of water for 48 h compared to those deprived of water for 24 h and 0 h in week 1 and week 4 of the feeding period (P <0.01). In week 2 and 3 of the feeding period, ADFI was smallest for goats deprived of water for 0 h compared to those deprived of water for 24 h and 48 h (P <0.01). The ADG and FCR declined as the level of water deprivation was increased (P <0.01). Water deprivation period had weak negative correlations amongst all parameters tested, where ADFI and WFR were weak correlations, with ADG and FCR being moderate correlations. It was concluded that water deprivation increased water and feed intake, whereas average daily gain and feed conversion declined as the water deprivation period was increased, thereby impacting on the productivity of Nguni goats.

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Comparison of different techniques for the assessment of sperm concentration in Nguni bull semen

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Assessing semen quality is crucially important for the exploitation of genetically superior sires in an artificial insemination (AI) program. This study compared four different techniques for assessment of sperm concentration of Nguni bull semen (Spectrophotometer®, Heamocytometer®, computer aided sperm analyser (CASA) and SpermaCue®). Semen was collected from Nguni bulls (n= 4) once per week with the aid of an electro-ejaculator. Semen samples were collected in 15ml graduated tubes and placed in a thermos flask with the temperature adjusted to 38°C. Following semen collection, semen was evaluated for macroscopic and microscopic parameters. Data was analysed using GenStat® statistical programme and treatment means were separated using Fisher's protected t-test. The sperm concentration results were comparative showing acceptable precision for all four techniques, with no significant differences observed. The average sperm concentration with Spectrophotomete® was $3.81x10^6$, Heamocytometer® ($4.97x10^6$), CASA ($3.75x10^6$) and SpermaCue® ($3.58x10^6$). Total sperm motility rate was above 86% among the semen donors. There was no significant difference on slow, medium and rapid moving sperm cells among the bulls. There was no significant difference on sperm cell morphology among the bulls. In conclusion, measurements of sperm concentration with the Spectrophotometer®, Heamocytometer®, CASA and SpermaCue® techniques were found to be equally appropriate for estimating bull sperm cell concentration which is crucial in preparation of insemination doses.

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Evaluating the effects of different inclusion levels of spineless cactus on growth performance of growing Windsnyer pigs

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Spineless cactus (SC) is an excellent source of water and nutrients for cattle, sheep and goats, especially during the dry seasons in arid and semi-arid regions in the world. Its productivity under harsh conditions is high. Pig farmers in the arid and semi-arid areas face challenges to provide nutrition for their animals and SC could mitigate these challenges. A study was carried out to evaluate the growth performance of South African Windsnyer (SAW) grower pigs fed diets containing different inclusion levels of spineless cactus. Diets containing either 0 (Control; CON), 50 (Low SC; LSC) or 100 (High SC; HSC) g/kg were formulated to provide similar energy (13.5 MJ/kg DE), protein (16 %) and lysine (1.16 %). The diets were fed *ad-lib* for 21 days to twenty one SAW grower pigs (30±2 kg body mass) that were individually housed. The pigs on the CON diet had higher final weight and average daily gain (ADG) and lower average daily feed intake (ADFI) and feed conversion ratio (FCR) compared to pigs on the LSC and HSC diets. Pigs on the LSP diet had higher final weight, ADG and lower ADFI and FCR compared to pigs on the HSC diet. It was concluded that inclusion of SC depressed growth performance of SAW pigs. There is need to investigate the impact of SC on intestinal health in pigs.

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Production efficiency of Nguni cattle in different agro-ecological zones of Limpopo Province, South Africa

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The study was conducted to determine the production efficiency of Nguni cattle in the different agro-ecological zones of the Limpopo Province. Production indices such as birth weight (BW), weaning weight (WW), pre-weaning ADG (P-ADG), total pre-weaning gain (P-G), pregnancy rate (PR), calving rate (CR), weaning rate (WR), cow efficiency (CE) and production efficiency (PE) were assessed in the different agro-ecological zones. Records of 827 Nguni calves and 2952 cows from 2008 to 2012 were obtained from nine herds in arid (AR), semi-arid (SR), dry-sub humid (DS) and humid (HU) agro-ecological zones. Cattle in AR had higher PR of 93%, while the lowest PR of 83.2% was observed in HU. A higher CR of 90.1% was observed from cattle in DS, while lower value of 77.4% was observed in HU. Higher WR of 97.2% was achieved in SR, whilst lowest WR of 90.8% was achieved in HU. The average CE and PE were 35.92 % and 32.55 % respectively. The highest CE of 38.27% and PE of 33.97% were observed in HU and AR respectively. Whilst the lowest CE (34.18%) and PE (30.02%) values were observed in DS and HU respectively. The influence of climate has a significant effect that determines the vegetation type of the Province. Nguni cows in the HU had higher growth performance due to high rainfall capable of sustaining vegetation growth and composed of savannah, resulting in better CE. The lowest growth performance in AR resulted from low erratic rainfall which in turn led to poor grazing content. WW and PR was a main determinant parameter of PE. Nguni cattle yielded acceptable levels of growth, CE and PE under the different agro-ecological zones of Limpopo Province.

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Partial nutritional evaluation of certain plant species used for browsing in the Savanna and Thicket biomes of the Eastern Cape, South Africa

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The aim of the study was to establish the nutritional value of different browse species, utilized by developing farmers, in various local municipalities of Amathole and O.R. Tambo districts of the Eastern Cape. A total of forty eight (48) households were interviewed using well-structured questionnaires. The parameters surveyed included gender, age, plant species preferred by animals as well as vegetation part(s) favored by different classes of livestock. More than 60% of respondents were male, 50% were between the ages of 41-60, whilst 29.2% and 20.8% were between the ages of 20-40 and below 20 years respectively. Samples of fourteen different browse species i.e. *Acacia karroo, Prunus persica, Ziziphus mucronata, Diospyros lyciodis, Vepris lanceolata, Rhus sp., Grewia occidentalis, Plumbago auriculata, Schotia latifolia, Calpurnia aurea, Erythrina latissima, Oleaeuropaea subsp. Africana, Cordia rudis, Mimusops caffra,* were identified and collected during the dry season (June). The chemical composition of these samples was determined using standard laboratory analytical techniques. Nutritional elements of importance, analyzed included : Ash, Ca (Calcium), Mg (Magnesium), K (Potassium), Na (Sodium), P (Phosphorous), Zn (Zinc), Cu (Copper),CP (Crude Protein) and CF (Crude Fiber). It was found that, CP, CF and Ash content of the leaves and stems ranged from 3.3-48.1%, 0.2-47.6% and 3.9-20.5% respectively. Minerals such as Ca, Mg, K, Na ranged from 0.61-9.71%; 0.007-2.747%; 0.007-2.928%; 0.003-0.352%, whilst Zn and Cu were between 0.7-30.1ppm and 4-20ppm respectively. In the light of the present data, it is concluded that certain browse species are rich in nutritionally important elements. These plants can be effectively used as supplementary feed during feed-scarce periods of the year.

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Ethno-medicinal study of plants used for treatment of livestock diseases by developing farmers in the Savanna and Thicket biomes of the Eastern Cape, South Africa

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Livestock is the mainstay of agriculture in South Africa, where developing farmers keep animals for milk, manure, draft as well as wealth status. The traditional practices in animal healthcare are area specific and depend upon the locally available bioresources. The aim of the study was to document plants used to treat diseases of livestock by developing farmers, in various local municipalities of Amathole and O.R. Tambo districts of the Eastern Cape Province. A total of forty eight elderly farmers who have traditional knowledge about these medicinal plants in the villages of surveyed districts were interviewed using a semi-structured questionnaire. It was found that 23 plant species belonging to different families are commonly used to treat livestock diseases in the surveyed study localities. These plants were used alone (8.7%) or in mixtures (91.3%) for different conditions. Leaves (50%) were the most frequently used plant part, followed by bark (36.4%) and roots (13.6%). The study showed that internal parasites, diarrhoea, gall-sickness, redwater, scab and retained placenta are the most commonly treated livestock diseases. The results indicate that medicinal plants are being used for treating livestock diseases and could therefore be a valuable resource to developing farmers. More research needs to be done on the medicinal efficacy and methods of application.

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Effect of ecotype and season on reproduction performance of Nguni cattle

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Reproduction records for the Venda, Shangaan and Pedi ecotypes of the Nguni cattle breed at Mara Research Station were used to evaluate the effect of ecotype and season on reproduction performance. Data of 644 (142 Venda, 65 Shangaan, 264 Pedi) calf births were analysed to determine differences in reproductive parameters of days to reconception (DTR), weight of cow at breeding (WCB), weight of cow at weaning (WCW), intercalving period (ICP), and weaning efficiency (WE). GLM procedures of SAS were applied to analyze the variance in parameters due to ecotype and season; LSD was used for mean separation for parameters influenced by the class effects. The Venda and Pedi ecotypes were similar but different from the Shangaan ecotype for WCB and WCW across all seasons. The WE of Shangaan and Pedi ecotypes were similar but different from that of the Venda ecotype. Ecotype had no effect on DTR and ICP. Season did not affect WCB and DTR across ecotypes, but the observed performance of WCW and WE differed between seasons. There were no meaningful interaction effects between ecotype and season. The observed differences amongst these three ecotypes were weight related reproductive performance (WCB, WCW and WE) which are influenced by the environment. The lack of differences in key reproductive indicators (DTR and ICP) suggests similarity in reproduction performance amongst these three Nguni ecotypes.

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Production performance of Holstein and Jersey cows in a pasture-based system

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It is well accepted that the production performance of Holstein (H) and Jersey (J) cows differ in most production systems. Except for milk recording data, only a few studies have been done locally to compare the production efficiency of H and J cows under similar feeding, management and environmental conditions. Within study groups, breeds are often compared, although differences among herds, management style, genetic and environmental factors are not taken into consideration. In this paper, the production performance of H (n=128) and J (n=103) cows on a pasture-based system were compared using records from several lactations. Cows were on kikuyu pasture, supplemented during winter with a pasture replacement mixture consisting of lucerne hay, oat hay and soy bean oil cake meal. All cows received the same concentrate mixture twice a day, after milking, at a total of 7 kg per cow per day. Holstein cows produced 34% more ($P<0.01$) milk (6908±1365 vs. 5160±909 kg), 10% more fat (265±53 vs. 240±43 kg), 18% more protein (217±42 vs. 184±32 kg) than J cows although at lower ($P<0.01$) fat and protein concentrations, being 3.84±0.28 vs. 4.65±0.35% and 3.15±0.20 vs. 3.57±0.20%, respectively. Component values estimated using milk, fat and protein yields also differed ($P<0.01$), being 2120±413 and 1848±324 kg for H and J cows respectively. Milk recording data of production parameters show larger differences between breeds than the present study, being 52, 24 and 31% higher for H vs. J cows for milk, fat and protein production, respectively. The erosion rate of cows up to sixth lactation is higher for H cows in comparison to J cows following a polynomial vs. linear decrease in cow numbers. This could indicate a greater prevalence for involuntary culling in H cows because of reproductive and other management problems. Further studies are envisaged to compare the production efficiency of H and J cows under this feeding system.

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Breeding and management practices on small holder and emerging dairy herds in South Africa

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The South African small holder and emerging dairy sector has the potential to contribute significantly to national economic growth and improved quality of life of the country's poor. This can be achieved by commercializing this sector and enabling it to play a meaningful role in the country's dairy industry. The main objective of this study was to benchmark breeding and management practices on small holder dairy herds (SDH) and emerging dairy herds (EDH) in South Africa. Such benchmarking serves to identify opportunities for improving herd performance. Data were obtained from 32 smallholder and 31emerging dairy herds, from 7 provinces of South Africa, using a structured questionnaire, during the period August-November 2014. The purposive sampling technique was used to select the respondents. The most commonly used breed on SDH was Holstein (52%), followed respectively by the Jersey (41%) and Nguni (7%), with an average herd size was 3 cows. On EDH the most predominant breed was also Holstein (36%), followed by crossbred (40%) and Jersey (24%), and the average herd size was 30 cows. Nearly all SDH (99.2%) use natural service for breeding, whereas 45% of EDH use artificial insemination and 55% use natural service. The majority of EDH (84%) have fixed milking parlours; however most SDH (92.6%) use hand milking and only1% have fixed milking parlours. Natural grazing on communal land is the predominant (98.2%) feeding system on SDH, while 60% of EDH are stall fed and 40% use natural pasture. There is a need to develop breeding strategies to match the low nutritional level with appropriate breed types on SDH. The high use of crossbreds on EDH also needs to be guided by well thought out breeding strategies. Increased use of assisted reproduction technologies, such as artificial insemination, on both SDH and EDH may be required to underpin such strategies.

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Production constraints of smallholder pig farms in agro-ecological zones of Mpumalanga, South Africa

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The South African pig industry is a major contributor to the primary agricultural sector. A study was conducted to identify the production constraints in smallholder pig farms and to compare the management practices in three ecological zones of Mpumalanga Province, South Africa. In total, 216 randomly selected smallholder pig farmers were interviewed using semi-structured questionnaire. The results indicated that smallholder pig farming was predominated by males (64%), age group above 50 years (54%), black Africans (98.6%) and approximately three quarters of the smallholder farmers were classified as being poor to just below average. Majority (80%) of respondents have no form of pig husbandry training, while few (33%) have received assistance from government Department of Agriculture. In terms of stock, mixed breeds (89%) from exotic pigs were mostly kept and majority (87%) of the farmers kept between 1 – 10 sows in their herds. Many farmers (75%) engaged in the risky practice of buying auction-sourced boars, free-range boars and untested boars from neighbours and relatives. Few (17%) farmers practiced vaccination and only 10% kept records of the pigs. Majority of the responses on pre-weaning mortality (50%) and post-weaning mortality (90%) were within acceptable range of 1-10% and 1-5%mortality rates respectively. The lead causes of mortality were weak piglets and crushing(46%), diarrhoea (27%), poor management knowledge (19%) and malnutrition (16%). Agricultural training and government incentives will facilitate improved productivity in smallholder pig farms within the Province.

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Farmer perceptions on the use of non-traditional animal protein sources for free-range chickens in semi-arid environments

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For sustainable intensification of village production systems, it is important to understand the views of farmers who keep the chickens on the utilization of available protein sources. The objective of the study was to assess farmer perceptions on the use of non-traditional animal protein (NTAP) sources for scavenging chickens. A total of 239 resource-poor households of Msinga local municipality in uMzinyathi district, KwaZulu-Natal were interviewed using a semi-structured questionnaire in August 2013. Logistic regression and general linear model was used to analyse the data. Women were the prominent heads of households, followed by men, and then youths. Feed shortages were among the principal challenges that limited chicken production. Provision of chicken housing and religion highly influenced a household's likelihood of experiencing feed shortages. Farmers who did not provide overnight housing for their chickens were likely to not provide any supplementary feeding. Christian farmers were predisposed to chicken feed shortages compared to traditional-religious farmers. More than half of the farmers (56.6 %) were aware that NTAP have a huge potential to be used as protein sources for chickens. Even though they were few, farmers commonly used termites as a protein supplement. Other common NTAP sources were earthworms and locusts. The potential of using NTAP sources were high for farmers with large flocks and female-headed households. Farmers with large chicken flock sizes were likely to be aware of NTAP as potential feed to chickens.

