DEVELOPMENT AND FIELD EVALUATION OF ANIMAL FEED SUPPLEMENTATION PACKAGES: AFRA II-17 PROJECT (PHASE I)

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ABSTRACT

Animal productivity is poor in many areas of Namibia due to deficiencies in the quality and quantity of feed. This affects weight gain, reproduction and milk production. The African Regional Co-operative Agreement (AFRA) project is aimed at addressing some of these problems in communal areas by developing the necessary supplementary feeds.

From baseline studies in one study area, Phase I of the project determined that Sanga cattle produce poorly under free grazing, especially during the dry winter. This is indicated by mass loss, low body condition scores (BCS) and poor reproductive performance.

In the second phase of the project, supplementary feed packages will be evaluated to determine energy and protein requirements of the animals. The effects of four supplementary feeds will be assessed by measuring progesterone levels using radioimmunoassay, body condition scoring and mass gain.

INTRODUCTION

In general, low productivity and poor reproductive performance of farm livestock are associated with poor nutrition and poor management. Poor nutrition in association with poor reproductive management leads to delayed puberty, inefficient oestrus detection in cows, long post-partum anoestrus, low conception rates, high rate of embryonic mortality, long calving intervals and a general low fertility of the herd (Garcia et al., 1995). The introduction of improved feeding practices, based on strategic supplementation using locally available feed resources, will enhance milk production and also introduce a sustainable farming practice that will ensure a continuous supply of milk and milk products.

Communal farms used in this study are located at Otjimatie within the north-east Camel-thorn Savannah. The area experiences summer (November to April) as the rainy season and winter (May to October) as the dry season. Initial studies, started in mid 1996, were aimed at obtaining baseline information on the communal farming sector in the region and for characterising the native Sanga breed of cattle in terms of its production and reproductive performance. Studies were carried out on eight communal farms with 107 mature dairy cows. The parameters that were used in the study were progesterone levels, live masses, body conditions and the assessment and evaluation of the field feed resource base.

Progesterone has been widely used to determine pregnancy because of its cyclic behaviour during the oestrus cycle and the relatively high levels occurring during pregnancy. Progesterone concentration in pregnant cows at 21 days after insemination is almost always greater than 6 nmol/L and usually is in the range of 19 to 26 nmol/L. Comparatively, the concentration of the hormone is found to be about 1.6 nmol/L or less in non-pregnant animals at the same time (IAEA, 1984). In cattle, sequential progesterone measurements taken during the oestrous cycle, at seven day intervals, assist in establishing the secretory status of the corpus luteum (ovarian cyclicity) in cases in which oestrus is poorly expressed or missed.

The objectives of the AFRA II-17 project are:

- To determine if supplementary feeding is a cost-effective way to improve animal productivity and reproductive performance of dairy cows in communal areas
- To maximise the utilisation of locally available feed resources
- To design supplementary feed packages to optimise cost and animal productivity
- To promote technical co-operation among AFRA member states in order to solve problems of common interest.

MATERIALS AND METHODS

Eight farms with a total of 107 dairy cows were selected for the experiment in the Otjimatie communal settlement. Animals graze freely in this area throughout the year. Animals cover long distances in search of food and water. Recently, water has been made available to the community by means of a borehole. In addition to free grazing, the animals are given summer and winter licks, the compositions of which are shown in Table1.

Table 1. Composition of summer and winter licks

Supplement	Ingredients	Dry matter (%)
Winter Lick	Sodium Chloride (NaCl)	50.0
	Mono-Calcium-Phosphate (P21)	25.0
	'Econo lick'	12.5
	Urea	12.5
Summer Lick	Sodium Chloride (NaCl)	50.0
	Di-calcium-Phosphate	50.0

The natural grazing was assessed by means of quadrate method to determine the dry matter production per hectare. Quality analysis of the grass was done at the Agriculture Laboratory. Results from the field evaluation are shown in Table 2.

Cows and their calves were tagged for identification. They were weighed and assessed for body condition scores (BCS)

Table 2. Total dry matter production and quality of grass at Otjimatie

Direction	Dry matter (kg/ha)	Dry matter (%)	Crude protein (%)	Fibre (%)	Ash (%)	NDF (%)
South-West	195	94.67	4.07	41.15	5.05	78.72
North-West	223	94.56	3.95	39.08	5.36	77.37
South-East	429	95.07	3.69	40.95	6.14	77.75
North-East	365	95.11	3.8	49.45	3.26	81.99

once a month. A scale of 1 to 5, where 1 indicates very lean and 5 very fat, was used to determine BCS. The data of live mass and BCS were compiled in Microsoft Excel for statistical analyses. Calving dates were recorded to determine the calving intervals.

