Pasture Quality and Animal Nutrition

SESSION CHAIR: LEANA NEL

Wednesday, 21 July 2010, 09:00-10:30

Platform & Poster Presentations

PLATFORM PRESENTATION: ASSESSING THE ANIMAL RESPONSE TO HIGH SUGAR RYEGRASSES USING SHEEP

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The progress made by the ARC Pasture Plant Breeding team at Cedara towards breeding new improved Italian ryegrass (*Lolium multiflorum*) varieties with higher total non-structural carbohydrate (TNC) and dry matter (DM) content, needed to be verified with animal trials. Forty sheep in metabolic crates were used to test the digestibility of five ryegrass varieties in June 2008. Four of these varieties had improved TNC and DM and one was an unimproved control.

The ryegrass herbage was also subject to laboratory wet chemistry for crude protein (CP), TNC, NDF (Neutral Detergent Fibre) and ADF (Acid Detergent Fibre). All four improved TNC varieties were superior in DM% and digestibility and had an improved TNC:CP ratio. While differences in CP intake were non-significant, TNC intake was significantly improved. ME (metabolizable energy) digestibility, was significantly higher than the control in two of the varieties while, the other two varieties were also higher than the control, but not statistically significant.

The variety with the highest digestibility (Performer) had the second highest TNC content and the lowest CP content. The variety with the highest TNC (AgriBoost) had the second lowest digestibility but the same TNC:CP ratio as Performer which was the highest out of all five varieties.

It would thus seem that the *L. multiflorum* breeding programme for high sugar and high DM content has been successful in its objectives and also the parameters which are not directly selected for, in all varieties except possibly AgriBoost. However, there are clearly other forage quality parameters other than TNC and DM that need to be quantified during the ryegrass breeding process to further improve animal performance.

Table 1: Digestibility, protein and TNC results of five ryegrass varieties assessed in a metabolic trial using sheep.

Variety	DM%	Digestibility%	CP%	TNC%	CP intake	TNC intake
AgriBoost	17.96^{a}	83.31^{bc}	18.25^{c}	23.41^{a}	1.18	1.51a
Agriton	14.68^{d}	82.69^{c}	21.1^{a}	16.58^{c}	1.14	0.90^{d}
Enhancer	16.05^{c}	83.72^{bc}	19.27^{b}	19.75^{b}	1.22	1.25^{bc}
Performer	17.69^{a}	85.03^{a}	17.9^{c}	22.7^{a}	1.1	1.4^{ab}
Supreme Q	16.35^{b}	84.3^{ab}	21.44^{a}	19.06^{b}	1.24	1.1^{c}
LSD 0.05	0.27	1.20	0.59	1.00	NS	0.17
CV%	1.4	1.2	2.5	4.1	10.8	11.9

NOTES:

POSTER PRESENTATION: EFFECT OF SUPPLEMENTING DIFFERENT LEVELS OF DAIRY CONCENTRATE TO JERSEY COWS GRAZING KIKUYU/RYEGRASS PASTURE

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The aim of the study was to determine the effect of feeding two levels of concentrate on milk production and milk composition of Jersey cows grazing kikuyu/ryegrass pasture over a period of 4 years. Three hundred Jersey cows were allocated to two treatments (n=150 cows per treatment). Cows were fed a maize grain based dairy concentrate at a flat rate of 4 kg or 6 $kg.cow^{-1}.day^{-1}$ over lactation. The crude protein (CP) content of the concentrate was 150 $g.CP.kg^{-1}$ (as is) from January to April and 120 $g.CP.kg^{-1}$ (as is) from May to December to ensure that protein intake did not limit milk production. Cows were milked twice per day at 06:00 and 14:30. Concentrate was fed during milking in the dairy parlour. Milk samples were taken monthly to determine milk fat and milk protein content.