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Targeted and high throughput growth hormone gene sequencing of South African goat breeds shows their high genetic diversity

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Growth is an economically important trait in goats and other livestock species. There is wide variation in growth performance within and between South African goat breeds. Variations in growth hormone gene have been observed to affect growth in a number of livestock species. This study assessed the genetic diversity in the growth hormone gene within and between SA goat breeds. Polymerase chain reaction (PCR) targeted gene amplification together with Illumina MiSeq next generation sequencing were used to generate the full length of the growth hormone gene and screen for SNPs in the South African Boer (n=17), the Tankwa (n=15), and village (n=35) goat populations. Seven additional sequences (Accession nos.: D00476.1, EU651859.1, DQ531712.1, GU355689.1, GU355688.1, GU355687.1, and GU355686.1) were extracted from the GenBank for construction of phylogeny. SNP analysis resulted in a range of 27.4 to 57.9 SNPs per population. There was more variation along the exon and intron regions. Mutations resulting in amino acid changes from Glycine to Serine, Tyrosine to Cysteine and Arginine to Glycine were observed at exon 2 (position 781) and exon 5 (position 2012 and 2017). Gene diversity, which was calculated by ARLEQUIN v 3.5, ranged from 0.8268 ± 0.0410 to 0.9298± 0.0050. A higher within population variation (73.18 to 97.37%) was observed using analysis of molecular variance method. Higher within breed diversity of 97.37% in the population category consisting of SA Veld and Tankwa goats. The maximum likelihood phylogenetic analysis indicated nine clusters illustrating the close relationships between the South African populations and the other international breeds with the exception of the Italian Sarda breeds. The South African goat breeds are genetically diverse within breeds and there is not much variation between breeds. Furthermore, the SA Veld goats show a much greater potential to be used in growth selection programs.

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Growth responses of entire and immunocastrated male pigs to dietary protein with and without ractopamine hydrochloride

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The growth performance of 120 individually penned entire (E) and immunocastrated (C) male pigs (PIC© Large White x Landrace x White Duroc maternal line cross PIC 410 terminal sire) fed diets containing varying levels of balanced protein with or without ractopamine hydrochloride (RAC) was evaluated. The pigs entered the trial at 16 weeks of age (live weight = 57.52 ± 5.36 kg) and were assigned to 12 treatments using a 2 x 2 x 3 factorial design. Three diets were formulated with increasing lysine levels; 7.50 g/kg (low), 9.79 g/kg (medium) and 12.07 g/kg (high) and all other amino acids balanced in terms of lysine. The treatment combinations were: E Low, E Medium and E High; E Low RAC, E Medium RAC and E High RAC; C Low, C Medium and C High; and C Low RAC, C Medium RAC and C High RAC. Vaccination protocol involved two doses of Improvac® administered at 16 and 20 weeks of age, the latter being four weeks before slaughter. Ractopamine hydrochloride was supplemented to the applicable treatments for 28 days preslaughter. The live weight, backfat depth and feed intake were measured on a weekly basis and used to determine the growth rate (average daily gain/ADG), change in voluntary feed intake, feed conversion ratio (FCR) and backfat gain. Immunocastrates fed RAC had the highest body weights from 22 weeks of age, with immunocastration and RAC improving the ADG. Immunocastration increased the average daily feed intake (ADFI) and backfat deposition rate while increasing the FCR after the second vaccination. The effect of RAC on the FCR depended on the level of dietary balanced protein, with the medium and high protein diets providing the best FCRs. Therefore, immunocastrates performed as entire males until the second vaccination, after which ADFI, FCR and leanness was sacrificed, while RAC supplementation improved feed efficiency when pigs were fed the appropriate dietary protein level.

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Effects of immunocastration and ractopamine hydrochloride on boar taint compounds and spermatogenesis in boars fed varying balanced protein levels

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Backfat samples from 96 PIC® pigs was analysed for androstenone (5α-androst-16-en-3-one), skatole (3-methylindole) and indole following a simultaneous extraction and analyses using mass spectrometry and fluorescence. The adipose samples were taken from pigs which formed part of a growth trial following a 2 x 2 x 3 factorial design, where half of the pigs were immunocastrated at 16 and 20 weeks of age; RAC was supplemented at 0 or 10 mg/kg for 28 days prior to slaughter and each pig was allocated to either a low, medium or high protein diet balanced with regards to lysine (7.50, 9.79 and 12.07 g digestible lysine/kg) from 20 weeks of age until slaughter at 24 weeks. For androstenone, 83.3 % of immunocastrates (C) had levels under the detection limit (0.02 µg/g fat), with 100 % being under the sensory threshold of 0.5 µg/g fat, while 77.1 % of entire males (E) had levels above the detection limit, with none over 0.5 µg/g. The C pigs had skatole and indole levels significantly lower than the E pigs. The testes size was decreased with immunocastration; however this was not significant and the changes in testicular morphology and activity can be seen by the histology and colour results. Testicular histology showed a visual decrease in seminiferous tubule diameter, deformation, increased lumen and decreased spermatogenesis. The CIE L*a*b* cut surface colour measurements indicated a decrease in testicular activity due to increased L*, b* and decreased a* values. Therefore the current vaccination schedule was successful in inhibiting testicular functioning and thus androstenone production. Also, testicle size does not provide an indication of vaccination success and alternatives such as the CIE L*a*b* cut surface colour should be considered.

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The role of feeding different levels of protein inclusion in pig diets on nitrogen balance and nutritional digestibility of Kolbroek boars

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The objective of this study was to evaluate the effect of dietary protein inclusion levels on nitrogen balance and nutrient digestibility of Kolbroek boars. A total of eighteen Kolbroek boars were used in this study and were allocated to three dietary treatments in a repeated 3×3 Latin square design. The Kolbroek boars were randomly allocated to three diets comprising of 10, 13 and 16% protein inclusion levels, respectively. Values from digestibility of protein, neutral detergent fibre (NDF), acid detergent fibre (ADF), dry matter (DM) and Ash were obtained using total collection methods. Data were analysed using Procedure General Linear Model. No significant difference was observed on protein digestibility between the experimental diets. There was no significant improvement in the digestibility of energy, fat, NDF, Ash, ADF and DM among the treatments. There was no difference in nitrogen retention among the treatments. Nitrogen absorption was increased in pigs fed 13 (17.0g/d) and 16% (17.0g/d) protein diet, respectively, compared to those fed 10% dietary protein (16.6g/d). Faecal and urine nitrogen concentrations progressively increased as the levels of dietary protein increased. Results from this study indicate that although there was an increased nitrogen absorption in Kolbroek boars fed diets with 13% crude protein, diets with the different protein inclusion levels did not evoke any effect on nitrogen balance and nutrient digestibility of Kolbroek boars.

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Effect of garlic meal supplementation on productivity of indigenous Venda chickens

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The study was conducted to determine the growth performance and carcass characteristics of indigenous Venda chickens fed grower's diets supplemented with varying levels of garlic meal. The study was based on four diets containing similar energy (12.2 MJ of ME/kg DM) and crude protein (180 g/kg DM), but different garlic meal supplementation levels of 0, 10, 15 and 25 g/kg DM. The study commenced with 800 day-old chicks with an average weight of 30.25± 2 g. A completely randomized design was used to allocate the chicks to the four garlic supplemented treatments with each treatment replicated ten times, thus, 40 floor pens were used in total. Data on feed intake, growth rate, live weight, feed conversion ratio and carcass characteristics were measured. All data were analysed by one-way analysis of variance. Where there were significant differences, Duncan test for multiple comparisons was used to separate treatment means. A quadratic regression model was used to determine the garlic supplementation levels for optimum variable measured. Results indicated that at one to 49 days, feed intake ,growth rate, feed conversion ratio and live weight were influenced ($p<0.05$) by garlic meal supplementation and they were optimized at different garlic meal supplementation levels of 14.0, 18.9, 27.5 and 17.0g/kg DM, respectively. While at 60 to 91 days, all the growth and the carcass parameters measured were improved ($p<0.05$) by garlic meal supplementation. Feed intake, growth rate, feed conversion ratio, live weight, carcass weight, dressing percent, breast meat, thigh, drumstick, gizzard and fat pad weights of Venda chickens were optimized at different garlic meal supplementation levels of 14.7, 15.8, 8.0, 16.4, 14.2, 12.7, 11.2, 12.7, 8.2, 10.5, and 15.1, respectively. It was thus concluded that garlic meal supplementation improved feed intake, growth rate, live weight, and carcass weight of Venda chickens.

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Effect of *Acacia karroo* supplementation on growth, ultimate pH, colour and cooking losses of meat from Indigenous Xhosa Lop-eared goats

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The objective of the study was to determine the effect of *Acacia karroo* supplementation on growth, ultimate pH, colour and cooking losses of meat from indigenous Xhosa lop-eared goats. Eighteen castrated 4-month-old kids were used in the study. The kids were subdivided into two treatment groups: *A. karroo* supplemented (AK) and non-supplemented (NS). The supplemented goats were given 200g per head per day of fresh *A. karroo* leaves. The kids were slaughtered on day 60 and sample cuttings for meat quality assessment were taken from the *Longistimus dorsi* muscle. The supplemented kids had higher ($p<0.05$) growth rates than the non-supplemented ones. The meat from the *A. karroo* supplemented goats had lower ($p<0.05$) ultimate pH and cooking loss than the meat from the non-supplemented goats. *Acacia karroo* supplemented goats produced higher ($p<0.05$) b* (yellowness) value, but had no significant effect on L* (lightness) and a* (redness) of the meat from goats. Therefore, *A. karroo* supplementation improved growth performance and the quality of meat from goats.

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Factors affecting beef cow longevity

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Although several factors have an effect on beef herd profitability, longevity has a substantial effect on the economic efficiency in beef production systems. However, it is also the one that is the most difficult to improve. Longevity for cows is defined as the length of productive life measured as the number of years from first calving to the date of culling. Beef cow longevity is a complex trait that is affected by the performance of a cow over her total herd life, which is largely influenced by her fertility, maternal potential, health, and survival of herself and her calves. In the beef industry information about factors affecting the cow's productive life is largely lacking. The length of time a cow remains in the herd solely depends on purchase price for heifers or opportunity costs if producers raise their own replacement heifers, feed costs, veterinary care costs etc. Heifers that calve early in the calving season with their first calf have an increased longevity, breed type, dystocia and body condition also affect cow longevity. If production efficiency is to be increased in South African beef herds it is important that the factors affecting beef cow longevity under different environmental conditions are understood.

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The effect of incubation temperature on *in vitro* maturation and embryonic development of cattle oocytes in South Africa

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Cells and tissues of African cattle breeds (*Bos Indicus*) are better able to survive and function after exposure to tropical conditions, such as increased temperature, than the European cattle breeds. Therefore, the aim of the study was to examine the effect of high *in vitro* maturation culture temperature, fertilisation and subsequent embryo development on South African cattle oocytes. In experiment 1, a total number of 208 oocytes were randomly allocated into four temperatures {39 ˚C (control), 41 ˚C, 42˚C and 43 ˚C}, 52 oocytes per treatment group. Oocytes were matured in 500µl of tissue culture medium (TCM)-199 + FSH/LH/EST covered with 250 µl of mineral oil and incubated in four incubators at different temperatures in CO_2 humid air. Following 24h of in vitro maturation, oocytes were examined for the extrusion of the first polar body to indicate signs of maturity. Based on the results from experiment 1, the best two temperatures were selected for experiment 2, which was to acssess cleavage rate and subsequent embryo development following in vitro fertilisation. In experiment 2, a total number of 473 oocytes were randomly allocated to the two treatment temperatures, 41 ˚C and 39 ˚C. Oocytes were respectively inseminated by frozen-thawed Nguni semen. Six hours post insemination, presumptive zygotes were removed from fertilization drops, cumulus cells were removed by vortexing in 200 µl of (m199+10% FBS) medium in an Eppendorf tube. Zygotes were washed 5 times in 5 drops of 100 µl (SOF-BSA) and transferred into 7 drops (20-25 oocytes per drop) of 50 µl (SOF-BSA) of culture medium under oil and incubated. Cleavage rate was recorded 48h post-insemination. Statistical analyses was performed using the Genstat software of SAS. In experiment 1, oocytes matured at 41˚C had higher extrusion (60%) of the first polar body compared to oocytes matured at 39˚C (30.3%), 42˚C (20.5%) and 43˚C (10.3%), respectively. Experiment 2 revealed that oocytes cultured and incubated at 41˚C resulted in a higher cleavage rate (62±22.7%) compared to oocytes cultured and incubated at 39˚C (25±10.3%). Moreover 41 ˚C yielded better blastocyst formation (6 ±1.5%) compared to other control group (1.0±0.0 %). In conclusion, oocytes cultured and incubated at 41˚C resulted in better extrusion of the first polar body compared to 39˚C, 42 ˚C and 43 ˚C temperature groups. Extrusion of the first polar body is regarded as sign of oocyte maturation. Furthermore, maturing oocytes in 41 ˚C yielded higher embryonic development and blastocyst formation compared to 39 ˚C. Therefore, it is recommended that 41˚C be used for *in vitro* maturation of cattle oocytes in South African laboratory conditions.

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Effects of bacterial inoculation on the fermentation dynamics of ensiled whole crop sunflower (*Helianthus annuus*)

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This study was conducted to evaluate the effects of bacterial inoculation on the fermentation characteristics of whole crop sunflower (WCS) (*Helianthus annuus*) silage. WSC (217.3 g dry matter(DM)/kg, 121 g water-soluble carbohydrates (WSC)/kg DM and a pH of 6.04) was harvested with a forage chopper adjusted to 10 mm chopping length, and treated with or without lactic acid bacterial (LAB) inoculant as: control (no additive), emsilage LAB inoculant, and Lalsil dry LAB inoculant. Treatments were ensiled in 1.5 L anaerobic jars and kept at room temperature for 90 days. Inoculation reduced ($P<0.05$) silage pH and ammonia-N while increasing ($P<0.05$) the content of lactic acid compared to the control treatment. The content of acetic acid was increased ($P<0.05$) with Lalsil dry inoculation compared to other treatments. This suggests that the aerobic stability of silage treated with Lalsil dry might be improved. Further work to evaluate the effects of these silage treatments on the aerobic stability and nutrient utilization of silage by ruminants is needed.

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Characterization of communal livestock farmers in Gwaba village, Amathole district of the Eastern Cape Province

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The Eastern Cape is the Province with the highest numbers of livestock, with the greater percentage being in the hands of developing farmers. Therefore livestock production and promotion of livestock production is a priority in the Eastern Cape. The developing agricultural sector is faced with a serious number of limitations, including inadequate resources, ineffective production systems and inadequate market access. In an attempt to quantify these constraints, a pilot study commenced in January 2014 to characterize aspects regarding livestock productivity in communal areas. The study is conducted in Buffalo City Municipality at Gwaba Village in the Amathole District. An initial survey was conducted amongst the households participating in the project. There is a significant relationship between age of the farmers and their literacy levels. A greater percentage of the farmers in the area are elderly people, with 83.4% being male and 17.6% being female. From these farmers, 70.6% have the ability to read, 58.8% can write and 29.4% have a high school education or higher qualification. When questioned on their farming priorities, 41.2% of the farmers ranked cattle production as their first priority. There is a positive correlation between farmers' ages and how they rank cattle and also a positive correlation between farmers' age and famers with high school and higher education levels. From the results it is observed that there is a negative correlation between number of cattle, goats and sheep and farmers with only a primary school education while there is a positive correlation with those that have higher education levels. This therefore means that the age and literacy levels of the farmers in communal farming sector plays a significant role in their production potential.

