P4

Use of non-conventional feed resources for improving the sustainability of the dual-purpose system

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Keywords
Agro-industrial byproducts; Cows; Forage conservation; Milk production.

The production of milk with cows in dual-purpose systems is an important activity that supports food security and the socioeconomic growth of the field. In these systems, the primary source of food for cows is forages, but their availability is decreasing due to climate change, which has negative impacts on milk production. In this context, the use of non-conventional foods of plant origin without industrial transformation (VO) and agro-industrial by-products (AIBP) becomes a strategic choice of feed for livestock. The objective of this study was to evaluate the effect of using non-conventional foods of plant origin without industrial transformation (VO) and agro-industrial by-products (AIBP) on milk production (MP) in cows of dual-purpose systems. Material & methods: The study was conducted for 177 days, in two commercial production units (PU) representatives of the system. In each PU, 28 cows were used during the mid and late lactation of racial crosses: Gyr, Holstein and Cebu, in grazing of *Botriochloa pertusa* and *Cynodon nlenfuensis*. Two groups of cows (n = 14 cows /per group) were fed at 13 g DM/kg live weight with diets based on the mixture of VO: Silages of corn (Z. *mays*), sorghum (S. *bicolor*), totumo (C.*cujete*), elephant grass (P. *purpureum*) sugar cane (S. *officinarum*) and AIBP: Rice bran (O. *sativa*), Cottonseed (*G. hirsutum*), Palm kernel cake (E. *Guineesnis*), and Palm Oil Mill Effluent (POME). The individual milk production (MP) of each cow was recorded daily. Results & discussion: Individual milk production (PM) was higher at 5.35 ± 0.87 kg in AIBP cows ($P < 0.001$), with increases in MP of 55.6% concerning VO treatment. The MP in animals of the AIBP diet was like milk productions of 6.7 kg in crossed cows of PD in star grazing (*Cynodon nlenfuensis*) and supplemented with 2.0 kg of daily concentrate and 6.9 kg of grazing cows in a PD system supplemented with silage and by-products, cottonseed, and rice bran. Conclusion: The use of agro-industrial by-products (AIBP) during the mid and late lactation allowed a significant increase in daily milk production to supplementation with unconventional foods of plant origin without industrial transformation (VO), due to AIBP foods being more concentrated in nutrients, however, both sources present a potential use, especially in critical times of low forage availability in these systems.

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P5

Supplementation of sheep fed on a poor-quality grass with *Calliandra* sp. improves health and productivity, and reduces enteric methane emissions

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Keywords
Haemonchus; Calliandra; Sheep; Methane; Climate Change.

Livestock systems in the arid and semi-arid regions of Africa face severe abiotic and biotic constraints, resulting in low productivity and high carbon footprint. Climate change (CC) is enhancing further the carbon footprint by worsening the negative impacts of nutritional and gastrointestinal nematodes (GIN) infection stress factors, prompting the need for development of CC mitigation and adaptation interventions and policy making. Previous studies at our institute (unpublished) showed that infection by GIN *Haemonchus contortus* have contrasting infection responses from indigenous (Red Maasai) and introduced (Dorper) breeds, with Red Maasai showing resistance and Dorper being susceptible and having larger enteric methane emissions than their counterparts Red Maasai. Here, we report results from a controlled indoors experiment carried out to evaluate the effects of nutritional status x GIN parasite (*Haemonchus contortus*) infection on animal health, liveweight gain and enteric methane emissions from Dorper lambs (28 kg liveweight). Sheep were artificially infected with H. contortus and fed either on a Control diet or supplemented with *Calliandra sp.* (a leguminous shrub) over a 56-day period, when daily feed intakes were measured daily, whereas response to GIN (faecal egg counts (FEC) and blood packed cell volumes) were measured on a weekly basis. Enteric methane emissions were measured using three respiration chambers over a 3-day period at the end of the trial, with each animal rotating daily throughout the three chambers. A poor quality Rhodes grass hay (7.2% crude protein and 8.0 MJ metabolisable energy/kg dry matter) was used as the basal diet (Control) to mimic the feed quality under free ranging. The supplemented diet was composed of 60% basal diet and 40% *Calliandra sp* leaves containing 5.6% crude protein and 9.2% condensed tannins (CT). The level of supplement replaced the proportion of the voluntary feed intake of the basal diet (dry matter basis). It was found that lambs infected with *H.*