Milk production, milk fat and milk protein content was higher ($P<0.05$) in cows fed 6 kg concentrate compared to the 4 kg concentrate treatment. The average milk production was 15.4 and 17.2 $kg.cow^{-1}.day^{-1}$, milk fat 5.00 and 5.04%, milk protein 3.56 and 3.62% for the 4 kg and 6 kg dairy concentrate treatment respectively. The milk response when increasing the concentrate from 4 kg to 6 kg was 0.91 kg milk per kg concentrate fed. At a milk price of R3.10 per kg and a concentrate price of R2.82 the margin over feed cost will not increase when concentrate feeding is increased from 4 kg to 6 $kg.cow^{-1}.day^{-1}$.

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POSTER PRESENTATION: EFFECTS OF A LIVE YEAST SUPPLEMENTATION ON NDF DIGESTIBILITY OF RYEGRASS (*LOLIUM* SPP.) PASTURES

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The aim of this study was to identify the effects of a live yeast supplementation on the neutral detergent fibre (NDF) digestibility of Italian ryegrass (*Lolium* spp.) pastures. Ten cannulated cows from the Outeniqua Research Farm were selected and randomly allocated to two treatment groups (5 cows per treatment) in a cross-over design.

Cows were adapted to treatments for 21 days followed by a measurement period of 2 days. Treatments were control (no yeast was supplemented) and the yeast treatment. Concentrate composition was identical for the two dairy concentrates, besides the addition of yeast which was supplemented to the yeast treatment group. The ten cows were allocated the same amount of ryegrass pasture which they grazed as one group continuously between milkings. The yeast product supplemented was supplied by Lallemand S.A.S (19 rue des Briquetiers, 31702 Blagnac cedex, France). The yeast from the strain (*Saccharomyces cerevisiae* CNCM I-1077) registered at the Pasteur Institute collection (CNCM), Paris, under the number I-1077, is a product manufactured as Levucell SC 10 ME – Titan. The yeast, containing 1×10^{10} colony forming units per gram ($cfu.g^{-1}$), was pelleted with the concentrate at 167 g per ton of feed, which allows a dosage rate of the yeast to be 1 g per cow per day. The *in Sacco* method was used to determine the NDF percentage disappearance of ryegrass pasture. Six dacron bags were inserted into each cow and 3 bags were removed after 12 and 24 hours of incubation. Bags were washed, dried for 72h at 60°C and weighed on a three decimal Sartorius L420P scale. NDF content of ryegrass and ryegrass residues were determined.

The NDF disappearance of the ryegrass was significantly (P<0.05) higher in cows fed the yeast treatment. NDF disappearance was 46.63 and 52.18% after 12 h incubation and 65.13 and 69.21% after 24 h incubation for the control and the yeast treatment respectively. Supplementation of live yeast increased fibre digestion of ryegrass.

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POSTER PRESENTATION: THE SEASONAL NUTRITIVE VALUE OF KIKUYU OVER-SOWN WITH RYEGRASS (*LOLIUM* SPP.)

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Planted pastures form the base for milk production in the Southern Cape region in South Africa, with kikuyu (*Pennisetum clandestinum*) comprising the greater part of summer and autumn pasturage. Metabolisable energy (ME) intake is the first limiting factor for milk production of dairy cows grazing kikuyu. Kikuyu has low concentrations of calcium, sodium, zinc and copper and is prone to Ca:P and K: Ca + Mg imbalances. The strategic incorporation of temperate grasses like annual Westerwolds ryegrass (*Lolium multiflorum* var. *westerwoldicum),* annual Italian ryegrass *(L. Multiflorum* var. *italicum)* and perennial ryegrass (*L. perenne)* into kikuyu pasture, can increase the quality of the pasture.

The study consisted of a system trial conducted over a period of two years on existing kikuyu under permanent sprinkler irrigation and grazed by Jersey cows in a put and take system. The Italian (cv. Jeanne) and perennial (cv. Bronsyn) ryegrass were established by grazing kikuyu down to 50 mm, mulching (1.6 meter Nobili with 24 blades) the remaining stubble and planting the ryegrass with an Aitchison Seeder (2.4 m Aitchison 3116C seedmatic with 16 rows). The Italian ryegrass and perennial ryegrass were planted at seeding densities of 25 and 20 kg/ha respectively. The Westerwolds ryegrass (cv. Jivet) was established by grazing kikuyu to 50 mm, broadcasting the seed at 25 kg/ha and mulching the pasture to ground level. All pasture treatments were rolled with a 2.33 m Cambridge roller after planting was completed. Fertiliser was applied to raise the soil phosphorus level to 35 mg kg^{-1}, potash level to 80 mg kg^{-1} and the pH (KCl) to 5.5. The treatments were topdressed monthly with nitrogen at 55 kg N ha^{-1}.