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Comparison of the reproduction potential of Boer goat and Mbuzi goats in a heartwater infested region of the Eastern Cape Province

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It is estimated that more than 50% of the national goat population can be found in the Eastern Cape Province with approximately 60% of these goats being farmed with in the developing areas. The majority of these goats in less developed areas is of the indigenous type (Mbuzi goats) and fulfills multiple roles that can hardly be equaled by other ruminant species. The indigenous Mbuzi goats which are generally farmed with in the areas of the Eastern Cape coastline and adjacent interior which is renowned heartwater infested areas. The excellent meat producing capabilities and high fecundity of the Boer goat makes it a sought-after goat breed to be farmed with in these areas but its susceptibility to heartwater remains a major challenge for sustainable goat production under such conditions. The aim of this study was to compare the reproduction and production potential of the Boer and Mbuzi goat breeds in a heartwater area at the Bathurst Research Station. Does from the two breeds were managed as one group throughout the year except during mating when does of each breed were separated but managed under similar grazing conditions. No preventative treatment for heartwater was applied. Boer goat and Mbuzi does were group mated with 2 bucks per breed during May 2013 and May 2014 for 42 days. Scanning for pregnancy started approximately two weeks after the end of the mating period and continued monthly thereafter for a total of four scannings. The rectal temperature of each mated doe was recorded at each scanning. The same vaccination and animal health program was applied to both breeds. Results after two production cycles showed similar conception percentages (90% and higher) for both breeds after two mating seasons. The average kidding percentage of the Boer goats after two production seasons (2013 & 2014) was 137.5% compared to the 143.4% of the Mbuzi goats over the same period. The largest differences between the two breeds were found when the weaning percentages and kid mortalities were being compared. The average weaning percentage (126.1%) of the Mbuzi kids after two production cycles was significantly higher than the 53.3% of the Boer goat kids. The average kid mortality after two seasons was significantly lower amongst Mbuzi kids (12.5%) compared to the 60% mortality from birth to weaning recorded by Boer goat kids. The productivity of Mbuzi does, expressed as total weight of offspring weaned per total weight of mated does, was significantly higher than the productivity of Boer goat does. The poor rearing ability of Boer goat does in this flock is limiting its production potential and future selection strategies should be towards increasing this parameter.

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The effect of oregano essential oil on milk production responses in Holstein cows

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Forty Holstein cows, 178 ± 17 (SE) DIM and weighing 624 ± 10 (SE) kg, were used in a lactation trial of 60 days to determine the effect of oregano essential oil on milk production and milk composition. Cows were ranked according to milk yield and each consecutive pair formed a block. Treatments were allocated randomly to each of the 20 blocks. An essential oil product (Dosto 500) was evaluated against a placebo control treatment. Cows were housed in a semi-open free-stall barn with sand beds and had free access to fresh water. All cows received a basal diet consisting of lucerne hay (470 g/kg NDF and 130 g/k CP) that was offered *ad libitum* and 28 kg/day of a semi-complete lactation feed, offered twice daily at 07:30 and 16:00. Treatments (DOS and CON) only differed in terms of a maize based supplement that, in the case of the DOS treatment, contained 1 g/kg of Dosto 500. Cows were milked twice daily at 06:00 and 16:00 and the supplements were offered individually to cows in the milking parlour during each milking. Milk yield, milk composition and cow weights were recorded daily via the Afikim system. Milk samples were also collected during weeks 3 and 8 for composition analysis at the Elsenburg Dairy Laboratory. Data collected over time were subjected to a repeated measurements ANOVA, while average values were analysed according to a main effects ANOVA with treatment and block as main effects. All data were analysed with the aid of Statistica 64 version 12 and significance was declared at $P < 0.05$. Regarding all 40 cows, treatment had no effect on milk yield or milk composition over the entire period. However, in the CON treatment, lactose content was higher ($P < 0.05$) during the first two weeks and milk protein content was higher from week four to eight. When data of the top ten cows per treatment were analysed separately, fat content and kg fat were higher ($P < 0.05$) for the DOS treatment during the first three weeks of the trial and lactose was higher for the CON treatment in the first week. Mean milk yield of the top ten cows per treatment did not differ and was 37.9 kg for the DOS treatment and 37.3 kg for the CON treatment. Mean fat content and fat yield was higher ($P < 0.05$) in the DOS treatment (37.1 g/kg and 1.41 kg) than in the CON treatment (33.8 g/kg and 1.26 kg). The higher fat content also resulted in a higher energy corrected milk yield of cows in the DOS treatment than in the CON treatment (38.8 and 36.6 kg/day, respectively). It was concluded that oregano essential oil stimulated fat production and increased energy corrected milk yield in high producing dairy cows.

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Haematological and nutritional health expressions of broilers fed admixture of whole hatchery waste meal

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This study was conducted to investigate the haematological and nutritional health profiles of broilers fed different levels of whole hatchery waste meal (WHWM). Fish meal (FM) was partially replaced, protein for protein, with WHWM at 0 (T1), 10 (T2), 20 (T3) and 30% (T4) inclusion levels, using (T1) as control. WHWM was prepared by boiling un-hatched incubator eggs in water for 30 minutes, crushed, oven dried at 110^{o}C for 2 hours, milled and used to formulate broiler feed at the 4 different test levels. A total of 180 day-old Ross broiler chicks were used in a 42-day feeding trial, involving 45 chicks per treatment and 12 replicates. Data were subjected to ANOVA in a completely randomized block design. At the end of the experimental protocols, 6 birds per treatment were randomly selected and exsanguinated for laboratory analyses. Hematological results showed only marginal variations between the control and treatment groups. Red blood cells (RBC) and haemoglobin (HGB) values showed no significant (P>0.05) difference in all groups, although broilers in T4 showed highest marginal value (2.67x10^{6}/mm^{3}) for RBC. The marginal differences may have been provoked by the highest oxygen carrying capacity observed in T4 broilers than other treatment groupings. Broilers fed T1 diet recorded the highest white blood cell (WBC) value (519.59x10^{3}/1) compared with T2-T4. Lower WBC values from T2-T4 may suggest that broilers fed WHWM had no known stimulus to provoke the production of antibodies to fight infections. The muscle nutrient profile of broilers showed that there was no significant (P>0.05) change in percent CP, Fat and moisture contents, from T1-T4, although T4 had the lowest (71.88± 0.17) moisture percentage. Results of this study indicate that 10 % of FM can be replaced with WHWM in broiler diets without any noticeably detrimental effect on the blood haematology and nutritional health status of Ross broilers.

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Effect of *Moringa oleifera* seed meal on layer performance and shelf life of table eggs

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The aim of the present study was to evaluate the effect of *Moringa oleifera* seed meal (MOSM) incorporated in layer mash at different levels (0, 1, 2 and 3% MOSM) on layer performance and egg quality. A total of 160 caged Lohmann Silver layer strain at 40 weeks of age were used for the experiment, each treatment containing 40 birds. Each treatment was further divided into four replicates consisting of 10 birds per replicate. All birds were randomly distributed into 32 cages, with each cage of an area 45cm X 45cm X 45cm containing five birds. Eggs were counted and weighed on a daily basis then stored at 4°C. 32 egg samples were collected once a week over a 6 week period and 8 eggs were evaluated per treatment for egg pH (EpH) a week after the end of the experiment. The diet with the highest MOSM rates (3%) resulted in increased egg weight (EW) (58.87g±0.19), whilst egg production (EP) (laying rate) did not achieve any significant differences within treatments. EpH was positively affected by storage time as it increased (7.80± 0.01) with number of storage days. Furthermore, MOSM on EpH had a negative relationship as high levels of MOSM decreased the pH of egg content. It is concluded that the highest levels (3%) of MOSM positively affects egg shelf-life by slowing the rate of increase in pH with relation to increased storage time and improved egg weight.

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Evaluation of meat safety knowledge, personal hygiene, attitudes and handling practices of slaughtermen from two selected abattoirs

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The objective of the current study was to assess the level of knowledge, practices and attitudes towards meat safety and personal hygiene of slaughtermen from two abattoirs in the Eastern Cape Province of South Africa. A survey was conducted in which 40 workers from a low throughput (LTA) and a high throughput (HTA) abattoir were interviewed. Data was collected using a questionnaire comprising questions on slaughtermens' knowledge and attitudes regarding meat safety, as well as personal hygiene and handling practices. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 22. Results indicated that slaughtermen were generally adhering to proper ways of hand washing (LTA: 95.45%; HTA: 100%), drying (LTA: 46.67%; HTA: 90.91%) and wearing protective clothing during the slaughter process, with individuals from the HTA yielding comparatively better scores. The results further revealed that smoking around processing areas (LTA: 53.34%; HTA: 18.19%), cleaning and disinfecting working clothes, reporting illness (LTA: 66.66%; HTA: 37.28%), frequency of medical examinations, lack of health certificates (LTA; 26.67%; HTA: 40.91%) and professional training (LTA: 53.33%; HTA: 13.64%) were the main areas with knowledge deficiencies and practices among those interviewed. Knowledge and practices of respondents were significantly different ($p<0.05$) according to educational level and professional training. Although the results showed a significant adherence to basic hygiene practices, some aspects such as routine medical examination, health certificates and professional training of slaughtermen still need to be improved.

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The prevalence and distribution of *Argas walkerae* (Acari: Argasidae) in the eastern region of the Eastern Cape Province, South Africa

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The prevalence and geographic distribution of the fowl tampan, *Argas walkerae* (Kaiser & Hoogstraal, 1969) was determined in the eastern region of the Eastern Cape Province, South Africa. Two fowl houses per dip-tank were inspected in the vicinity of 72 randomly selected communal cattle dip-tanks. Tampans were collected from 102 (70.8 %) of the 144 fowl houses comprising of 57 (79.2 %) of the 72 selected dip-tanks, and the localities of the collections were mapped. *Argas walkerae* was present in fowl houses from the warm coastal regions bordering the Indian Ocean in the south to the cold and mountainous Drakensberg in the north-east of the Province. Taking into account the probable sensitivity of the sampling method, it is estimated that *A. walkerae* is likely to be present in fowl houses belonging to between 74 and 84 % of communities making use of cattle dip-tanks in the eastern region of the Eastern Cape Province, and that when it is present, between 64 and 75 % of fowl houses will be infested. The geographic distribution of *A. walkerae* seemed to be more strongly associated with the presence of fowls and fowl houses containing raw or processed wood in their structure than with climate.

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Growth performance of growing boars fed varying levels of raw or fermented cottonseed cake

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Cottonseed cake (CSC) is a veritable source of protein, energy and fibre for a variety of livestock species. However it contains a deleterious polyphenolic compound, gossypol, that restricts its use to ruminant feeding. Fermentation is one of the biotechnological options for reducing toxicity of many feed ingredients. This study was conducted to determine the effect of different levels of raw or fermented CSC on sperm characteristics of growing boars. Thirty (30) cross-bred (Landrace x Large White) weanling boars with average weight of 7kg, (n=6 per treatment) were randomly assigned to five dietary treatments arranged in a 2x2 factorial with a control within a completely randomized design (CRD). The CSC was included in diets at 0 (control), 10 and 20% (Raw or Fermented). Animals were fed for twelve weeks, during which growth performance data were taken. The boars were supplied with feed and water *ad libitum*. Feeding was done twice per day at 8:00am and 4:00pm, while the left-over was measured every morning to estimate the daily feed intake from which the weekly intake was determined. Body weights of animals were taken at the commencement of the experiment and subsequently once a week. Average final weight was significantly ($p< 0.05$) higher for the control (19,274.00g) than other treatments. Average total weight gain for the 20% raw CSC (11.720.00g) was similar to that of the control (12.274.00g). Average weekly weight gain was highest (1,022.83g) ($p<0.05$) for the control while the lowest value was obtained at 20% fermented CSC (706.17g). Boars that were fed 20% fermented CSC recorded lowest average daily weight gain (100.88g). Average daily feed intake was significantly ($p<0.05$) higher for 20% raw CSC (134.00g) compared with other treatments. This study shows that growing boars could tolerate raw CSC up to 20% provided that growth performance is the ultimate target. Sperm concentration was significantly ($p<0.05$) higher for the control ($48.50x10^6$/ml) than for other treatments.

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Effect of supplementing feed grade or oral xylanase enzyme on performance and carcass characteristics of broilers

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This experiment was conducted to investigate the effect of dietary replacement of wheat offal with rice husk with or without oral or feed grade xylanase enzyme supplementation on the growth performance, organ and carcass characteristics of broiler chickens. Two hundred and eighty- eight (288) one-day old Marshal strain of broiler chicks of average weight of 37-42 gramme were used for the experiment. The birds were randomly divided into 8 groups of 3 replicates of 12 birds each, to make a total of 36 birds per treatment in a complete randomized design experiment. Eight diets were formulated as follows: Diet 1 was the control with wheat offal, Diet 2 – control (wheat offal replaced with rice husk without enzyme supplementation), Diet 3 – Diet 2 + AG enzyme (1ml/litre of water) for eight weeks, Diet4 – Diet 2 + Maxigrain (0.1 grams/kilogram of feed) for eight weeks, Diet 5 - Diet 2 + AG enzyme (1ml per/litre of water) for the first four weeks of the experiment, Diet6 - Diet 2 + Maxigrain (0.1 grams/kilogram of feed) for the first four weeks of the experiment, Diet7 - Diet 2 + AG enzyme (1ml per/litre of water) for the last four weeks of the experiment, Diet8 - Diet 2 + Maxigrain (0.1 grams/kilogram of feed) for the last four weeks of the experiment. The experiment lasted for 8 weeks. Data collected were used to evaluate ADFI, ADG and F:G. At the end of the study the birds were euthenased and the weights of the internal organs were obtained and expressed as percentage of BW. Data were analyzed using the GLm procedure of SAS. The final BW of broilers on the control diet and other treatments were comparable (P>0.05). Similar trends were observed in the values for ADG and AFI. The weights of kidney, lungs, heart, and spleen were not affected (p> 0.05) by dietary treatments. In conclusion, rice husk could be used as an alternative to wheat offal in formulating broiler diet at 10% in the starter phase and16% in the finisher phase without incorporation of enzyme.

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Reproductive performance of Red Sokoto Goats fed graded levels of baobab *(Adansonia digitata* L.*)* fruit meal

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Reproductive performance of twenty four (24) synchronized primiparous Red Sokoto goats of 15.80kg – 23.70kg weight at mating fed graded levels of baobab *(Adansonia digitata.L)* fruit meal supplement was investigated. A feed supplement tagged Baobab fruit meal (BFM) containing 0%, 10%, 20%, and 30% baobab fruit was fed to the experimental animals in a completely randomized experimental design comprising of six (6) animals per treatment. There were significant differences ($P<0.05$) in the results obtained. At parturition, animals on the 20% baobab fruit inclusion level had the highest mean weight value of 28.75kg and the does on the 0% inclusion level recorded the least value of 20.50kg. Animals on the 30% baobab inclusion level had the highest weight gain value of 5.85kg, followed by the 10% inclusion level with a weight gain of 5.52kg. The 20% inclusion level had 5.52kg weight gain and the least value of 4.70kg was recorded for animals on the 0% baobab fruit inclusion. Similarly, the weight of dam at weaning ranged from 17.05 kg to 24.75 kg. The mean weight values were 2.10 kg, 2,15 kg, 1.98 kg and 1.70 kg for 20% , 10%, 30% and 0% levels of baobab fruits inclusion respectively. The sex ratio of Male : Female recorded in the study were significantly different ($P<0.05$). 0%, 10%, 20% and 30% baobab fruit inclusion recorded 33:67% (2 males, 4 females), 50:50% (3 Males, 3 Females), 83:17% (5 Males , 1 Female) and 67:33% (4 Males, 2 Females) respectively. The kid weight at weaning (kg) and Daily weight gain of the kids were significantly different ($P<0.05$) at all levels of baobab fruit inclusion. The percentages of kid mortality at birth and at weaning was zero in the study.