contortus and supplemented with Calliandra had significantly ($P < 0.05$) higher feed dry matter intakes (DMI, 753 vs 644 g/d) and live-weight gain (6 vs -27 g/d), but lower faecal parasite egg counts (1 690 vs 8 675 eggs/g) and daily methane emission (14 vs 16 g/d) and yield (18.7 vs 26.5 g/kg DMI) than their infected but unsupplemented counterparts. Addition of polyethylene glycol to the supplemented diet did not change the differences above described, except that FEC were numerically increased (by 85%), indicating the likely anthelmintic action of CT in Calliandra. Results of this study suggest that introduction of Calliandra in the farming system may be a cost-effective means of intervention addressing CC in resource-poor farming systems. This research was supported by a grant from the International Development Research Centre (IDRC) – Canada (Project 109211 – Livestock Keeping in a Changing Climate).

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P6
In vitro degradability, gas and methane production of brewery residues and its potential in small ruminants[StQuote] diets

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Keywords
Industrial by-products; Brewery residues; Sustainability; Greenhouse gases.

Due to the fast increase in the world population, there is a growing demand for practices that aim to mitigate the environmental impact of animal production, such as reducing greenhouse gases emissions and using feed ingredients which do not compete with human food, while not changing the quality of animal diets. This has raised the use of industrial by-products on animal feed, especially for ruminants as complement/replacement of the conventional products for balancing the energy and protein requirement of the animals; as for they have the capacity to transform non-human edible foods into products such as meat and milk. Thus, this study aimed to assess the potential of brewery residues (yeast (RCY), trub (RCT) and dry brewer's grain (RCD)), as feed ingredients for ruminants, compared to soybean meal (SB) and milled corn (MC, which are commonly used in animal diets. The samples were incubated in ruminal liquid for 24 hours (39 °C) for *in vitro* total gas production (TGP) evaluation, organic matter degradability assessment (OMD) and methane production (CH_4). Variance analysis (ANOVA) and Tukey test at 5% significance were performed. TGP for the substrates RCY, RCT, MC, SB, and RCD was 163, 140, 124, 75, and 47 mL per gram of degraded organic matter (mL/g dOM) ($P < .0001$), respectively. OMD was highest for the RCY, with 992 g/Kg ($P < .0001$), and lowest for RCD, with 520 g/Kg ($P < .0001$), whereas RCT, SB, and MC presented similar OMD values (782, 727, and 712 g/Kg, respectively). The high OMD value for RCY could explain the high CH_4 production for this substrate, (12.7 mL/g dOM) ($P < .0001$) when compared to the other ingridients. RCD had the lowest CH4 production between the substrates, with 1.8 mL/g dOM ($P < .0001$). RCT, MC, and SB had a CH_4 production of 7.4, 6.2 and 5.1 mL/g dOM ($P < .0001$), respectively. The results suggest that residues coming from the brewing industry are ingredients which have potential to be included partially or entirely in ruminants diets, as alternatives to reduce environmental impairment in the sector. However, the high CH_4 production associated with RCY residue could pose a challenge, as it may increase the environmental impact if not correctly used.

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P7 (not presented)
Effect of pomegranate peel on the rumen milieu of dairy cows

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Keywords
Sustainable ruminant nutrition; Hydrolysable tannins; Rumen pH; Ammonia; Volatile fatty acids.

Pomegranate peel (PP) is a food industry by-product rich in hydrolysable tannins (HT) and has shown to reduce urinary nitrogen excretion, thereby reducing the environmental load of ruminant production systems. However, knowledge about intraruminal effects of HT is limited. To investigate short-term effects (1–24 h) of dietary PP on the rumen milieu, four late-lactating, rumen-cannulated Original Brown Swiss dairy cows fed a basal mixed ration (maize and grass silage, alfalfa, concentrate, straw, hay) were subjected to intraruminal supplementation of dried PP (203 g HT and 15 g condensed tannins per kg dry matter). For each cow, PP was not applied (control) on day 1, while on days 3 and 5, 250 and 500 g PP, respectively, were placed directly into the rumen 15 min after morning feeding. Each treatment day, rumen fluid samples were collected directly before (0 h) and 1, 3, 6, 12, and 24 h after intraruminal treatment application. Rumen fluid pH and volatile fatty acids (VFA) and ammonia concentrations were measured. Bacteria and protozoa were counted. A two-way repeated measures