Six pasture samples were cut per treatment at a height of 30 mm every 10 days (three times per 28 day grazing cycle on three different camps) and dried for 72 hours at 60°C to determine dry matter content. Samples were analysed to determine crude protein (CP), neutral detergent fibre (NDF), metabolisable energy (ME), calcium (Ca) and phosphorus (P) content. Botanical composition was determined on a monthly basis by separating a 500g pooled sample into three fractions. The three fractions were kikuyu, ryegrass and other (all species not part of the treatment). The samples were dried at 60°C for 72 hours, weighed and the percentage contribution of each fraction calculated on a DM basis.

As the kikuyu component increased for all treatments from winter to summer, it resulted in an increase in NDF content and the ME content decreased. It was found that if ryegrass was maintained at higher levels in the kikuyu-based pastures during summer and autumn it resulted in higher ME values of pastures during these seasons. All pastures were deficient in terms of Ca requirements for dairy cows throughout the trial, thus dairy cows grazing kikuyu over-sown with ryegrass should be supplemented with Ca. The kikuyu based systems were also deficient in P for high producing dairy cows during summer and autumn. The Ca:P ratio of kikuyu over-sown with Italian ryegrass, Westerwolds ryegrass and perennial ryegrass was below the recommended ratio of 1.6:1 for dairy cows during all seasons.

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POSTER PRESENTATION: PRELIMINARY RESULTS ON THE RELATIONSHIP BETWEEN THE ESSENTIAL AMINO ACID AND CRUDE PROTEIN CONTENT OF LUCERNE HAY

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Feed formulation of the rations of monogastric animals should be based on the provision of essential amino acids and not crude protein, since the nutrient requirements of monogastric animals is based on the amino acids requirement of the body for growth, production etc and not for crude protein *per se*. Lysine is considered as the first limiting amino acid in the nutrition of monogastric animals. Synthetic amino acids are normally provided, in conjunction with the complete diet to animals in order to prevent any amino acid deficiencies. Lucerne hay is an important feed ingredient of monogastric animals, especially ostriches. Huge variation in crude protein and amino acid content however exists. To analyze any feed for the crude protein content is quick and affordable, while amino acid analysis is time consuming, laborious and expensive.

A preliminary study was therefore embarked on to determine the relationship between the crude protein content and amino acid content of lucerne hay. Forty-three lucerne hay samples were randomly collected in the Western Cape region and subjected to crude protein and amino acid analysis. Linear regression models were fitted between amino acid and crude protein content. Statistical analysis revealed a linear relationship between lysine ($y=0.042x+0.21; R^2=0.53; P<0.05$), methionine ($y=0.006x+0.003$; $R^2=0.48; P<0.05$), threonine ($y=0.03x+0.011; R^2=0.49$; $P<0.05$), cystine ($y=0.009x+0.007$; $R^2=0.16$; $P<0.05$), arginine ($y=0.05x+0.02$; $R^2=0.47$; $P<0.05$) as well as total amino acid ($y=0.73x+0.73; R^2=0.71; P<0.05$) content and the crude protein content of the collected lucerne hay samples. Preliminary results indicated the possibility to predict the amino acid composition of lucerne hay from the crude protein content thereof. The analysis of a lot more samples is however necessary to be able to do more accurate predictions before it will be possible to apply in practice.