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The effect of *Carica papaya* seed powder on the sex differentiation, growth and survival of *Oreochromis mossambicus* fry

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Tilapia species, endemic to Africa, are farmed globally because of its easy adaptability to different environmental conditions, and the fact that they are easily cultured. However, in most tilapia species, precocious maturation and indiscriminate spawning leads to over population of ponds, resulting in stunted growth, which impacts negatively on the cost-efficiency of tilapia production systems. The production of all-male populations offers a means to overcome this limitation. All-male populations can be achieved by the administration of exogenous 17-methyltestosterone during the undifferentiated stage of gonadal development in Mozambique tilapia (*Oreochromis mossambicus;* OM) fry. The use of exogenous 17-methyltestosterone, however, raises concerns with regards to food safety and environmental impact. Pawpaw (*Carica papaya*; PP) seeds contain phytochemicals that have antibacterial, antifungal, and anti-fertility properties. The potential of PP seed powder to be used as an alternative to MT to manipulate the sex ratio in OM to obtain all-male populations during the period of sexual differentiation (days 10-20 post-hatch) was investigated in this study. Treatments consisted of 0 g PP/kg basal diet (BD; negative control), 60 mg MT/kg basal diet (positive control), and 10g, 15g, 20g, 25g and 30g PP/kg of basal diet, respectively. The OM fry, housed at 60 fish per replicate, received the treatment diets from day 9 post-hatch (yolk was absorbed) for a period of 30 days, whereafter all treatment groups were fed the BD for 90 days. Each experiment was repeated 3 times. Data recorded included condition factor, growth and mortality rates, and gender. Gonad and liver tissue samples were collected and processed for histological examination. An increase in the number of males was observed with an increasing PP inclusion level, with 20g PP/kg BD that resulted in 77.8% males, indicated to be the optimum inclusion level. The MT treatment resulted in 83.3% males. Survival rate was not affected by any of the dietary treatments. High PP inclusion levels (25g and 30g /kg BD) resulted in hyperplasia of the follicular epithelium, fragmentation of oocyte nuclei, and follicular atresia. Mild alteration in the normal architecture of the liver was also observed in this study, and included vacuolization of hepatocytes, and hepatic degeneration.

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Chemical profiling and health benefits of two Cymbopogon species found in Nkonkobe District, Eastern Cape, South Africa

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Southern Africa has up to eight species of *Cymbopogon* lemon grasses. *Cymbopogon validis* and *Cymbopogon plurinodis* have been identified in Nkonkobe district by the traditional healers and botanist. The oil extracted locally is use by these traditional healers for the treatment of allelopathic respiratory tract infections. Industrially, they are often used in flavours, fragrances, andcosmetics. The leaves of *Cymbopogon validis* and *Cymbopogon plurinodis* were hydro-distilled and the extracted oils were analyzed by GC-MS. The result of the analysis of the essential oil resulted in the identification of 76 and 70 compounds, representing 90.36% and 85.3% of the total oils, respectively. The major components of the *C. validis* oil were identified as linalyl alcohol (18.9%), citronellal (0.77%), citronellol (1.47%), geraniol (2.68%), geranyl acetate (1.97%), Hinesol (4.78%), agarospirol (5.26%) and 4-epi-cubedol (6.08%).While the main components of that of *C. plurinodis* were characterized as limonene (3.65%), cubedol (2.22%), phytol (0.05%), Epiglobulol (0.09%), 2,4-carene (12.66%) and Nerolidol 1 and 2 (13.6%). The phytochemical profile of *C. validis* and *C. plurinodis* and their medical applications by the traditional healers and industrial cosmetics should be considered before eradication from the veld.

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Dairying in Sub-Tropical regions – Makhathini Research station

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The usual dairy breeds have some serious challenges when they are introduced in the tropical and sub-tropical regions. One of the challenges faced in the area was nutrition with distance to feed merchants. The high temperatures deterred animals from grazing during the day and night time grazing occurred. In circumstances where animals had to be kraaled, feeding was necessary during the night. Providing shade and cool clean drinking water is another challenge that faces the dairy farmer in these parts. It is therefore quite debatable whether to do dairying (with traditional dairy breeds) in hot, humid environments – or not. The demand for milk and dairy products however, does not disappear.

An initiative was launched at Makhathini Research station in the far north east of KwaZulu-Natal, to breed a crossbred dairy cow combining the adaptability of the local Nguni cattle and the diary characteristics of the Jersey. An added benefit (to hot environs) by using the Nguni and Jersey breeds was keeping the frame of the crossbreed small.

Initially all three breeds (Nguni, Jersey and the Crossbreed) were milked in a standard operating milking parlour. The Nguni and Crossbreed's yields were disappointingly low. Therefore the operation was changed to include a restricted suckling regime and the Nguni and Crossbreed cows were milked outside. The crossbreed has proven itself under these conditions with improved milk yields and longer lactation periods (reaching 300 days). Twice a day hand milking was also rejected in favour of once a day milking as some calves were losing condition.

A simulation of the communal scenario (regarding feeding and nutrition of the dairy animal) was done to serve as a demonstration unit for local farmers. The breeds were compared in trials within the breeding program. The results of a trial on the effects supplementation have on the milk production of the crossbreed showed a significant increase in milk production, although not economically feasible. The restricted suckling regime resulted in poor calf performance when the cows were milked twice a day. An investigation was done to determine the milk intakes of the calves, with calves weighed before and after suckling. This served as an indication of the mother's ability to retain milk and from the results milk retention indicated figures from 22% to 120% of saleable milk.

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Condensed molasses solubles (CMS) vs. molasses in a feedlot diet on gas production during *in vitro* fermentation

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A waste product that accumulates after molasses fermentation to produce alcohol, is called condensed molasses solubles (CMS), and has the potential to be used as a substitute for molasses in ruminant diets. To ascertain the potential of CMS as a feed ingredient, gas production during *in vitro* fermentation was measured, comparing different levels of CMS and molasses in a cattle feedlot diet. The experimental diets contained CMS and molasses at ratios of 0% : 15%, 5% : 10%; 10% : 5% and 15% : 0%, respectively, and were formulated to be iso-energetic, iso-nitrogenous and balanced for moisture content. Total gas production during a 40 hour fermentation period was used as measure of microbial digestion of the feedlot diets. An ANKOM RFS Gas Production Measurement System was used to automatically measure cumulative gas production over 40 hours. Results from this study did not indicate any significant differences in total gas production or VFA production between CMS treatments. It is concluded that the inclusion of CMS at different levels in the feedlot diet did not affect fermentation differently from that of molasses. In a further *in vitro* fermentation study the composition of the gas was measured to simulate gas production within the rumen. Under commercial conditions H_2SO_4 is used to terminate fermentation during alcohol synthesis, and it was suspected that high levels of sulphur would be present in CMS. Levels were elevated in CMS compared to molasses but not exceptionally high. The composition of the gas released during *in vitro* fermentation was measured at the South African Nuclear Energy Corporation SOC Limited, Pelindaba, North-West, using calibrated gas chromatography. Concentrations of CO_2, H_2S, N and CH_4 in the gas did not differ significantly between feedlot diets containing different levels of CMS and molasses. It is concluded that CMS can effectively replace molasses in a feedlot diet, provided that the diets are formulated to be iso-energetic.

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Estimating breed purity for six cattle breeds in South Africa

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In the beef cattle industry of South Africa, breed purity has been of some concern amongst some of breeders of landrace breeds, whereas it is not a concern with others. Furthermore, breed purity has never been estimated for South Africa's landrace breeds. Until recently, little was known about the generic composition of indigenous, composite and exotic cattle breeds that are found in South Africa. Due to unrestrained crossbreeding of both indigenous and exotic breeds in South Africa, the importance of getting an indication of breed purity of certain breeds has now emerged. Therefore, the aims of this study were to determine the genetic structure, composition and breed purity of four South African landrace- and two exotic breeds. Eleven microsatellite markers were used to assess 550 animals from each of six breeds. Bayesian multi-locus clustering without *a priori* assignment of individuals to populations as implemented in STRUCTURE revealed four foundational genetic clusters (K=4). Animals representative of Angus were predominantly assigned to cluster one with an average probability of membership of 94%. Animals representative of Afrikaner were predominantly assigned to cluster two, also with an average probability of membership of 94%. Animals representative of Drakensberger were predominantly assigned to cluster three having an average probability of membership equal to 90%. Animals representative of Brahman were predominantly assigned to cluster four having an average probability of membership equal to 95%. Animals representative of Bonsmara and Nguni were more heterogeneous with average probabilities of membership in cluster two of 18% and 59% and average probabilities of membership in cluster three of 73% and 29%, respectively. Thus, two of the four South African landrace breeds shared two ancestral clusters with probabilities greater than 10% suggesting that they descend from more than one breed.

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An overview of goat meat quality: Part II. Effects of *post mortem* electrical stimulation on goat meat quality

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Electrical stimulation (ES) has been reported to improve meat colour and tenderness, but there is limited information on the effects of ES on goat meat quality. This study was conducted to evaluate the effects of ES on goat meat quality. Twenty (20) post weaned Boer and indigenous goats (n =10 /breed; weighing 17.34 ± 2.67 kg) were raised to a marketable weight of *ca.* 35 kg. The goats were slaughtered according to standard abattoir procedure. Immediately after dressing down, the carcasses were split into two halves, along the vertebral column. Left sides of carcasses were electrically stimulated (220 V for 30 seconds at a pulse 9.5 per second) and right sides remained unstimulated (NS). Carcass pH and temperature values were recorded at 0, 1, 3, 6 and 24 hours *post mortem*. After 24 hours of chilling (0 -4^{0}C), the *m. longissimus dorsi* (LD) and *m. semimembranosus* (SM), were dissected from both carcass sides and meat quality characteristics such as, colour (L*, a*, b*, Chroma, hue and myoglobin fractions), water holding capacity (meat to fluid ratio), juiciness (thawing and cooking losses) and tenderness (sarcomere length and Warner-Bratzler shear force (WBSF) values) were evaluated.

Carcass pH values were lower in ES carcass sides than in NS carcass sides, during the 24 hour *post mortem* period. Warner-Bratzler shear force values were lower in ES carcass sides (5.17 ±1.89 kg) compared to NS carcass sides (6.44 ± 2.48 kg). Sarcomeres were shorter in ES carcass sides (2.03 ± 0.10 µm) than in NS carcass sides (2.08 ± 0.12 µm). Parameters for meat colour, water holding capacity or juiciness were not affected by ES. In conclusion, ES accelerated the rate of pH decline and improved meat tenderness, but did not improve meat colour. The present study confirms the potential of ES in counteracting the effects of cold shortening in goat muscles.

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Genetic trends for residual butterfat and residual protein in South African Holstein cattle

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Genetic trends show the direction and magnitude of genetic change for a trait, in a population, over a period of time. Butterfat and protein content of milk are economically important dairy production traits, as they determine the factory output of high value dairy products. Residual butterfat and protein (i.e. protein and butterfat yields, with milk yield held constant) provide an indication of the efficiency of production of these milk components. The objective of this study was to assess genetic trends for residual butterfat and residual protein in the South African Holstein cattle population for the period 1983-2010. Performance and pedigree data of 687 048 Holstein cattle were used to compute estimated breeding values (EBVs) for production traits (i.e. milk, butterfat and protein yield) using fixed regression test day models. Thereafter, EBVs for residual protein and residual butterfat were calculated from the EBVs for butterfat and protein yield. Average EBVs for residual butterfat and protein were in turn computed for each year of birth, to determine annual rates of genetic change. There was a marginal positive genetic change of about 5% annually, for both traits. Genetic improvement strategies are needed to ensure the production of more milk solids without producing excess carrier at the same time.

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Genetic diversity and population structure of two Zulu sheep populations in rural KwaZulu-Natal

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The Zulu sheep play an important role as a source of food and income for subsistence farmers in KwaZulu-Natal. The breed is characterised by a mixed appearance with their tails being either fat or thin, different colours and have a coat of hair or wool. This breed can survive and flourish in environmentally challenging conditions. The numbers are declining rapidly due to stock theft and indiscriminate crossbreeding. Therefore, as the first step towards the development of their conservation programmes, the objective of this study was to determine the genetic diversity and population structure of two Zulu sheep populations located in Jozini and Nongoma of KwaZulu-Natal using microsatellite markers. Reference populations included the Afrino, Dorper, Nguni, Swazi, Damara, Black-headed Persian, and South African Merino. DNA was extracted using a commercial DNA extraction kit and PCR amplification was performed using eight polymorphic microsatellite markers. The genotypic data was analysed using GeneMapper software. Statistical analyses were performed using Arlequin, FSTAT and Structure software programmes. Results obtained demonstrated that the mean number of alleles vary from 5.4 (Jozini) to 6.3 (Nongoma). The observed heterozygosity values varied from 0.58 (Jozini) to 0.55 (Nongoma), while the expected heterozygosity across the loci varied from 0.71 and 0.70 respectively. The structure results indicated genetic similarity and demonstrated clustering between the two populations (0.55 Jozini and 0.63 Nongoma), while revealing negligible similarity with the outgroup populations. Results of this study form the basis for the implementation of appropriate breeding and conservation programmes in Jozini and Nongoma that will assist in saving the endangered Zulu sheep.

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Comparison between South African unimproved indigenous and Tankwa goat semen characteristics

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South African indigenous goats are tolerant of parasites and diseases, and are able to survive under harsh environments. However, they are poorly managed and are under threat of extinction. Moreover, there is a lack of information on their reproductive performance. Therefore, conservation of these goats is important in order to protect their diversity. The study was aimed at comparing and characterising the South African unimproved indigenous and Tankwa goat semen characteristics. An electro-ejaculator was used to collect semen samples from 41 South African unimproved indigenous and 32 Tankwa goats. Following semen collection, semen samples were evaluated for colour, volume, pH, sperm cell motility, concentration, viability and vitality. The data were analysed using SAS Software (1999), Version 9.2. Means and standard errors were used to summarise the data at 95 % confidence limit. Tankwa goats resulted in significantly higher ($p < 0.05$) semen volume and sperm cell concentration when compared to the South African unimproved indigenous goats. Both types resulted in the same neutral semen pH. South African unimproved indigenous goats' ejaculated semen samples that were clear, cloudy, milky, thin-creamy, creamy and thick-creamy in colour while Tankwa goats ejaculated semen samples that were clear, milky and creamy in colour. South African unimproved indigenous goats resulted in significantly higher ($p < 0.05$) non progressive motility, slow velocity and non-progressive sperm cells. Tankwa goats resulted in significantly ($p < 0.05$) higher curvilinear velocity, straight-line velocity and average path velocity when compared to the South African unimproved indigenous goats. However, South African unimproved indigenous and Tankwa goats showed similar ($p > 0.05$) total and progressive motility, rapid and medium velocity, static, fast, slow progressive, normal and wobble sperm cells, linearity, straightness, primary and tertiary abnormalities. In conclusion, the two South African indigenous goat breeds showed similar and acceptable sperm cell morphology, abnormalities, progression, velocity and viability parameters, and similar semen characteristics.

