

# **DAIRY CATTLE NUTRITION PROJECT**

**BOLIVIA                      1994 TO 1997**

**FINAL REPORT BY ELIZABETH ALDERSON**

## **1. BACKGROUND**

The project was identified in February 1992 following a visit to Santa Cruz by Dr. Lindsay Bell, Senior Animal Health and Production Adviser for the ODA (Overseas Development Administration), now DFID (Department for International Development).

Dr. Margaret Gill of the Natural Resources Institute then visited Santa Cruz in June/July 1992 to evaluate the need for technical assistance in the field of dairy cattle nutrition. As a result, Dr. Gill recommended that the ODA consider providing technical assistance in the form of a TCO Animal Nutritionist for a 3 year period to work with the local dairy farmers to develop feed management strategies appropriate to local conditions.

A project proposal was outlined by Ms Bell after consultations with ADEPLE, the milk producers association of the department of Santa Cruz, following her visit to Santa Cruz in March 1993.

The Dairy Cattle Nutrition Project (DCNP) was finally approved in 1994 under a bilateral agreement between the governments of Bolivia and UK.

The TCO Animal Nutritionist, Elizabeth Alderson, was appointed for a period of 2 years, commencing on July 8th, 1994 to work with ADEPLE, which has seven branches with a total of approximately 1,500 members.

MAIN PROJECT OBJECTIVES were defined as:

1. "Improved livestock productivity in the department of Santa Cruz through improved animal feeding practices and hence increased income of local dairy farmers."
2. "Improved utilisation of natural resources in the production of milk."

A one year extension was granted to the project and to the contract of the TCO Animal Nutritionist in May 1996, following a request by ADEPLE, soon to be converted to a federation (FEDEPLE), with the concomitant expansion into new areas, to Ms Bell on her monitoring visit to the project in October 1995.

The project was extended until 31 October 1997.

## **2. PROJECT PERSONNEL**

The British input consists of one TCO Animal Nutritionist and that of FEDEPLE two Bolivian counterparts and a project secretary.

The counterparts, Drs. Fernando Cadario and Maria Cruz Limpas, are graduates of the faculty of veterinary medicine of the University of Santa Cruz (UNAGRM).

They have both obtained post graduate degrees in the field of animal nutrition after successfully completing 12 month MSc courses at Reading University in 1996 and 1997, respectively, after receiving training scholarship awards from the British government.

### 3. ANTECEDENTS

Livestock production in the Department of Santa Cruz is traditionally based on the extensive rearing of *Bos indicus* (Nelore) cattle for meat production, whilst dairy cattle farming is a relatively new innovation.

Rapid development of the dairy sector within a 100-130km radius of the city of Santa Cruz de la Sierra tended to centre on genetic improvement and animal health programmes whilst neglecting the basic requirement of sound dairy cattle nutrition strategies.

This was clearly demonstrated during the dry season by drastic drops in milk yields and the drying-off of large numbers of cows, especially among the small producers, which resulted in erratic lactation curves and excessive calving intervals.

Deterioration in body condition of dairy animals of all ages during the dry season was another consequence of poor nutrition, while the lack of importance given to the nutritional requirements of dry cows in the last 2 months of gestation resulted in low birth weight, disease prone calves, leading to the high incidence of calf mortality (10 - 12%) as well as low lactation yields.

#### "ACID MILK"

The phenomenon of "acid milk" was a serious problem which had affected a majority of the milk producers supplying the milk factory.

The term is given to milk which coagulates on mixing with alcohol. This test is normally used as a platform rejection test by milk manufacturing plants for milk of high acidity, i.e. high bacterial count.

In Santa Cruz the term is used to designate milk unsuitable for processing by heat due to protein precipitation even though it fails the test straight from the udder and the coagulation with alcohol is not due to a high bacterial count.

Although many theories had been advanced as to the cause of "acid milk" no satisfactory explanation had been discovered for the problem which appears to have no set pattern and was causing high losses in revenue for the dairy farmers.

