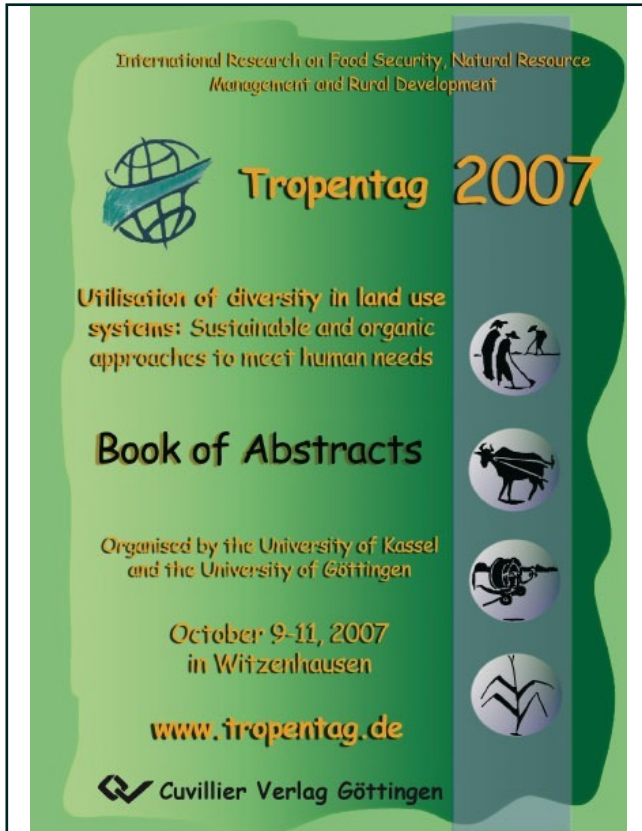




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Effect of Supplementing a Tanniniferous Shrub Legume on Milk Yield and Composition of Dual Purpose Cattle Grazing *Paspalum notatum*

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Low availability and poor quality of forages for livestock are major constraints faced by tropical smallholders. This is particularly relevant in regions with low-fertility soils and extended dry seasons. Shrub legumes have been suggested as promising feeds in the dry season, and CIAT has selected some accessions of species with good agronomic performance on low-fertility soils and under drought. Many of these species are characterised by high contents of condensed tannins (CT). Particularly one accession of *Calliandra calothyrsus* showed auspicious potential regarding ruminal fermentation dynamics in vitro and was therefore tested for its suitability as supplement to grazing cattle. In a duplicated 4 × 4 Latin Square design, 8 dual purpose cows (Holstein × Zebu) kept on a *Paspalum notatum* pasture, were supplemented with *Vigna unguiculata*, a more difficult to grow high quality herbaceous legume, and *C. calothyrsus* (CIAT 22310) alone or in mixtures at proportions 1:2 and 2:1. Allowance for supplementation was set to 1 kg of dry matter per 100 kg of body weight. Cows were allowed to adapt for 7 days, followed by 7 days of measurement. Milk yield and composition were measured daily. Consumption of the legumes was 87 % of the amount offered with *Vigna* and only 29 % with *Calliandra*. The mixture with low *Calliandra* proportion did not differ in consumption from the *Vigna*-only supplement, while that with the high *Calliandra* proportion was intermediate with 59 % of the amount offered ($P < 0.05$). Milk yield linearly decreased with increasing proportion of *Calliandra* in the supplement. Accordingly, milk yield was highest ($P < 0.001$) with *Vigna*-only (5.3 kg d⁻¹), and declined to 4.7, 4.4 and 3.6 kg d⁻¹ with increasing *Calliandra* level. There were no treatment effects on contents of fat, solids-non-fat and total solids. Milk urea N declined ($P < 0.05$) with increasing *Calliandra* proportion from 6.3 to 3.7 mg dl⁻¹ as expected from the protein-binding properties of the *Calliandra* CT. In conclusion, *C. calothyrsus* had a low suitability as sole protein supplement, but it may be added at low proportions if availability of *Vigna* is limited. When supplemented, a major limitation seems to be the low palatability apart from the high CT content.

Keywords: Calliandra, legumes, milk production, supplementation, tannins

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Efficiency of Microbial Protein Synthesis in Steers Fed Freshly Harvested Tropical Grass

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Rumen microbial crude protein (MCP) supply is a vital element in the rumen models to predict respond of ruminants to a certain feeding regime. Data from tropical pastures always below predicted results from the existing rumen models due to the fact that database used in the models are derived mainly from temperate pastures. Thus, quantification of the rumen MCP supply from tropical pastures is expected to improve predictive rate of the models under tropical feeding condition. Four Brahman cross-bred steers (457 ± 20.1 kg) were used in a metabolism study to quantify efficiency of microbial protein synthesis (EMPS) in cattle consuming a freshly harvested tropical grass. Pangola grass (*Digitaria erianthe* cv. Steudal) was harvested every morning and fed to the animals soon after. Data were collected over 1 week after the steers were previously adapted to this diet for 2 weeks. Parameters regarded were EMPS, intake, fractional passage rates, and rumen ammonia concentration. Passage rates were estimated using dual marker (chromium-EDTA and ytterbium) technique. The EMPS was estimated using purine derivative excretion in urine (total urine collection method). The EMPS value obtained was compared to the values in the feeding standards. Mean crude protein (CP) and water soluble carbohydrates (WSC) were 6.3 and 7.4 of dry matter (DM) respectively. Mean DM intake was 1.6 % W. Average rumen ammonia ($\text{NH}_3\text{-N}$) concentration was $69 \text{ mg NH}_3\text{-N l}^{-1}$ whilst rumen passage rates were 7.48 and 6.92% h^{-1} for fluid and solids respectively. Mean EMPS in the steers was only 72 g microbial crude protein (mcp) kg^{-1} digestible organic matter (DOM). It might be concluded that EMPS in steers consuming freshly harvested pangola grass, with the above nutritional characteristics, was below the minimum level for forage diets adopted in the current feeding standards.