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Consumer and handlers' perceptions on meat quality and safety along the distribution chain

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The objective of the study was to investigate the perceptions and knowledge of consumers and meat handlers' on meat quality and its safety throughout the distribution chain. A survey was conducted where 300 consumers randomly selected from five different municipalities, 50 retailers and 50 meat handlers from two abattoirs in the Eastern Cape Province of South Africa were involved. Data was collected using a questionnaire on perceptions of meat quality, consumer knowledge on meat safety and challenges faced by handlers during distribution. Frequencies for respondent's profiles and perceptions were determined using PROC FREQ of SAS (2010). The Chi-square test was used to determine associations between respondent's demographical characteristics and their perceptions on meat quality and safety. The results revealed that 53.69% of consumers, 81.63% retailers and 99,9% of abattoir workers were male, above 50 years of age, with more than 10 years of experience in the meat sector. There was some general disagreement between the three groups on the use of quality attributes to predict meat quality and safety. Consumers used colour and price to predict meat quality, while handlers used freshness. Expiry dates, change in colour and aroma were considered as the best indicators of meat safety. The results further showed that more than 60% of the consumers perceived that meat purchased from the butcher and retail shops differ in quality. Meat from high class shops was considered to be safer than low class shops. A strong significant association between educational status and awareness on meat safety was observed, where 55% of the consumers had shown lack of knowledge on the pathogenic diseases that they may obtain from consuming raw meat. However, series of loading and offloading, temperature fluctuations, environmental temperatures and queues during offloading were reported as the major challenges during transportation of carcasses from the abattoir to the supply points. It was concluded that consumers and meat handlers have different perceptions on meat quality and meat handlers generally perceived the distribution chain as having an effect on meat quality.

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Oestrous synchronization response in communal cows of Limpopo Province

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Oestrous synchronization programs have been tested in controlled environments on commercial farms, but not in uncontrolled communal setups. The aims of the study were to evaluate the oestrous synchronization response of communal cows and the effects of age and body condition score (BCS) on oestrous response following training of the farmers. A total of 125 cows were selected from the communal villages in the Limpopo Province. The BCS ranged from 2.5 to 4.5 (on a scale of 1-5; 1 = emaciated and 5 =obese). Cow's age ranged between 3 to 10 years while parity ranged from 1 to 7. Cows were grouped into two BCS groups (<3 and ≥3) and two age groups (<6 and ≥6). All groups of selected cows were subjected to a 9 day Ovsynch + controlled internal drug release (CIDR®) protocol and separated from the herd throughout the oestrous synchronization program. A CIDR® was inserted into the vagina on day 1 and Oestradiol benzoate (2mL) was administered. On day 8 the CIDR® was removed and the cows were administered with 2mL of prostaglandin ($PGF_{2\alpha}$). In addition, on day 9, cows were given estradiol benzoate (1mL) and a heat mount detector was placed on the tail head of the cows to detect oestrous response (standing heat). Data was analyzed using ANOVA. Cows responded to oestrous synchronization regardless of BCS and age group. However, there was a noticeable difference between age groups <6 (78%) and ≥6 (68%). Oestrous synchronization response tended to decrease as BCS increases in age group <3, but was not statistically different. In conclusion, communal cows in Limpopo responded to oestrous synchronization program. Furthermore BCS and age did not alter the response to oestrous synchronization protocol.

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Comparative evaluation of different extenders and sperm protectors to keep the spermatozoa viable for more than 24 hours

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Preservation of semen is an important process to ensure that semen quality is sufficient for assisted reproductive technology. The aim of this study was to compare the effectiveness of three different extenders on Nguni bull semen stored at controlled room temperature 24 °C for 3 days, as an alternative to frozen-thawed semen straws used for artificial insemination. Two Nguni bulls were used for semen collection with the aid of an electro ejaculator. The collected samples were transported to the laboratory at 37 °C for evaluation within 15 minutes. The two semen samples were pooled together before being aliquoted into three extenders namely Triladyl, modified Ham's F10 and M199 culture media, at a dilution ratio of 1:4 (semen:extender), and then stored at controlled room temperature 24 °C. Sperm motility was analysed after 0, 24, 48 and 72 hours. Morphology and viability were analysed after 72 hours. The study was replicated four times and data was analysed by ANOVA. The highest and consistent total motility was obtained with Triladyl extender for 3 days ($P<0.01$). However, the highest progressive motility for 3 days was observed with Ham's F10 as compared to the other two extenders. The highest rapid motility was again observed with Triladyl as compared with the other two extenders ($P<0.01$). Furthermore, the highest sperm viability was observed with samples extended with Triladyl, no significant decrease ($P<0.01$) was, however, observed between the other two extenders Ham's F10 and M199. No significant difference was also observed in total morphological abnormalities (absent tails, coiled tails and bent tails), except for reacted acrosomes ($P>0.05$), between the two Nguni bulls. In conclusion, Nguni bull semen can be preserved with the commercial extender Triladyl or modified Ham's F10 and M199 culture media, stored at 24 °C and stay alive for 3 days. Triladyl extender proved to be the best extender showing the highest viability and consistency in total motility as compared to Ham's F10 and M199 modified culture media.

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The effects of different storage temperatures on Nguni bull semen extended in Ham's F10

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Artificial insemination with frozen-thawed semen in the isolated rural areas in South Africa is not the optimal procedure, because of the not readily availability of liquid nitrogen (LN_2), safe storage of LN_2 tanks for genetic banking, and other factors. Deployment of extended freshly collected bull semen stored at refrigerated temperatures for artificial insemination purposes could be a valuable tool to maximize utilization of superior bulls between producers in fairly close proximity**.** The aim of this study was to evaluate the effects of different refrigerated storage temperatures on Nguni bull semen extended in modified Ham's F10 culture media. Semen samples to be used were collected from two Nguni bulls with the aid of an electro-ejaculator and transported to the laboratory for evaluation at 37 °C within 15 minutes. The two semen samples were pooled together and aliquoted into four samples diluted in modified Ham's F10 culture medium at a ratio of 1:4 (semen:extender). The four extended samples were randomly allocated to the four storage temperatures (controlled room temperature 24 °C, 17 °C, 12 °C and 5 °C). Sperm motility, viability and sperm DNA fragmentation were analysed using CASA. The study was replicated four times and data was analysed by ANOVA. The storage temperature 24 °C showed the highest sperm motility and viability percentages for 3 days. No significant difference in wobble velocity ($P>0.05$) was observed between the storage temperatures 17 °C and 12 °C for 3 days. The overall sperm viability rates of the storage temperatures 17 °C, 12 °C and 5 °C were less than 10%. Furthermore, no significant decrease ($P<0.01$), in viability percentages was observed between 12 °C and 5 °C storage temperatures. Sperm DNA fragmentation did not differ between all the four storage temperatures ($P<0.01$), which indicated that temperature did not have an influence on sperm DNA fragmentation. In conclusion, lower storage temperatures than 24 °C noticeably decreased sperm motility and viability. Storage temperature did not influence sperm DNA fragmentation.

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Differences in growth performance of F1 Nguni x Angus cross calves raised and weaned in different farm environments

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One hundred and fifty F1 Nguni x Angus cross weaners were evaluated to determine their growth performances under different farm environments. Eighty six of the calves were in the Loskop farm which is a sweet veld and 64 were on the Roodeplaat farm which is a mixed veld. The calves were reared under natural grazing for six months post-weaning on two separate farms. The calves in the two farms where exposed to different feeding and management regimes. Farm environment did not have an effect on calf birth weight but had significant effect on their weaning weights. Calves from the Loskop farm generally showed lower live weights. There was no significant difference between gender and body weight of the calves. These varying findings may be due to differences in environment and management practice. However, the post fattening of the calves in a feedlot setup showed compensatory growth for calves that were small at and after weaning. The results show that management and environment plays a big role in production and profitability of any beef herd. It is thus advisable for farmers get correct supplements and supplementation practices for their herds to avoid hampered growth.

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The use of Medroxyprogesterone acetate in an attempt to delay lambing season in communal wool sheep

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Previous investigations have established that the peak lambing season of communal wool sheep in the Eastern Cape tend to occur in the months of June and July. Although an open mating season is practiced, nutritional conditions tends to roughly synchronize pubertal females (ewes) to lamb during this period. This pattern seems to be fairly constant with subtle changes (forward and backward shifting) influenced by rainfall, subsequent nutritional conditions and other post lambing events. This cycle of events leads to high neo natal mortality rates and subsequent production losses due to unfavorable nutritional and environmental conditions during the winter period. In this pilot trial, an attempt was made to delay conception and consequent lambing through the use of a high dose of long acting Medroxyprogesterone acetate. A total of twenty (N=20) experimental ewes in two different communities (N=10 per location) were treated with an intramuscular administration of 150 mg of Medroxyprogesterone acetate (Depo Provera, Phizer) during mid-December. This period was selected based on limited historic information on the possible time of conception. All treated ewes were ultrasonically examined in an attempt to exclude, as far as possible, any pregnancies at the time of hormonal treatment. The remainder of the ewes (N=137) in the two flocks were used as controls. A customary open mating season was practiced and ewes were exposed to the rams at all times. All ewes (treatment + control) were ultrasonically examined on a monthly basis from April to September to establish their reproductive status. In April, the percentage of non-pregnant ewes was 61.1% and 9.1% for the treatment and control group respectively. During the months of June and July, the cumulative percentage of ewes which finished lambing was 31.6% and 27.8% respectively for the treatment group. During the same months this figure was 10% and 69.2% for the control group. The highest cumulative percentage (69.2%) of ewes which finished lambing in the control group was recorded in July. The highest cumulative percentage (76.5%) of ewes which finished lambing in the treatment group was recorded in September. There was a definite shift in lambing period between the control and treatment group which should be beneficial for improved survival rate in both ewes and lambs. Further studies are needed where larger numbers of ewes should be included and the optimum time of treatment established.

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Genetic characterization of Nguni type animals in rural areas of South Africa

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Nguni is one of the most recognised indigenous beef cattle breed in South Africa. It has a significant contribution in the livelihoods of rural communities. The genetic status of Nguni cattle in rural areas has not yet been genetically quantified. Characterization is a step to design appropriate management and conservation to save rare adaptability traits that can be useful in future for food security. The objective of this study was to assess the genetic status of Nguni cattle from rural areas of South Africa. About 1445 hair samples were collected from the rural villages of Eastern Cape, KwaZulu-Natal, Limpopo and Mpumalanga Provinces. Each Province was represented by a minimum of 40 samples from different farmers. Seven beef cattle breeds were used as reference populations for admixture evaluation. Genomic DNA was isolated from hair roots using proteinase-K digestion followed by phenol:chloroform:isoamyl alcohol extraction and ethanol precipitation. A panel of 25 microsatellite markers recommended for genetic diversity studies by the FAO/ISAG advisory panel were used to amplify the DNA regions. The estimated mean allelic diversity varied from Limpopo (7.6) to Mpumalanga (8.5) with a total of 267 alleles. The level of gene diversity values were high, indicated by a mean expected heterozygosity (He) across cattle from Limpopo (0.74) to KZN (0.79). Structure analysis indicated the levels of admixture in eight clusters. The Eastern Cape, KwaZulu-Natal and Mpumalanga cattle were clustered together and can be regarded as one population. While Limpopo cattle assigned independently and appeared to be more closely related to Loskop Nguni stud cattle. The findings in this study provide insight into Nguni cattle genetic resources that can be conserved in rural areas to avoid the loss of genetic diversity.

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Medicinal plants used to control internal and external parasites in goats in the Eastern Cape Province, South Africa

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The use of medicinal plants play a major role in the primary health care of animals in South Africa. A survey was conducted to document medicinal plants used to control parasites in goats in Kwezi and Ntambethemba villages in the Eastern Cape Province, South Africa. Information from 50 farmers and 3 herbalists was obtained through the use of a structured questionnaire and snowball sampling technique was used to identify key informants. The obtained data was analyzed using PROC FREQ of SAS (2003) and Fidelity level (FL) values were determined to estimate the healing potential of the mentioned plants. The survey revealed 9 plant species belonging to 8 families that are used to control parasites in goats. Asphodelaceae (22.22%) was the most frequently used plant family. Leaves were the most used plant parts constituting 60.38%. They were prepared either as infusions or decoctions of single plants or in mixtures. *Aloe ferox*, *Acokanthera oppositifolia* and *Elephantorrhiza elephantina* were the plants having the highest FL for their use to control parasites, each scoring 100.00%, followed by *Albuca setosa* (83.33%). The study showed that there was low knowledge on ethno-veterinary medicine (EVM) in the study area. It also revealed that information of EVM in this area is mostly confined to older people and there is danger that this knowledge can be lost before being passed on to other generations. Therefore, there is an urgent need to document information on these plant species so that the future generation can benefit. Further investigation should be done to validate the efficacy and safety of the mentioned plants so as to provide cheap alternative ways of controlling parasites.

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The effect of sheep breed, attachment area and season on total tick counts of indigenous and commercial sheep in South Africa

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Sheep form an integral component of livestock production systems, particularly in the arid, pastoral regions of South Africa. Ticks are of veterinary and economic importance and can cause blood loss, damage to the skin and/or udders, lameness, transmit disease or irritate their hosts, causing serious welfare problems and productivity losses. This study reports on the effect of sheep breed, attachment area as well as season on the total tick counts of Namaqua Afrikaner (NA), Dorper and South African Mutton Merino (SAMM) reproducing ewes. Ewes were compared under marginal, extensive conditions at the Nortier Research Farm near Lamberts Bay, Western Cape Province. All the animals grazed together on natural shrub pasture typical of the west coast region. Ticks were counted in December 2011, May 2012 and September 2012. Ewes (n = 73) were upended and a total of 3980 ticks were removed from six attachment areas per animal: head (including the neck); right front leg; belly; udder; right hind leg and perineum area (including the tail in the NA). Animal information was recorded and all the ticks, from each of the body areas, were collected. Ticks were preserved in 70% ethanol and identified to species, sex (male/female) and development stage (mature/immature). Three tick species (*Hyalomma truncatum*, *Rhipicephalus evertsi evertsi* and *R. gertrudae*) contributed to >99% of ticks identified. Analyses conducted on the combined tick data recorded higher total tick counts on the legs; belly and udder for Dorper and SAMM compared to NA. Back transformed geometric means (±S.E.) for total tick count on the udder recorded 1.70 ± 0.17 and 1.69 ± 0.18 ticks for Dorper and SAMM respectively, compared to 0.43 ± 0.11 for NA. When the sheep breeds were analysed separately, NA had the lowest total tick counts on the udder all year round. Total tick numbers on the belly area for all the breeds were very low and may be a less preferred attachment site. The higher tick counts on the head of NA ewes were due to higher abundances of *R. evertsi evertsi* immature stages in autumn. NA ewes had the highest total tick count on the perineum/tail area compared to the other two breeds. This may be due to the fact that the NA breed still has an intact tail compared to the commercial breeds. The advantage in favour of the NA for tick infestation on the udder supports evidence of improved udder health in this breed under tick challenge conditions compared to the commercial breeds.