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POSTER PRESENTATION: ESTIMATING THE VOLUNTARY HERBAGE INTAKE OF GROWING PIGS FED A CONCENTRATE SUPPLEMENT ON A KIKUYU PASTURE BY THE N-ALKANE AND ACID-INSOLUBLE ASH METHODS

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Pigs can consume an extensive variety of feeds to meet their nutritional needs and there is a renewed interest about the use of cheaper nutrient resources for animal feeding. Forages have been proved to be a substantial source of nutrients for pigs. However the bulk of the existing work has focused on feeding with forages to sows and grower-finisher pigs above 50kg. The current investigation was to determine the voluntary forage intake and nutrient digestibility in growing pigs fed a mixed diet (forage + concentrate).Twenty five Large white x Landrace pigs (27 ± 3.8 kg) were randomly assigned to 5 dietary treatments (A, B, C, D and E) of five animals each and received 100, 90, 80, 70 and 80% of the basal concentrate allowance, respectively. Indoor treatments were either fed the concentrate only (A) or received freshly cut Kikuyu grass (*Pennisetum clandestinum*) *ad lib* (B, C and D). Treatment E animals were housed in Kikuyu outdoor camps. Forage intake was measured daily and also estimated using a pair of N-alkanes markers. Nutrients and diet digestibility were calculated using acid insoluble ash (AIA) and dotriacontane (C_{32}) as markers. The results showed that the concentrate intake was significantly different between treatments ($P<0.05$) and there was a highly significant correlation between the

concentrate level and its intake (P<0.01). The measured intake of Kikuyu (MKI) and the animal's average daily gain (ADG) did not significantly differ between treatments (P>0.05). Mean AIA digestibility estimates (organic and dry matter) were significantly superior to C32 estimates (P<0.05). The measured Kikuyu intake was significantly superior (P<0.05) to the estimated intake means. It is concluded that Kikuyu intake was not affected by the reduction of the concentrate level allowance. It was proposed that forage intake in a mixed diet (forage + concentrate) is more dependant on its own characteristics than the concentrate's nutritional value.

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POSTER PRESENTATION: THE EFFECT OF TWO LEVELS OF SUPPLEMENTARY FEEDING AND TWO STOCKING RATES OF GRAZING OSTRICHES ON IRRIGATED LUCERNE ON DRY MATTER INTAKE AND PRODUCTION

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This study determined the effect of two stocking rates of ostriches (10 and 15 birds.ha^{-1}) and two levels of supplementary feeding (0 and 800 g.bird^{-1}day^{-1}) on the intake and production (kg.ha^{-1}day^{-1}) of irrigated lucerne pastures over a period of five months (January to May). A lucerne pasture was divided into 16 paddocks of approximately 0.85 ha each. One hundred and seventy ostriches (± 6 months old) were randomly allocated to four groups and four different lucerne paddocks were randomly allocated to each group. Each ostrich group rotationally grazed the four lucerne paddocks and was moved to a new paddock weekly. Five exclosure cages were placed in a each group of paddocks before grazing and moved with the ostriches.

The available pasture dry matter was determined by cutting and collecting a 0.166 sq m size sample to ground level inside and outside each cage every time the ostriches left a paddock. The dry matter material was then manually seaparated into lucerne, grass, broad leaf weed, clover and dry/dead material fractions, before washing to remove soil and dirt and drying to a constant dry mass at 59°C.

The plant material was composed mainly of lucerne (90 - 99%) and contained only very small quantities of clover, grass, broadleaved weeds and dry/dead material. As the ostriches therefore mainly consumed lucerne, only data regarding the intake and production of the lucerne component were analyzed. The data was analyzed with analysis of variance, using the four paddocks as replicates and with two treatments and two treatment levels.

The residuals for lucerne intake and production were distributed normally ($P \leq 0.05$). For lucerne intake a significant ($P \leq 0.05$) interaction was found between level of supplementary feeding and month. Intake was not significantly influenced by supplementary feeding during January, February, March and April, but during May lucerne dry matter intake was significantly ($P \leq 0.05$) higher at 0 g.bird^{-1}day^{-1} than at 800 g.bird^{-1}day^{-1}. This seems to indicate an increasing level of replacement of grazed lucerne dry matter by supplementary feeding as the trial progressed. This is supported by the fact that there tended to be an interaction ($P \leq 0.10$) between stocking rate and level of supplementary feeding in terms of lucerne dry matter intake. This resulted in lucerne dry matter intake being higher ($P \leq 0.10$) at 15 birds.ha^{-1} than at 10 birds.ha^{-1} at 0 g.supplementary feeding.bird^{-1}day^{-1}, while at 800 g.supplementary feeding.bird^{-1}day^{-1} there was no difference in lucerne dry matter intake.