Keywords: Efficiency, rumen microbial proteins, steers, tropical grass

Apparent Digestibility Coefficient of Housefly Maggot Meal (magmeal) for Nile Tilapia (*Oreochromis niloticus* L.) and Carp (*Cyprinus carpio*)

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Several feed ingredients including animal and plant protein sources, have been investigated in order to find substitutes for fish meal in fish diets. Though these feed ingredients may be cheaper than fishmeal, diverse responses on growth parameters have been reported. The reasons for the variations are summarised to include the protein composition and amino acid profile, palatability/acceptability, phosphorus content and availability, anti-nutritional factors (especially in plant protein sources) and apparent digestibility of alternative feeds. Digestibility gives the relative measure of the extent to which ingested food and its nutrient components have been digested and absorbed by animal. From its chemical composition a feed ingredient may appear to be an excellent source of nutrients but unless it can be digested and absorbed in the target species the actual value can be limited. Interests to study the use of housefly maggot meal (magmeal) as substitute for fishmeal in fish diets have increased in recent. However, no report has been published so far on the digestibility of this alternative protein source. This study was therefore designed to determine the apparent digestibility coefficient of magmeal for Nile tilapia (*Oreochromis niloticus*) and carp (*Cyprinus carpio*). In order to evaluate the digestibility of magmeal formulated reference diet (containing fishmeal as primary protein source) and a test diet (containing 70 % reference diet + 30 % maggot meal) were fed triplicate groups of tilapia and carp with initial average body weights of 108.3 ± 32 g and 110.3 ± 23 g respectively. Faeces were collected over a period of 15 days by siphoning. The apparent digestibility coefficients (ADCs) of tilapia fed with test diet was lowest (80.11 %) and significantly different from carp (87.08 ± 0.8), however no difference was observed with ADC of crude fat. Magmeal digestibility of dry matter (47.65 %), crude protein (57.7 %), crude fat (86.1 %) and energy (58.1 %) for tilapia are significantly lower than for carp (dry matter: 63.84 %, crude protein: 84.9 %, crude fat: 96.8 %, energy: 74.9 %). Spawning activities of experimental tilapia and soft faeces consistency of carp may have affected the results.

Keywords: Carp, fibre, housefly maggot meal, nutrition, Tilapia

Potassium Chloride Supplementation in Drinking Water of Laying Hens as a Means to Maintain High Productivity under High Ambient Temperature

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Voluntary water intake in laying hens is considered an important factor of adaptation to hot temperatures. This experiment was carried out to study the response of potassium chloride (KCL) in the drinking water on water intake, feed intake and productivity traits under heat challenge. A total of 48 hens (Hisex breed) were kept in climatic chambers and randomly allocated to three experimental groups of 16 hens each. These groups were given 0; .2 and .4 % KCL in the drinking water for seven consecutive days. The room temperature was cycled from $21\pm 1^{\circ}\text{C}$ (from 23 to 8 hrs) to $34\pm 1^{\circ}\text{C}$ (from 9 to 22 hrs) for seven days. Water and feed intake, egg production and quality traits of the individual hens were recorded throughout the experimental period. Body temperature was recorded at days 1, 3, 5 and 7. Water intake was significantly higher in the hens receiving .2, .4 % vs. 0 % KCL supplementation. There was no significant difference between .2 and .4 % KCL. Feed intake in the control group was significantly higher in the KCL-supplemented groups at day seven of experimental period. There was no effect of the treatments on egg shell strength, but shell thickness was significantly higher and the number of egg shell defects was lower in the KCL-treated hens. Body temperature was not affected by the treatments. The results show that KCL supplementation through drinking water may be a means to avoid a reduction of egg production which usually occurs when the temperature in the layer house increases.