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Factors influencing preweaning performance of Nguni and Angus x Nguni calves in an experimental herd

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The importance of indigenous breeds that are adapted to the anticipated warmer climate, lower nutritional value of the grazing and harsher conditions will increase. Crossbreeding between British / European and indigenous breeds may thus become more important to increase beef production in the near future. In this study the Nguni in a terminal crossbreeding system was evaluated at the Vaalharts Research Station in the Northern Cape over a period of four years. In total 167 pure Nguni and 81 Angus x Nguni calves were weaned. The average 205-day adjusted weaning weight of the Angus x Nguni calves were 181 kg and that of the pure Nguni calves 146 kg. Although the adjusted weaning weight of the Angus x Nguni calves was 35 kg higher than that of pure Nguni calves, the difference was not significant. This can be attributed to the large variation in weaning weights, with that of the pure Nguni calves ranging from 56 kg to 230 kg and that of the Angus x Nguni calves from 105 kg to 303 kg. As a result of the very large variation in weaning weights, some non-genetic factors affecting 205 day-adjusted weaning weight of pure Nguni and Angus x Nguni calves were evaluated. The results indicated that adjusted weaning weight is affected by factors like the sex of a calf, age of the dam, the year of birth of a calf and the herd of origin of the dam. The cow weight at weaning did not seem to influence the weaning weights of the calves. Since weaning weight is affected by many non-genetic factors there is a great need to make adjustments for them when estimating genetic parameters. There is also a need to investigate the reason(s) for the large variation in weaning weight of the calves from Nguni cows. This may include an in depth study of the differences between farms from which the dams originate, cow weight and genetic merit. The fact that herd of origin of the cow affects the weaning weights of her calves may also suggest the presence of epigenetics. All alterations in DNA function without alterations in DNA sequence are referred to as epigenetics. It is associated with gene expression and the expression of different phenotypes (appearance). These modifications are influenced by environmental factors and can be transferred to the progeny. Epigenetic mechanisms play a major role in phenotypic diversity in response to environmental conditions and this warrants further investigation.

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Efficiency of small scale poultry farmers in Lepelle-Nkumpi municipality, Limpopo Province

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Efficiency plays a prominent role in increasing productivity of poultry farmers. However, they are constraints that results in low efficiency of poultry farmers. Inefficiency studies indicated that there is a possibility to increase productivity through improved efficiency without increasing resources used. This study analysed efficiency with special reference to small-scale poultry farmers in Lepelle-Nkumpi Local Municipality, Limpopo Province. Data was collected with the aid of a well-structured questionnaire on the basis of a sample of 72 poultry farmers. Among them, 9 egg producing enterprises, 55 broiler producing enterprises and 8 egg and broiler producing enterprises were found. With the use of the stochastic frontier production function, cost of bird stock, hired labour cost and cost of litter were found to be highly significant at 1.0% in affecting the level of broiler producing farmers' output. Broiler production inputs such as electricity cost, family labour cost, cost of feed and cost of medication had no significant influence on the farmers' output. Broiler producing farmers are operating close to the frontier with 88.89% of respondents having efficiency levels of more than 90%. The mean efficiency of farmers was 0.9577 indicating large efficiencies in broiler production. The socio-economic determinants of inefficiency were education level, gender, household size and years of farming experience. Years of farming experience had a positive coefficient which indicated that experienced farmers were more inefficient. Moreover, new entrants' farmers benefit and rely more on invaluable advice from extension officer. The study recommends that government should provide adequate agricultural extension agents coverage for poultry farmers because new entrants were depending on their valuable pieces of advice and that abattoir facilities should be made available as they will enhance participation of poultry farmers in formal and good contract markets, thereby increasing their productivity.

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The effect of dietary crude protein on the performance of indigenous grower pigs

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The study was conducted to assess and compare the performance of grower indigenous males and females when fed three levels of crude protein in the diet. The following parameters were measured for the duration of the experiment; average daily gain (ADG), average daily feed intake (ADFI), test days (TDs) and feed: gain ratio (F:G). The pigs were offered three diets formulated to contain 10, 14 and 18% dietary crude protein (CP) with a constant level of 14MJ/kg DE. The pigs were allocated to the varying levels of dietary protein according to sex in a factorial design. A total of 154 indigenous males and females were used in the study. On a weekly basis measurements for live body weights and feed intake were recorded in order to calculate ADG, ADFI, TD and F:G. Treatment as well as the interaction of sex*treatment had a significant effect on the ADG. The males in the 14% CP have significantly the highest weight gain of 0.926g than the females (0.860g) in the similar CP level, while the males in the 10% CP (0.669g) and 18% CP (0.737g) and that of females in the 10% CP (0.854g) and 18% CP (0.825g) had lower weight gains. Treatment as well as sex had a significant effect on the ADFI of the pigs. The females in the 18%CP levels have a significantly higher ADFI of 1.622g than the males (1.451g) in the similar CP level and males in the lowest at 10% CP levels had the ADFI of 1.31g. Treatment level had a significant effect on the length that the pigs took to achieve market weight. The males in the 14%CP had the shortest period of 49 days and the females in the 14% CP had 53 days in the test while the males in the 10%CP and 18%CP taking more than 60 days in the test and females in the 10% CP and 18%CP taking 58 and 55 days respectively in the test. Different treatment levels had a significant effect on F:G for all the pigs in the study. F:G was the lowest for the males on the 14%CP level, and subsequently increased in the 10% CP (1.92) and 18% CP (1.99). While the females had the lowest F:G at 10% CP and increased with the level of CP in the diet. The CP level of 14% seems to be an optimal level for males when it comes to weight gain and they also reach market weight faster at this CP level.

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The use of quail egg-yolk in the extender improve cryopreservation of Nguni bulls semen

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Chicken egg yolk is traditionally used in semen extenders due to its easy availability. However, the use of egg yolk from quail has not been used for preserving Nguni bull semen. The aim of the study was to compare the effect of different concentrations of quail egg yolk during the cryopreservation of Nguni bull semen. Semen was collected from 8 stud Nguni bulls by the use of electro ejaculator aged between 4-5 years. Collected semen samples were kept in a thermos flask containing warm water at a temperature of 37 ºC and transported to the laboratory for further analyses within 20 minutes. After arrival at the laboratory, semen samples were pooled and sperm motility rate was evaluated using computer-aided sperm analysis (CASA). Thereafter, the samples were grouped into three treatment, the fresh semen was group 1, and the diluted semen with either 10% (group 2) or 20% (group 3) of quail egg-yolk citrate extender and equilibrated for a period of 4h at 5ºC. After equilibration, semen samples were loaded into 0.25ml straws, placed into a controlled rate programmable freezer and stored in a liquid nitrogen tank (-196ºC) until thawing. After 60 days of storage, frozen semen straws were thawed in water bath at 37°C for one minute. Thawed semen was evaluated for sperm motility traits using CASA. Data was analyzed with ANOVA. A significant difference (p<0.05) was recorded between fresh total sperm motility rate (97.7%) and frozen-thawed sperm total motility rate with either 10% (87.8%) or 20% (70.6%) quail egg-yolk citrate extender. Moreover, fresh semen also resulted in a significantly higher progressive motility [PM (54.8%)] and rapid [RP (53.1) as compared to 10% [PM (31.5%) and RAP (3.5%)] and 20% quail egg-yolk citrate extender [PM (18.0%) and RAP (2.5%)]. The results demonstrated that the use of 10% of quail egg yolk in citrate extender yielded similar results compared to fresh semen. In conclusion, quail egg yolk was found to be suitable to be used in citrate extender to cryopreserve Nguni bull semen and yielded similar sperm motility rates compared to fresh semen.

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Effects of maize processing and dietary protein on lactation performance by Holstein cows

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The aim of this study was to test whether intensive maize processing and diets containing lower proportions of ruminally degradable protein (RDP) alters feed intake, milk production and milk composition in mid-lactation dairy cows. The objectives were to evaluate the effects of maize grain processing and level of dietary RDP on milk yield and milk composition in dairy cows. Four multiparous lactating Holstein cows averaging BW 570 ± 40 and DIM 90 ± 9 (mean ± SD) kg at the beginning of the study were allocated to a 4 × 4 Latin square design within 21 days period. Treatments were: Fine ground maize grain + Low RDP (T1); Coarse maize grain + Low RDP (T2); Fine ground maize grain (T3) and Coarse maize grain (T4). Low RDP diet was balanced to have 10% low RDP: RUP ratio. The two last treatments (T3 and T4) were balanced at NRC RDP value. Animals were housed in individual pens and had a two week diet adaptation period and data collection was for 7 days. After the sampling period animals were allowed a period of 7 days for withdrawal before a new diet was introduced. Dry matter intake ranged from 22.1 for T4 to 23.3 for T2, but did not differ ($P>0.05$) between treatments. Milk yield was higher for T4 compared to T2 and T3, and did not differ between T1 and the rest of treatments. Cows in T1 had lower milk fat and milk protein % compared to T4, but milk fat and protein yield did not differ between the two treatments. There were no differences in Milk fat and milk protein % between T1, T2 and T3. ECM was higher for T4 compared to T2 and T3, but did not differ with T1. ECM of Cows in T1 was only numerically higher than T2 and T3. Feed efficiency was higher for T1 and T4 compared to T2 and T3. Response of cows fed intensive maize processing + low RDP was comparable to coarse maize + NRC RDP suggesting that total digestibility and microbial N sequestration from starches was maximised with extensive grain processing, and that requirement for RDP was met at low dietary RDP compared to recommended NRC value.

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Water conservation and effluent generation in dairy processing plants

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The objective of the current study was to assess the level of awareness of dairy industries in water conservation and management of effluents. A questionnaire was administered to 233 companies and 103 enterprises responded. Aspects covered include; water usage, types of dairy product, effluent generation and water conservation practices. The influence of period of operation, size and location of company was also assessed. A Proc-Freq procedure and chi-square test of SAS program was used to analyse the data. Water use on different processes was influenced by the size of the company ($P<0.05$). There was an association ($P<0.05$) between period of operation and water conservation strategy adopted by companies (80%). Water source was not associated ($P>0.05$) with size of the company, location and period of operation. The influence of size of company, location and period of operation did not have an impact ($P>0.05$) on dairy effluent treatment method used. The high proportion of dairy companies adopting irrigation as a major water conservation strategy indicates that alternative sustainable methods of recycling waste water should be developed.

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Causes of morbidity and mortality and their associated risk factors in communally kept goat kids in resource-poor areas of the Eastern Cape Province, South Africa

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An investigation on the prevalence of morbidity and mortality in communally kept goat kids was carried out in ten different communal farming areas of the Eastern Cape Province of South Africa. The sampling scheme adopted during study was simple random sampling and data on 30 goat flocks were selected for the study. The causes of morbidity and mortality were diagnosed on basis of clinical signs, owner's statement, laboratory diagnosis and relevant post-mortem findings. The current study revealed that from a total number of 396 kids born during April 2014 to March 2015, the overall morbidity and mortality rate was 37.12% and 25.76%, respectively. Gallsickness (10.78%), heartwater (10.78%), predation (9.80%) and coccidiosis (8.82%) were the major causes responsible for the death of kids. Age of kids was the most important factor and accounted for 36.28%, 35.29% and 28.43% mortality in 0-2 month, 3-4 month and 5-6 months, respectively. The incidences of mortalities were 13.0%, 28.0%, 33.0% and 26.0% in post-rainy, cold-dry, hot-dry and hot-wet season respectively. The study revealed that kids were kept under poor housing conditions. Incidence of morbidity and mortality was significantly influenced by age groups, season and management of kids. It was also affected by birth weight, litter size and sex of kids. These results indicate the high incidence of kid mortalities due various infectious diseases in the study area. It was suggested that more care and attention need to be paid in all the age groups irrespective of season. Mortality due to various diseases in kids could be minimized by identifying the cause and giving proper treatment.

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Lifetime relationships among body weight and fleece traits in Angora ewes

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It is accepted that the ewe flock is mainly responsible for current flock income in any small stock enterprise. This is even more important in mohair producing Angora goats than in sheep breeds where income from mutton production contributes directly to income generated per ewe. As with all biological traits, there are differences among animals in their ability to maintain higher levels of production throughout their flock life than other animals. The ideal is to have a high producing ewe flock in terms of reproduction as well as mohair production. It is therefore important to identify ewes at an early age that will maintain a high level of mohair production and reproduction throughout their flock life. Data collected since 2005 during the winter shearing on the adult ewe flocks of the participants of the Grootfontein Angora Biobank were analysed to obtain lifetime relationships among body weight, fleece weight, fibre diameter and staple length. Fleece records of the ewes recorded at 12 and 18 months of age were obtained from the GADI-Biobank databank and included in the analyses. The relationships between age of ewe and body weight and fibre diameter followed similar trends, both increased up to four to five years of age, after which it tended to stabilise. Fleece weight, however, increased until two years of age, after which it decreased with age. Staple length tended to follow the same trend as body weight and fibre diameter; i.e. increasing up to four years of age, after which it tended to stabilise. Some of these trends are in contrast with the genetic correlations estimated among these traits at second and third shearing (12 to 18 months of age), where a positive genetic correlation was estimated between body weight and fleece weight, as well as between fibre diameter and fleece weight. From these trends, where fleece weight decreased with age, while body weight and fibre diameter tended to remain constant after four to five years of age, it seems as if these correlations do not apply later in life. Components of fleece weight include fibre diameter, staple length, number of fibres per area of skin (follicle density) and skin area (body size). As body weight (size), fibre diameter and staple length all remained constant later in life, it seems as if the decrease in fleece weight should be due to a decrease in follicle density or the number of fibres produced. These results warrant a more in-depth investigation into follicle characteristics and its possible changes with age of the animal.

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Growth performance, internal organ weight and carcass characteristics of broiler chickens fed *Moringa oleifera* seed meal as an additive

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The objective of the study was to determine the effect of *Moringa oleifera* seed meal (MOSM) fed as an additive on daily weight gain, feed intake, body weight gain, feed conversion ratio, carcass characteristics and internal organ weight of broiler chickens. A total of 100 day old unsexed Cobb 500 broiler chicks were randomly allocated to three dietary treatments (TRTS), the treatments had three replicates, where each replicate had 10 birds. The housing was environmentally controlled. Water and feed were provided *ad libitum,* the feeding phases were; starter (0-10 days), finisher (11-28 days) and post-finisher (29-35 days). Diets were formulated and the following levels of *Moringa oleifera* seed meal were added T1- 0 %, T2- 1% and T3-2%. At day 35 all chickens were humanly slaughtered and slaughter weight, carcass weight and internal organ weights (gizzard, intestines, liver and heart) were recorded. The average body weight (ABW) differed significantly with TRTS in week 4 and week 5. The TRTS in week 3 to week 5 had a significant effect on ADG. In week 5 chickens in T3 (2% MOSM) had the highest ADG. There was no significant in week 5 in all TRTS in FCR. Feed intake (FI) differed significantly in all TRTS. Slaughter weight (SW) and carcass weight (CW) values were similar in all treatments. No significant effect was found in dressing percentage (DP%), head weight, feet weight, intestinal weight in all TRTS. Gizzard weight, Heart weight differed significantly in T1 compared to T2 and T3. Liver weight was significantly different. It was found that the inclusion of *Moringa oleifera* seed meal as an additive in broiler diets had a significant in growth performance; however, there is a need to increase the inclusion levels to determine the effect of MOSM on carcass characteristics.