In the case of lucerne dry matter production a significant interaction ($P \leq 0.05$) was found between stocking rate and month. During January, February and March lucerne dry matter production was significantly ($P \leq 0.01$) higher at the 15 birds.ha^{-1} stocking rate than at 10 birds.ha^{-1}, while there was no difference in April and lucerne production was significantly ($P \leq 0.01$) higher at 10 than at 15 birds.ha^{-1} in May. The high stocking rate of 15 birds.ha^{-1} therefore seems to have

had a gradual depressing effect on lucerne dry matter production. The less severe levels of defoliation at the low stocking rate possibly promoted lucerne dry matter production.

It can be concluded that stocking rate, as well as level of supplementary feeding, influenced lucerne dry matter intake, but only stocking rate influenced lucerne production. Supplementary feeding depressed lucerne intake only at the high stocking rate.

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POSTER PRESENTATION: THE EFFECT OF SUPPLEMENTARY FEEDING OF GRAZING OSTRICHES (STRUTHIO CAMELUS) ON THE YIELD OF IRRIGATED LUCERNE PASTURES

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This experiment was conducted to determine the effect that grazing ostriches, which received different levels of supplementary feed, had on the intake and production of irrigated lucerne pasture.

Two hundred ostriches (± 7 months of age) were randomly allocated to four groups of fifty ostriches each. Pre-established lucerne pasture was divided into 16 paddocks of approximately 0.85 ha each. The four groups of ostriches were allowed to graze the 16 paddocks in a four-paddock rotational system from October 2005 to February 2006. The stocking rate in each paddock was 15 birds per ha. Four paddocks were randomly allocated to each group of ostriches. Three of the four grazing groups received supplementary feed at 1500, 1000 and 500 $g.bird^{-1}day^{-1}$ respectively while the fourth group received no supplementary feed (0 $g.bird^{-1}day^{-1}$). The ostriches were weighed every 14 days and subsequently moved to a new paddock after each grazing.

Five exclosure cages were put in each paddock before the ostriches were allowed to graze the camp. With these exclosure cages the available pasture dry matter was determined by cutting and collecting 0.166 m^2 size samples to ground level inside and outside these cages. The dry matter material was then manually divided into lucerne, grass, broad leaved weed, clover and dry/dead material fractions before washing them to remove soil and dirt. The samples were then dried to a constant dry mass at 59°C. Data were analyzed using analysis of variance. The plant material was composed mainly of lucerne, with negligible quantities of clover, grass, broad leafed weeds and dry/dead material. The ostriches consumed mainly lucerne.

There was no interaction between the level of supplementary feed and months regarding both lucerne production (P=0.9390) and lucerne intake (P=0.7795). Only the two main effects, level of supplementary feed and month, were therefore considered. Lucerne production was not significantly influenced by level of supplementary feeding (P=0.5474), but was significantly (P=0.0193) different between months. The lucerne production declined inexplicably during December and January, which may have been due to problems with irrigation. This was most probably the reason why there was no significant difference in the amount of lucerne the ostriches ingested between different levels of supplementary feeding (P=0.1734), while the amount of lucerne ingested did differ significantly between months (P=0.0301).

When the data of December and January were removed from the data set and the intake and production data analyzed statistically over the whole period, there was still no significant influence of supplementary feeding on lucerne production (P=0.2513) and intake (P=0.0610). The data was then used to try and fit quadratic functions between level of supplementary feeding and lucerne production and intake. In the case of lucerne production, it was once again not possible to fit a significant (P=0.1295) quadratic model to the data.