The farmers collected about 10 ml of milk from each cow weekly. One tablet of either sodium azide or dichromate was used as a preservative. These samples were kept in cooler boxes for between two and three days until collected from the farmers and taken to the laboratory. Centrifugation of samples was done at 2000 rpm for 15 minutes at +4 ^{0}C. After separation, the milk was either assayed or stored deep-frozen until analysed.

Radioimmunoassay (RIA) is a technique that is widely used for the determination of hormone concentrations because of its specificity and sensitivity. In RIA, antibodies specific for progesterone are used as the binding protein. Radioligand assays are based on the ability of a non-radiolabelled antigen (Ag), such as progesterone, in a specific volume of standard or in an unknown sample to compete with a fixed amount of a radiolabelled antigen (Ag*) for a limited number of binding sites on a specific binding antibody protein (Ab). The quantities of Ab and Ag* are held constant in a radioimmunoassay, inhibition of binding of Ag* to Ab is related to the concentration of the Ag in the standards and samples (IAEA, 1984). The process is viewed as a simple competition in which unlabelled antigen, Ag, reduces the amount of free antibody, Ab, and thereby decreases the availability of the antibody to Ag*. Therefore, as the concentration of Ag in standards and samples increases, the percentage of Ag* that binds to Ab decreases. The concentration of Ag in unknown samples can then be extrapolated from an inhibition curve generated by standard solutions. The sensitivity of the assay or the smallest mass of the substance that can be distinguished from zero can be adjusted by varying the concentration of the antiserum and the radiolabelled antigen. Decreasing the concentrations will increase the sensitivity. The process is illustrated in Figure 1.

RESULTS

1. Reproductive performance

Reproductive performance (ovarian cyclicity) from the eight farms indicates that about 81 percent of the animals were not cycling during the period from August to December 1996 (Table 3). In this state animals are not able to go into oestrus (heat) and consequently reproduction will not be possible under these conditions.

Table 3. Ovarian cyclicity (reproductive performance) of the cows from August to December 1996 at Otjimatie

Farm	No. of cows cycling	No. of cows not cycling	Total	Cows not cycling (%)
Farm A	6	6	12	50
Farm B	6	5	11	46
Farm C	3	13	16	81
Farm D	3	4	7	57
Farm F	2	13	15	87
Farm H	0	10	10	100
Farm K	0	30	30	100
Farm M	0	6	6	100
Total/average	20	87	107	81

2. Weights and body condition scores

Live mass shows a trend of growth of the animals on communal farms. During the winter (May to October) the animals tended to loose weight. In the summer (November to April) the animals gradually start picking up weight, reaching over 500 kg in March/April (Figure 2).

A gradual decrease in body condition scores was observed during the winter period. In September and October the lowest BCS of about 1.8 were recorded. Cows with such low BCS are undernourished and both production and reproduction are reduced.

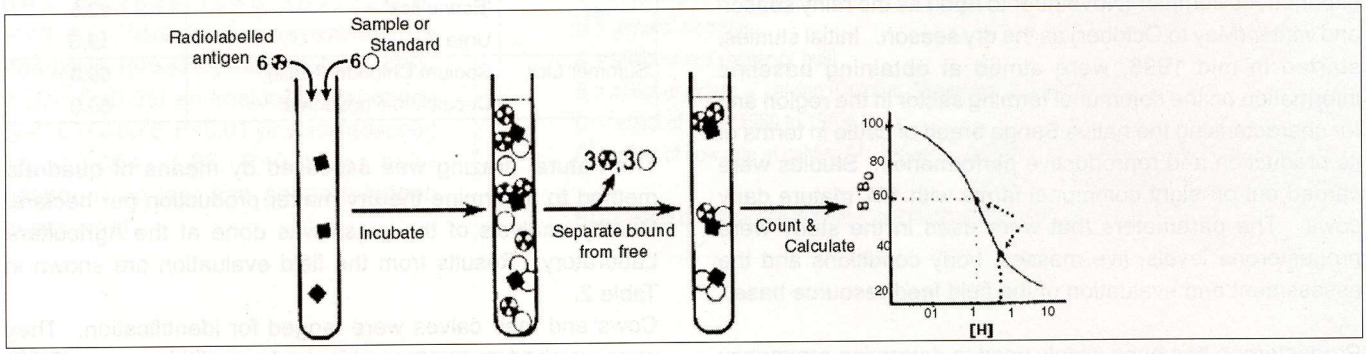

Figure 1. Principles of radioimmunoassays (IAEA, 1984).