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Effect of sex on some blood metabolites and the quality of mutton from Dorper sheep slaughtered at a commercial abattoir

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The objective of this study was to determine the effect of sex on stress indicators and quality of mutton from Dorper sheep slaughtered at a high throughput abattoir in the Eastern Cape Province, South Africa. The ethical clearance certificate (Reference number MUC091SSTE01) to conduct this study was obtained from the University of Fort Hare animal ethics committee. Data was collected from a total of 100 sheep (50 rams and 50 ewes) of approximately eight years of age. The sheep were kept in lairages and fasted for nine hours with *ad libitum* access to water. Humane slaughter procedures stipulated in the Meat Safety Act No. 40, 2000 were adhered to at the abattoir. After slaughter, blood samples were collected at exsanguination using 10.0 ml disposable vacutainer tubes treated with fluoride oxalate and SST™ II, for blood glucose, lactate and plasma cortisol determination. A total of 100 meat samples were also collected from the *Muscularis longissimus thoracicus et lumborum* (LTL) from each of the carcasses. The samples were analysed for pH (pHu) and colour (L*, a*, b*, hue angle and chroma). Data was analysed using generalised linear model procedure of SAS (2009) and correlations were determined using Pearson`s correlation coefficient. The results showed no significant differences in blood glucose but significant differences were observed in blood lactate and plasma cortisol. The ewes had higher levels of blood lactate (7.43± 0.49 mmol/L) and plasma cortisol (293.92±14.32 nmol/L) than the rams. Significant differences were also observed for mutton pHu and colour. The rams had a higher meat pHu (6.03±0.03) and lightness (L*) values (38.13±0.47). Whilst ewes expressed higher values for redness (a*), yellowness (b*), hue angle and chroma. Relationships between stress indicators and meat quality attributes were also tested, it was found that blood lactate was negatively correlated to L*(r = -0.37) and positively correlated to a*(r = 0.24). There were also significant correlations between cortisol and L* (r = -0.67), a* (r = 0.42), b*(r = 0.23), chroma (r = 0.37). These results suggest that the ewes were more stressed than the rams as indicated by high levels of lactate and cortisol, but surprisingly mutton quality from the ewes was better compared to the rams. It can be concluded that response to stress is dependent on sex. However differences in mutton quality can be observed due to sex differences rather than stress alone.

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Rumen response in Jersey cows grazing ryegrass pasture to two levels of high fibre concentrate supplementation

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Most of the energy in dairy cow concentrates comes from maize, resulting in a dairy ration high in starch. Starch is primarily fermented to propionate and acetate, but when the rumen pH drops below pH 6.2 some lactate is also produced. At a rumen pH below 5.8 more lactate is produced, contributing to a decrease in ruminal pH. Below pH 5.5, lactate begins to accumulate and animals could begin to show signs of sub-clinical rumen acidosis. This is detrimental to pasture DM and NDF degradation and leads to a decrease in milk fat and protein content, as well as a decrease in energy use efficiency. Contrary to starch, pectin and sucrose are not fermented to lactic acid but rather to butyric and acetic acid, contributing to a more favourable ruminal pH. The aim of this study was to determine the effect on rumen activity and health by replacing 100% maize with citrus pulp in a concentrate feed. Six rumen cannulated Jersey cows were randomly allocated to one of two treatments in a two period cross-over design. The treatments were: high maize (75% maize and 0% citrus pulp inclusion) and high citrus pulp (0% maize and 75% citrus pulp inclusion). Cows in all treatments received 6 kg DM of the relevant concentrate per day and were allocated 10 kg DM pasture per day. The ME, CP and NDF content of the high maize and high citrus pulp diets was 9.8 and 9.4 MJ/kg DM, 97.9 and 10.1 g/kg DM and 151 and 333 g/kg DM, respectively. Rumen parameters measured included ruminal pH, volatile fatty acid content and *in sacco* ryegrass DM and NDF degradability. There was no difference in the diurnal ruminal pH curve between the high maize and high citrus pulp treatments. Average rumen pH over a 24 hour cycle was 6.25 and 6.17 for the high maize and high citrus pulp treatments, respectively. There was also no difference in the time spent below pH 6.2, 6.0 and 5.8 between treatments. There was no difference in the rate and extent of pasture DM and NDF degradability between treatments. In conclusion, the replacement of maize with citrus pulp did not improve the rumen environment or rumen health, and all readings were within an acceptable range. From a rumen activity and health viewpoint, it is possible to replace 100% of the maize in a dairy concentrate fed to cows grazing ryegrass pasture with citrus pulp without any detrimental effects.

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Near infrared reflectance spectroscopy (NIRS) as a rapid method for the prediction of amino acids in mixed compound ostrich feeds

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Accurate knowledge of the amino acid content of feedstuffs is crucial for the successful formulation of diets for monogastric animals such as ostriches. A lack of the essential amino acids such as lysine, methionine, arginine and threonine in the diet, limits the nutritional value of the feed with a resultant decrease in growth rate. Amino acid analysis is complicated and labour intensive, requiring three days of processing time for example, when using a Dionex HPLC. This procedure is costly and time consuming in comparison to using near-infrared reflectance spectroscopy (NIRS) predictions, which are less time consuming and cost effective. This study was conducted to develop NIRS equations to predict the amino acid content of mixed compound ostrich feed samples. Lysine, methionine, arginine and threonine analyses were performed on 61 milled ostrich feed samples. Calibration equations were developed using a Bran + Luebbe InfrAlyzer 500 NIRS and the samples were scanned between 1 100 and 2 500 nm by using modified partial least square regression (MPLS), with internal cross validation. The coefficients of determination in calibration (r^2_{cal}) values for lysine, methionine, arginine and threonine were 0.82, 0.67, 0.86 and 0.84 respectively. This indicated that calibrations were reliable enough for quality control. The results showed that NIRS could be used for the estimation of lysine, arginine and threonine in mixed and processed ostrich feed samples, providing a rapid and cost effective method for users who need to rapidly analyse a large number of samples. Calibration equations can be improved for methionine by increasing the number of reference samples originally used to develop the calibration equation.

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Prediction of live weight from body measurements of indigenous and cross bred goats from different regions and production systems in Mozambique

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Knowledge of animal live weight is important for a variety of herd or flock management purposes. In poorly resourced small holder farms of Mozambique, however, unavailability of weighing devices makes it difficult to measure live weight of animals. The primary aim of the current study was to investigate the possibility of predicting live weight from body measurements of indigenous and crossbred Mozambican goats. Linear body measurements were randomly taken from 59 indigenous and 56 crossbred goats from small holder farms and research stations, in different regions of Mozambique. Goats on smallholder farms were reared extensively while those on research stations were managed under semi-intensive conditions. An ordinary tape was used to take body measurements and live weight was determined by hanging the goats, in a bag, to a portable hanging scale. Body measurements were chest girth, body height, body length, chest width and pin bone width. Pearson correlation coefficients among the body measurements and live weight were calculated using the Minitab 17 software. Multiple linear regression analysis of live weight on body measurements was subsequently performed by the general linear models procedure of Minitab 17. The model included the fixed effects of breed, region, sex and age. Principal component factor analysis was subsequently carried out to determine the best model for predicting live weight from the body measurements. Correlations among body measurements ranged from 0.25 between pin bone width and body height to 0.66 between body height and chest girth. Live weight generally had high correlations with body measurements, ranging from 0.52 with pin bone width to 0.87 with chest girth; thus chest girth was the best predictor of live weight.

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Effect of pellet size on feeding efficacy and feed wastage of three different size groups of redclaw

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Problems associated with feeds and feeding has been a major cause of concern for redclaw farmers for many years. In particular, the redclaw farmers in Australia have no option but to use only available one pellet size (4.5 mm in diameter) for all developmental stages of redclaw. Efforts to maximise feed utilisation should consider the feeding behaviour of cultured species at different developmental stages. Therefore, the optimal size range of the pellets for each size group of redclaw was identified through quantification and comparison of feeding efficacy and feed wastage when feeding three different size groups of redclaw with pellets of different sizes.

Three size groups of redclaw were transferred individually into a 20 L glass aquarium. Based on its size category, each redclaw was offered pellet with one of the three different sizes to be tested. That is, 1.0, 3.0 and 4.5 mm for juveniles; 2.0, 3.0 and 4.5 mm for sub-adults and 3.0, 4.5 and 7.0 mm for adults, noting that the commercial pellet size of 4.5 mm was included in all size categories for testing as the control. Subsequently the feeding behaviour was observed and once was completed for each redclaw the animal was removed from the aquarium to determine feed wastage.

Our results highlighted that the bigger pellet size tested had the advantage of being detected quickly by all different size groups of redclaw examined, but not ingested efficiently as the diameter of the pellet did not match with the mouths of all sizes of redclaw observed. This indicates that the effort of shredding a larger pellet size may be energetically costly and results in significantly long time spent feeding and increased feed wastage. The pellet size of 4.5 mm, which is the only available size of commercial pellets, was observed to be unsuitable even for adult redclaw of weight up to 50 g. It was recommended that the most suitable pellet size for the juveniles, sub-adults and adults redclaw was 1.0, 2.0 and 3.0 mm, respectively.

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A comparison of preference patterns in South African Windsnyer grower pigs fed different inclusion levels of spineless cactus based diets

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Twenty one South African Windsnyer (SAW) grower pigs weighing 28 ± 2 kg were selected from the ARC-Irene pig breeding unit and used in double choice feed experiments. The pigs were housed individually in pens containing 2 identical feeders placed side by side. The pigs were blocked by weight when assigned to the choice treatments. Each treatment had seven replicates. Diets were formulated to provide similar energy (13.5 MJ/kg DE), protein (16 %) and lysine (1.16 %). In each pen, one feeder contained the 0 % spineless cactus based diet that acted as the reference diet and the other feeder contained a test diet with 0, 5 or 10 % spineless cactus resulting in six preference comparisons. The study was carried out in 2 periods of 0-3 and 4-7 days. There was no difference in initial weight, final weight, ADFI and ADG between the treatments. However during the first period, pigs' preferences for the 5 % spineless cactus (38 %) and control (35 %) diets were higher than for the 10 % spineless cactus (20 %) diet. During the second period, diet preference between the 5 % diet (20 %) and 10 % diet (29 %) were not different. Preference for the control diet was higher (42 %). It was concluded that different inclusion levels of spineless cactus influenced the preference of diets by South African Windsnyer growing pigs. The results of the study have implications for diet formulations for indigenous pigs and more studies to determine why there is preference for the spineless cactus diets need to be carried out.

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Breed effects and (co)variance ratios for early live weight and tick count in sheep

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Ticks can be detrimental to sheep productivity and general welfare in a free-range system. They can transmit disease, cause skin damage, lameness, paralysis and damage to the udder in ewes. Until recently, tick control mostly involved chemicals. Resistance of pathogens to chemicals, as well as environmental concerns, cast doubt on the long-term sustainability of chemical control. Alternative ways of controlling ticks on sheep have to be sought for inclusion in an integrated control programme. Birth weight, weaning weight and overall tick count of Namaqua Afrikaner (NA), Dorper (D) and South African Mutton Merino (SAMM) lambs at the Nortier Research Farm were analysed. Crosses between breeds were also studied, namely: NA rams mated to D ewes, the reciprocal cross between the D and SAMM breeds and backcrosses of ewes of the latter two genotypes on either D or SAMM sires. Animal numbers ranged from 1016 to 1038, depending on trait. These breeds were compared under marginal, extensive conditions to study the adaptability and robustness of each breed. NA lambs had lowest weights both at birth and weaning compared to the other breeds and crosses. NA and NA x D lambs had the lowest tick count of all breed combinations. NA x D lambs were comparable to Dorpers in weaning weight. Crosses involving the Dorper and SAMM breeds were generally heavier than the other breeds, with a higher tick count. Genetic parameters involving weights were consistent with the literature. The heritability (h^2), dam permanent environmental (c^2) and phenotypic variance (σ^2_p) for tick count were respectively 0.13 ± 0.06, 0.07 ± 0.03 and 1.06 in a three-trait analysis with birth and weaning weights. When the effect of breed was excluded from the analysis to study across-breed genetic variation, values of respectively 0.33 ± 0.07, 0.06 ± 0.04 and 1.19 were derived for the h^2, c^2 and σ^2_p of tick count. There were positive genetic and phenotypic correlations between weights and tick count. This study suggests that resistance to tick infestation is influenced by genetics in sheep. Selecting breeds which are more resistant to ticks is more likely to improve tick resistance more in the short term than selecting individuals within breeds.

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Alternative remedies used by resource-limited farmers to manage ophthalmia in cattle, from Ntabazinduna communal area, Umguza district, Matabeleland North Province, Zimbabwe

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Many people around the world depend on cattle for their livelihood; as a result farmers have an obligation to properly manage their cattle for maximum production. However, due to limited resources, some farmers cannot afford to use conventional veterinary drugs to manage some cattle diseases. Hence, resource-limited farmers resort to the use of low or no-cost alternative remedies which are locally available. One disease which has become problematic is ophthalmia, which poses an economic threat to the beef industry. The objective of this study was to determine and document the alternative remedies used by communal farmers in Ntabazinduna communal area to manage ophthalmia in beef cattle. The survey was done at ward 5 in Ntabazinduna communal area found in Umguza district of Matabeleland North Province of Zimbabwe. A questionnaire was administered to 100 cattle-keeping households in January 2015, to determine alternative remedies used in treating ophthalmia. Ophthalmia was reported to be most prevalent during the rainy season and 100% of the respondents considered the disease as a common problem in cattle. About 89% of the respondents used alternative remedies, 6% used conventional drugs, while 5% used both to treat opthalmia. The following alternative remedies were used; S*olanum incanum* (36%), millipede shell (31%), hot wire (17%) while those using sugar granules and Terramcyin eye powder were both at 8%.

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Growth and reproductive traits of two species of snails (*Archachatina marginata* and *Achatina Achatina*) under different stocking rates

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The growth and reproductive traits of the African giant land snails fed *ad libitum* and reared under different stocking densities were investigated in a twelve week experiment. A total of eighty four breeding snails, made up of forty two *Archachatina marginata* and forty two *Achatina Achatina,* were used for the study. Four different groups of stocking densities of 4, 6, 8 and 10 snails per cage (20.8cm x 35cm x 21cm) were used, with each group replicated three times. The snails with stocking density of 4 per cage recorded the best ($P<0.05$) growth and reproductive performance in relation to weight gain, efficiency of feed conversion to meat, number of eggs laid, percentage hatchability, fertility, embryo mortality and average weight of hatchlings. It was concluded that 20.8cm x 35cm x 21cm cage could house up to 4 breeding snails without any adverse effect on growth, reproduction and state of health of the breeding snails.