Keywords: Egg production, feed intake, heat stress, potassium chloride, water intake

Effects of Roxazyme -G on Growth Indices and Haematological Variables of Broilers Fed Maize Offal-Based Diets

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Influence of roxazyme -G on the utilisation of maize offal in place of maize was investigated using 420 broiler chicks. Seven diets were used in which the control diet (diet 1) contained 529 g kg⁻¹ and 569 g kg⁻¹ maize at starter and finisher phases, respectively. In diets 2, 3 and 4, twenty five percent of the maize components of diet 1 were replaced with maize offal while in diets 5, 6 and 7, fifty percent maize component of diet 1 was replaced with maize offal. Roxazyme-G was added to the diets at levels of 100, 200 and 300 mg kg⁻¹ in diets 2 & 5, 3 & 6 and 4 & 7, respectively. At the close of the starter (2–4 weeks of age) and finisher (5–8 weeks of age) phases 5 chicks and 5 chickens per replicate, respectively were sacrificed conventionally and their blood collected for blood analysis. Only the final weight of chicks were significantly ($p \leq 0.05$) influenced while growth indices were not in finished birds. The entire haematological indices measured were not significantly ($p \geq 0.05$) influenced by dietary treatment in both starter and finisher birds. At starter phase, the optimum level of maize offal substitution for maize could be achieved at 132.3 g kg⁻¹ + 200 mg kg⁻¹ roxazyme -G while 142.3 g kg⁻¹ maize offal + 200 mg kg⁻¹ roxazyme -G was the optimum level for finisher birds. Conclusively, the use of maize offal and roxazyme -G at these optimal levels could lead to more of maize offal being included in broiler diets in tropical countries.

Keywords: Blood indices, broilers, broiler feeding, roxazyme -G

Effect of Supplementation of Grazing Bali Cows During Pre and Postcalving Period on Intake, Digestibility, and Rumen Environment

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Ten pregnant Bali cows were used to study effect of supplementation on intake, digestibility, and rumen environment. Approximately 90 d before the expected date of calving, cows were randomly allocated to one of two feeding groups. The 5 cows of Group A were grazed on native pasture, while the remaining cows of Group B grazed with the others but received 1.50 kg concentrate (coconut cake + fish meal + rice bran) with gross energy of native grass = 13.61 kg MJ⁻¹ and concentrate = 16.68 kg MJ⁻¹. Voluntary intake of basal diet and supplemented feeds by both groups was measured over successive 14-day periods including 7 days of preliminary treatment at 1 month after calving, while apparent digestibility was determined at 4–6 weeks after calving, and ruminal fluid was collected on the final day of the trial. Data was analysed using student-t test procedure. Forage intake particularly total dry matter (DM) intake was markedly increased ($p < 0.01$) when cows grazed on natural pasture were supplemented with concentrate (7.6 vs 6.0 kg). The estimated total energy intake also increased ($p < 0.01$) with supplementation. The intake of all the nutrients i.e. total organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF) and nitrogen free extract (NFE) were significantly higher ($p < 0.01$) in the supplemented group than in the non-supplemented group. Digestibility data in the study showed that there were improvements after supplementation i.e. DM was significantly higher (66.7 vs 58.3 %); also digestibility of all nutrients except EE and NFE. Rumen pH, ammonia and VFA levels were affected by concentrate supplementation (pH: 6.4 vs. 6.7; NH₃-N: 137.4 vs. 11.0 mg l⁻¹; VFA: 115.2 vs. 86.2 nM l⁻¹). Molar proportion i.e. acetate, propionate and butyrate including acetate and propionate rati also influenced by supplementation (2.9 vs 3.9).

Keywords: Bali cows, digestibility, intake, native pasture, rumen environment, cattle

Plant Species Selection by Free-Ranging Cattle in Subandean Mountain Forests of Southern Bolivia

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In southern Bolivia, Department of Tarija, the Subandean mountain forests are used as winter grazing areas for cattle. Practicing a transhumance system, the cattle is moved to the forests at the beginning of the dry season (April-May), when the forage in the grasslands of the valleys, used for summer grazing, becomes scarce. The cattle stays in the mountain areas during the complete dry season and returns to the grasslands around the villages when the rainy season starts (October-November). In the community of Salinas, inside the Reserva Nacional de Flora y Fauna Tariquía, traditionally silvopastoral areas (Meringal (M) and Rio Tarija (T)) were chosen for evaluating the plant selection of cattle in free-ranging conditions, using direct observation. During 4 to 5-day periods per month from May to November, an adult cow was observed during daylight hours. The bites per plant species were counted every 5 minutes during a 1-minute period. From May to July, grasses and grass-like species made the highest contribution to the cattle's diet, contributing to more than 55 % of bites during May and June at both study sites. The main species consumed was the grass *Ichnanthus cf. pallens* (more than 50 % in both sites in May). In the following months, consumption of grasses and grass-like species decreased, and the contribution of herbs, shrubs and subshrubs, and trees increased in the diet. In area T, bites on shrubs and subshrubs were more frequent, especially in August (42.5 %), while in M more trees than shrubs and subshrubs were browsed, with highest values being found in September (45.2 %). Not only fresh plant parts served as food but also dry tree foliage was consumed, mainly during August to October, at both study sites, but with higher proportion of browsing at site M (September=35 %). The dry tree foliage was mainly derived from *Chrysophyllum gonocarpum* and *Celtis brasiliensis*. The results show a high diversity of plants consumed by cattle (aprox. 376 species). In general, the ten most important plant species (including dry tree foliage of non-determined tree species) made up more than 50 % of bite counts.

Keywords: Biodiversity, forest grazing, Latin America, plant species selection, silvopastoral systems

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