For the intake data, a highly significant (P=0.0226, R^2=0.44) quadratic relationship was fitted. Based on the fitted function ($Y = 1133.632 + 1.805X - 0.00145X^2$), it was derived that the

maximum lucerne intake level (1692.79 g.bird^{-1}day^{-1}) was achieved at 619.57 g.supplementary feed^{-1}bird^{-1}day. This indicates that DM pasture intake increased with increased levels of supplementation up to a maximum level of supplementation of 619.6 g.bird^{-1}day^{-1}, after which pasture intake started to decline with a further increase in level of supplementary feeding.

The correct level of supplementary feeding will therefore result in more effective utilization of lucerne pasture and higher ostrich production. The correct level is, however, important, as both a too low and a too high level resulted in decreased lucerne intake.

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PLATFORM PRESENTATION: THE EFFECT OF FEEDING SAANEN DOES WITH THREE BROWSE AND FORAGE LEGUMES AS SUPPLEMENTS TO THE CONVENTIONAL DAIRY CONCENTRATE AND A BASAL DIET OF KATAMBORA RHODES (*CHLORIS GAYANA*) GRASS HAY ON MILK YIELD AND QUALITY

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The study assessed the production of milk and the composition of milk of twenty lactating Saanen dairy goats whose diets were supplemented with tropical forage legumes *Vigna unguiculata* (L.) Walp. (Cowpea) and *Stylosanthes scabra* (Fitzroy) and a browse *Brachystegia spiciformis* (Musasa) as nitrogen supplements to dairy concentrate and Katambora Rhodes grass in dairy rations. The does were fed conventional commercial dairy diet (16%CP) consisting of dairy concentrate and maize mixed at 1:3 (MD), the control treatment. The conventional dairy concentrate was then substituted with 25% of either Cowpea (MC) or Scabra (MS) or browse, Musasa (MB). All the does were offered a basal diet of milled Katambora Rhodes grass hay *ad-libitum*. The goats were milked twice daily and milk yields recorded daily for 13 weeks. Composite milk samples for each goat were taken for analyses of butterfat, lactose, protein and total solids. There were no significant (P>0.05) differences in milk yield and composition of milk constituents among the treatments. The does produced an average of 44 kg of 5.3% butterfat, 3.9% lactose, and 8.5% solids-non-fat (SNF) milk over the study period. This study suggests that dairy concentrate can be substituted with 250 g kg^{-1} forage legumes without affecting milk yield and composition in Saanen goats.

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POSTER PRESENTATION: SOIL AND PLANT MINERAL STATUS VERSUS SUSTAINABLE CATTLE PRODUCTION IN ARID REGIONS

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Livestock plays a very important role in the economy of every country by providing meat, milk, motive power and hides. In the current economic climate, forage production is becoming more

important as the foundation of the beef cattle industry. Beef cattle can derive up to 85% of their diet from forage, with the remaining 15% being derived from feed supplements. This study will highlight how certain mineral nutrients in the forage utilized by beef cattle; affect their growth and reproductive capacity. The study will also determine the influence of soil characteristics on the occurrence of mineral problems in the forage utilized by beef cattle maintained on pastures and forages in arid regions.

Arid regions are known to be areas unsuitable for permanent and sustained rain fed farming, and are generally dominated by natural rangeland with the odd planted pasture, with a mean annual precipitation of less than 300 mm. Mineral imbalances (deficiencies and excesses) in soils and forage, are quite common in these arid regions and have been held responsible for low production problems identified for grazing ruminants in these areas. Inadequate nutrient levels and nutrient imbalances in forages, may lead to physiological disorders such as arthrosis, which ultimately suppresses animal performance. It is therefore important to note that both the level and balance of minerals in the forage, which are affected by the soils nutrient status, are critical to livestock in both tropical and arid regions.

Previous research conducted indicated that soil, water and forage available in the arid areas have severe deficiencies in mineral nutrients essential for animal growth. This study therefore aims to provide information regarding mineral imbalances in soils and plants found in- and the beef cattle raised in arid regions. This research on the mineral status of soils and forages will possibly help to overcome nutritional constraints, which limit the productivity and impaired health of livestock in these arid regions. This study will help in providing a guide for sustainable beef cattle production through optimal and balanced supplementation of rangelands used in arid regions.

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