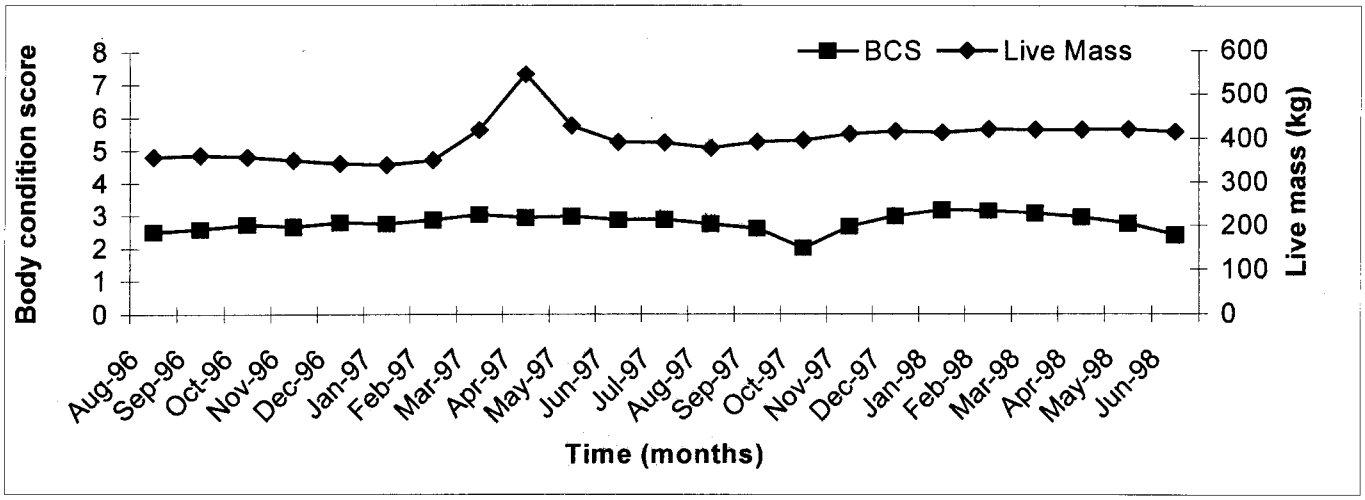

Figure 2. Average monthly live masses and BCS of cows in Otjimatie

The effects of the dry and the rainy seasons are clearly observed from the live mass and BCS data. Results indicate that insufficient nutrition and/or malnutrition could have contributed to low production and reproduction in the study area.

DISCUSSION AND CONCLUSION

The poor quality and low availability of feed during the dry season appears to have affected the reproductive performance of the animals. The progesterone concentrations in the milk samples, collected between August and December 1996 from the cows on the eight mentioned farms, indicates that about 81 percent of the cows were not cycling during this period. This non-cyclic activity of the majority of the animals during the dry season could be due to an inadequacy of energy and/ or protein supplied by the rangeland and the current winter supplement.

The present winter lick needs to be modified to increase the energy and/or the protein intake. The preparation and field testing of this new supplement will commence in phase II. The suggested treatments will be as follows:

1. *Winter lick plus additional energy source
2. *Winter lick plus additional protein source.
3. *Winter lick plus additional energy and protein source
4. *Present winter lick will be used as a control

*The winter lick will be of the same composition as the one referred to in Table 1.

The protein supplement that will be used will be an oil seed meal, fish meal or seal meal. Crude protein content will be increased by 25 percent. The energy supplement that will be used will be maize meal or maize bran. Metabolizable energy will also be increased by 25 percent. The supplement will be limited to 500 grams per animal daily.

The supplement packages will be offered to 80 cows that have just calved. The animals to be tested should be cows calving in April or May 1999. Each alternative package will need to be thoroughly monitored during the trial phase. Farmers will be trained to feed the packages separately to the treatment animals only.

Cyclic (ovarian) activity will be determined for the treatment animals, as was done in Phase I. The animals will be weighed and assessed for BCS during the trial phase. All the collected data will be analysed to determine the supplementation package that has highest biological and economic value. This supplementation package will then be promoted among the communal farmers.

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REFERENCES

GARCIA, M. et al. 1995. Improving Animal Production by Nuclear Techniques. IAEA Yearbook.

IAEA. FAO/IAEA Division. 1994. Laboratory Training Manual on Radioimmunoassay in Animal Production. Technical Reports Series no. 233.

IAEA. FAO/IAEA Division. 1993. Feeding Strategies for Improving Ruminant Productivity in Areas of Fluctuating Nutrient Supply.