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Preliminary results of the feedlot performance of South African Boer goats

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Goats are more commonly reared in extensive production systems in South Africa and are directly marketed from the farm at a weight of less than 30 kg. This study was performed to determine the effect of dietary energy content on the production of South African Boer goats in a feedlot system to be able to increase marketing weight. In this trial, 53 Boer goats were randomly divided into three dietary treatments that varied in energy content, giving a low, 11.3 MJ ME/kg feed (18 goats), medium, 12.0 MJ ME/kg feed (16 goats) and high energy diets, 12.7 MJ ME/kg feed (19 goats). The diets were equal in terms of crude protein (17.0%), calcium (0.86%) and phosphorus (0.36%). The goats were reared in individual pens for a period of 8 weeks, where the trial diets were fed *ad libitum* and growth and feed intake were monitored. Initial body weight was 22.4±0.39 kg and after 8 weeks the goats on the medium diet had gained the most weight, weighing 34.6±0.94 kg followed by the low energy (33.4±0.86 kg) and the high-energy diets (31.4±0.84 kg). The difference between the three treatments were significant at $P = 0.01$. The average daily gains differed ($P = 0.036$) with goats on the medium energy diet attaining the highest ADG of 250.9±13.0 g/day, while goats on the high-energy diet had the lowest ADG of 183.1±16.9 g/day. This suggests that the energy content of the medium energy diet is probably close to the energy requirements of the goats, while the low diet does not contain sufficient energy to maintain higher growth rates. Goats on the high diet exhibited slower growth, as goats are natural browsers and have not been selected to efficiently utilise diets with a very high energy and starch content. Feed intake differed between the three treatments ($P < 0.001$) with the goats on the low energy diet having the highest DMI of 1274.2±44.34 g/day which decreased with an increase in dietary energy content (973.7±50.88 g/day for the high energy diet). The feed intake for the medium energy group was intermediate at 1135.8±17.63 g/day. The feed conversion ratio (FCR) did not differ significantly for the 3 treatments and was calculated to be 6.61 kg feed/kg weight gain. Goats fed the medium energy diet displayed the best growth at a moderate feed intake, even though the FCR between the diets did not differ significantly.

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Effect of palm kernel expeller supplementation on rumen fermentation of Jersey cows grazing kikuyu-based pasture

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High fibre by-products have the potential to partially replace maize in the concentrate for dairy cows. Palm kernel expeller (PKE) is a low-cost, high fibre by-product from the palm-oil industry. The energy (range: 10.5 – 12.0 MJ/kg DM) and crude protein content (range: 14.2 to 19.6% DM) of PKE is comparable to that of corn gluten or rice bran. A positive milk fat response has been reported from cows grazing kikuyu pasture when PKE was included up to 30% in a dairy concentrate without adverse effects on fat corrected milk yield and other milk components. The question is to what extent improved pasture degradation will compensate for the lower ME intake on concentrates containing more PKE and less maize. The objective of this study was to determine the effect of partially replacing maize with PKE in concentrate for dairy cows on rumen fermentation of Jersey cows grazing kikuyu-based pasture during summer. The study was conducted in summer at the Outeniqua Research Farm situated near George in the Western Cape, South Africa. Eight multiparous rumen-cannulated Jersey cows were randomly allocated to four treatments (PKE0, PKE10, PKE20 and PKE30) in a 4x4 Latin square design. The PKE inclusion in the PKE0, PKE10, PKE20 and PKE30 treatment concentrates was 0, 10, 20 and 30%, respectively, replacing part of the maize and soybean oilcake in the concentrate. Concentrates were balanced to be iso-nitrogenous. All cows grazed kikuyu pasture as one group and concentrate was fed at 6 kg as is/cow/d in the dairy parlour during milking (3 kg/milking). Pasture was allocated at 10 kg DM/cow/d above a height of 30 mm. Cows were offered PKE ad libitum in feed troughs on the pasture for 7 d prior to the study. This was followed by 14 d adaptation of feeding the allocated treatment concentrates and 8 d measurement period. Ruminal pH, ammonia nitrogen and VFA concentrations, and in situ pasture DM degradability (DMd), NDF degradability (NDFd) as well as rate of NDFd (NDF kd) were determined. Mean ruminal pH of cows did not differ between treatments and was 6.44, 6.53, 6.52 and 6.50 for cows on the PKE0, 10, 20 and 30 treatments, respectively. However, the daily rumen pH of cows on the PKE0 treatment was below pH of 6.0 for a longer period at 2.13^{a} *vs*. 0.13^{b}, 0.06^{b} and 0.31^{b} h/day for cows on the PKE10, 20 and 30 treatments, respectively. In terms of VFA fractions (% of total VFA), only iso-butyric and valeric acid differed between treatments, 3.55^{b}, 3.59^{ab}, 3.57^{ab} and 3.70^{a}, and 1.13^{ab}, 1.12^{ab}, 1.08^{b} and 1.17^{a}, respectively, for cows on the PKE0, 10, 20 and 30 treatments, respectively. Dry matter degradability, NDFd and NDF kd were the lowest for cows on the PKE30 treatment at both the 18 and 30 h incubation intervals. It is concluded that PKE sustained a favourable ruminal pH and VFA profile up to an inclusion level of 30%. However, the 30% inclusion level resulted in reduced pasture degradability. This could be attributed to the increased fat level in the diet, induced by PKE.

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Direct anthelmintic effects of feeding *Lespedeza cuneata* hay (leaf material) on gastrointestinal parasites in sheep: *In vivo* studies

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The existence of livestock is closely bound to that of parasites. Increased concentration of livestock and grazing on monoculture forages has enhanced parasite populations to such a level that livestock production, to a large extent, has become dependent on anthelmintic chemotherapy. Increased public awareness of chemical drug residues in agricultural products, together with the increasing development of resistant strains of parasites to chemical anthelmintics, has required the search for sustainable alternative methods to complement or replace anthelmintics. Many calls are made for a more holistic management solution. Recent studies on the use of bioactive forages, especially *Lespedeza cuneata*, highlighted the potential of these forages to contribute towards holistic parasite control. The aim of the study was to determine the effect of *Lespedeza cuneata* leaf hay on an established gastrointestinal parasite infection in Merino sheep. Different dried herbage diets were offered to confined Merino ewes, which had confirmed established gastrointestinal parasite infections. The leaf portion of *L. cuneata* hay and *Medicago sativa* hay was offered *ad libitum* to these sheep. *L. cuneata* is a tannin rich legume, while *M. sativa*, known for its very low condensed tannin content and zero anthelmintic properties, was used as control. Faecal egg count (FEC), Famacha©, live weight changes and rectal temperatures were monitored. The FEC of the sheep showed a significant reduction on Day 35, ($P<0.05$), with FEC levels constantly lower in the *Lespedeza* group, compared to the control. Rectal temperatures tended to correlate with the FEC, but need further investigation. Famacha© scores were not significant different ($P>0.05$). The results from this study, despite some values that were not significant, indicated that dried *L. cuneata* leaves can reduce the gastro-intestinal parasite infection in sheep. *L. cuneata* has an advantage over many other plants with anthelmintic properties, since it is already established as a planted pasture with commercially available seed. Together with other agronomic advantages, the inclusion of *L. cuneata* as bioactive forage can play an invaluable role in a holistic gastro-intestinal nematode control programme.

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The effect of lucerne (*Medicago sativa)* hay quality and rate of fermentation on rumen parameters of Jersey cows

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The influence of lucerne hay quality and the rate of fermentation on rumen parameters of Jersey cows were investigated. Three different grades of lucerne hay (Prime, Grade 1, Grade 2; selected according to the New Lucerne Quality Index) were included in a TMR and fed to lactating cows. The three dietary treatments consisted of the same basal diet (53% lucerne hay, 7% wheat straw and 40% concentrate), differing only with respect to the lucerne hay quality. Three multiparous lactating Jersey cows (389 ± 40 kg) fitted with rumen cannulas were used in a crossover study with three periods and three treatments. After a dietary adaptation period of seven days, each animal received the respective treatment diet for the remaining period of 14 days (total of 21 days). Ruminal pH, VFA and ammonia concentrations, as well as *in sacco* DM and NDF disappearance were measured accordingly. The data was analysed according to a 3x3 crossover design (three treatments by three periods) (n=1 animal per treatment). Treatment, period and sequence were treated as a fixed effect and cow (sequence) was the random effect. Lucerne hay quality had no effect (*P* >0.05) on the ruminal pH and VFA concentration of Jersey cows. The DM disappearance after a 12 hour incubation period in the rumen decreased (P <0.05) when Grade 2 lucerne hay was included in the total mixed ration (TMR), compared to the Prime treatment alone. NDF disappearance after 12 hours of incubation followed the same trend (P =0.07). In addition, the ruminal ammonia concentration measured at 20:00 tended to be higher (P =0.059) following the Prime hay's inclusion. Results of the present study seem to indicate that lucerne hay quality does not affect the rumen fermentation characteristics of Jersey cows to any meaningful extent when included at 53%.

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Effect of varying levels of protein and amino acid concentrations on the production parameters of growing ostriches

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An estimated 70 to 80% of the input costs of an ostrich farming enterprise are solely attributed to the feeding of the birds. Protein, along with energy, is a macronutrient and both comprise the bulk of the digestible matter contained in animal diets. The aim of this study was to investigate the effects of five different levels of protein with corresponding amino acid profiles in the diets of slaughter ostriches (*Struthio camelus* var*. domesticus)* on the feed intake, average daily gain (ADG) and feed conversion ratio (FCR). The trial, with five treatments and three replications per treatment, was structured into 15 camps containing 20 young chicks each. The middle of the five diets was formulated according to the standard diet commonly used in industry, and served the purpose of the control for this study. The inclusion levels of diets one through five were thus 11.8%, 12.2%, 12.6%, 13.0% and 13.4% crude protein, with corresponding amino acid profiles, respectively. The ostriches had access to fresh clean water and fed their respective diets *ad libitum.* Weekly feed intake was measured, as well as weekly weighing of the birds was done until they were slaughtered at 13.5 months of age. Any differences were significant at a level of P =0.05. Results for feed intake had differences (P =0.002) between the treatments and a linear function was applied to best fit the data. An incremental increase in diet would result in a subsequent increase in intake by 63 g/bird/day. Diets 3, 4 and 5 had higher intakes than diets 1 and 2. Diet 5 had the highest feed intake of 1684 g/bird/day, whilst Diet 1 the lowest of 1432 g/bird/day. Differences (P =0.0001) were found between treatments for the ADG, with the trend across the five treatments best fitted by a quadratic function. Diets 3, 4 and 5 did not differ between themselves, with diet 4 (347 g/bird/day) marginally higher than the other two. Diets 1 and 2 had significantly lower ADG's, 259 g/bird/day and 299 g/bird/day respectively, than the other three diets. In terms of FCR, a quadratic function was fitted to the trends, with diet 1 differing (P =0.0002) from the rest of the treatments. Diet 1 had a FCR of 4.4 while diet 4 had a FCR of 3.8, the best, though not significantly different from diets 2, 3 and 5. Overall, although diets 4 and 5 consistently performed the best across the production parameters; there were no significant differences for diets 3, 4 and 5 in terms of these parameters. Therefore, conclusively it can be stated that these diets consistently performed above diets 1 and 2. Increased protein concentrations in the diet above the norms used in industry did not result in significant increases in performance levels of slaughter ostriches.

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Sensory evaluation of beef, pork and offal by rural consumers

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The aim of the study was to evaluate the rural consumer sensory evaluation of beef, pork and the offal meat. The study was conducted in three villages (Ncerha, Mxalanga and Tyhusha) in the Eastern Cape, South Africa. The samples of beef, pork and offal bought from a local butchery were used for the sensory evaluation. Consumer panels consisting of 50 people from each village were used for sensory evaluation and were of different age (≤ 30, 31- 35, 36-40 and ≥ 40) and gender (male and female). The consumer sustained impression of juiciness score for pork was highest ($P < 0.05$) in Tyhusha village (3.53 ± 0.15). Muscle fibre and overall tenderness scores of beef meat were indicated as tender ($P < 0.05$) by Ncerha village respondents (2.15 ± 0.13). Ncerha (3.10 ± 0.20) and Mxalanga (3.09 ± 0.19) consumers found the offal meat to be fairly tough ($P > 0.05$) on the first bite. The offal meat first impression was regarded as slightly tough ($P < 0.05$) by female (4.04 ± 0.13) respondents. The overall flavour intensity of beef was rated significantly highest ($P < 0.05$) by ages 36-40. The muscle fibre and overall tenderness of the offal meat was regarded as tender ($P < 0.05$) compared with the other meats.

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Health challenges of Indigenous chickens of two rural communities in Mnquma municipality of the Eastern Cape

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Most households in the rural areas keep indigenous chickens for various socio-economic purposes. The chickens and eggs are consumed to provide protein, used in traditional rituals and sold to generate household income. However, the socio-economic contribution of the indigenous chickens tends to be curtailed by various health challenges that result in reduces production and mortality. A series of studied were conducted to establish health challenges and dynamics that affect their prevalence. Indigenous chickens in two locations were tested and examined for prevalence of Newcastle disease (NCD), internal and external parasite and salmonella during all seasons of the year in two locations (Gcina – coastal and Ngcingcinikhwe – inland).

Between 90 and 100% of birds in Gcina tested positive for NCD in winter, summer and autumn whereas in Ngcingcinikhwe between 70 and 90% of chickens tested positive around the same period. In both locations the least proportion of NCD positive samples (60% in Gcina and 50% in Ngcingcinikhwe) was observed in spring. Lice species (*Goniodes dissimilis*, *Goniodes gigas* and *Menopon gallinae*) were more prevalent in the coastal location and the highest prevalence was that of *M. galinae* (90%) in autumn in Gcina. Higher prevalence of fleas (*Echidnophaga gallenacea*) was observed in the inland location (Ngcingcinikhwe) compared to the coastal. Two tick species (*Amblyoma hebraeum* and *Argus spp*) were observed. *A. hebraeum* was most prevalent in the coastal location in spring and autumn at 70%, whereas the *Argus spp* was most prevalent inland in winter (40%). Three worm species (*Railetina spp., Ascaridia galli and Heterakis gallinarum*) were observed. There was a generally higher prevalence of all worm species in the inland area. The three worm species exhibited highest prevalence (80%) in Ngcingcinikhwe in autumn whereas highest prevalence of *Railetina spp.* (70%) was observed in winter and autumn in Gcina. In conclusion, the results of these studies show that there is a seasonal and geographic location effect on the prevalence of various health challenges of indigenous chickens and, therefore, these should be taken into consideration when health management strategies are developed.

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Seasonal prevalence of gastrointestinal nematodes in low-input low output farming systems in Zimbabwe

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Gastro-intestinal nematodes (GIN) are a major constraint to production. Methods of control mainly are centred on the use of drugs which has led to development of anthelmintics (AH) resistance. The study was conducted to assess production, management, the level of knowledge and control of gastrointestinal nematodes (GIN) and also assess seasonal prevalence of GINs. Surveys were conducted in Chipinge, Shurugwi, Binga, Tsholotsho and Matopo districts, representing the five agro-ecological regions in Zimbabwe. Biological samples in form of blood and faeces were also collected in interviewed households in the dry and wet seasons. Results indicated that goats were ranked the most livestock species, with high flock sizes in Natural regions (NR) 4 and 5. Partitioning of roles was such that the adult males were involved in decision-making while females and children were involved in day-to-day management of animals. Farmers showed low levels of input use in management in terms of feeding, health control and breeds reared, with natural pasture (98.4%) and indigenous breeds (73.2%) being kept. GINs ranked highest as the most common disease, with majority of farmers (57%) not controlling or treating animals and 63% of farmers not having knowledge on the spread of GINs. Benzimidazoles (56.8%), Salicylanilides (27.3%) were the dominating drugs used with Imidothiazoles and Macrocyclic lactones being the least. AH use differed by NR ($P< 0.05$). Strongyles and Coccidia were the most common parasites (65 and 53%). Species identified included Haemonchus, Trichostrongylus, Oesophagostomum and Strongyloides. Overall prevalence ranged from 96-100%, with cases of single species (5-52%) and multiple species (48-98%) infection across NR. Flock, season and natural regions had significant effects on the distribution of parasites ($P< 0.05$). There is need for alternative methods of control, with a more focus on shifting from eradication to manipulation of host-parasite equilibrium.

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