### 3.1. CONSTRAINTS

The major constraints to increasing milk production were identified as:

- The lack of balanced diets
- Insufficient feed dry matter intake leading to the general failure to provide the daily nutrient requirements of the dairy cow.

#### 3.1.1. Management of Pastures and forages

The inadequate management of pastures and forages, which form the basic diet for milk production in Santa Cruz, was identified as the greatest constraint to increasing milk production.

Although improved pasture species, predominantly the *Bracharia* and *Panicum maximum* varieties, have been established for at least 10 years in the region, they rarely attained maximum growth and nutrient values during the growing (wet) season due to poor management, such as lack of pasture renovation leading to compacted soils, non-use of rotational grazing leading to overgrazing or undergrazing, and lack of fertiliser application.

Although mixed legume/grass swards had been introduced, lack of management had led to disappearance of the legumes thus discouraging continuation of their use.

Pastures therefore rapidly deteriorated with the onset of the six month dry season which normally begins in April and ends in September. An absence of dry season feeding practices meant that cattle were left to subsist on dried out pastures with very little nutrient value where over-stocking contributed to slow pasture recuperation during the onset of the wet season.

Poor grazing practices also contributed to insufficient dietary intake. For example, cows are normally kept in enclosures overnight to prevent rustling. Due to the popular belief that "cows sleep at night and therefore don't need feeding," the majority were left without feed overnight which drastically reduced the time available for feeding, often to well below the minimum 12 hours required. This was exacerbated by the fact that the period allocated for grazing was normally between morning and evening milking, the hottest part of the day, in pastures with an almost universal absence of shade trees.

Cows were therefore physically unable to consume enough forage to meet their daily requirements.

In general the quantity of forage offered to the animals was far below that needed to satisfy their dry matter intake due to lack of understanding of the dairy cow's intake requirements.

The predominant forage species in the region are Taiwan (*Pennisetum purpureum*), maize and sorghum. Although a few of the more progressive

farmers had experimented with silage this was generally considered too expensive, too difficult and unnecessary.

Lack of correct management of Taiwan, usually cut and fed fresh, meant that it was usually of low nutrient value due to over maturity.

Sugar cane, one of the most important cash crops grown in Santa Cruz, although an excellent dry season forage feed used in many tropical countries, was under-utilised for dairy cattle feeding mainly due to the widely held misconception that it caused "acid milk". This was also attributed to the feeding of the sugar cane by-product, hydrolysed bagasse, produced by some of the sugar cane factories as animal feed.

### **3.1.2. Protein and Energy Supplementation**

Although Santa Cruz is fortunate in having a very wide range of locally available agricultural and agro-industrial by-products for protein and energy feed supplementation their use was generally inefficient and uneconomical.

Because of the poor understanding of their correct usage, milk producers tended to stick to a few well known products such as cotton seed, Soya bean meal, wheat bran and maize, resulting in shortages and hence price increases for these products.

As the majority of producers did not understand the need for a balanced diet and could not distinguish between protein and energy supplements they were often feeding excess protein whilst neglecting energy, the availability of the former being greater than the latter.

Abundant locally available and economical protein supplements such as urea and poultry manure were not being utilised due to the popular misconception that they were unfit for dairy cattle feed.

Although there are five sugar cane processing factories in Santa Cruz, liquid molasses was not available as an animal feed supplement as it was traditionally processed into fuel alcohol, there being no other demand.

## **4. TECHNOLOGICAL ADVANCES**

### **4.1. NEW FEEDING PRACTICES INTRODUCED AND ADOPTED**

New feeding technologies were introduced to the farmers by means of a series of talks given to each of the seven FEDEPLE Associations in rotation as well as to other milk producer associations such as those of the Beni, San Javier, Concepcion, the Mesothermic Valleys of Santa Cruz, etc.

A total of 37 talks were given, covering the basic principals and practices of dairy cattle nutrition and dry season feeding and forage conservation, accompanied by

slides and complimented by field demonstrations and individual farm advisory visits.

DCNP has produced a series of 10 technical pamphlets and 50 information sheets together with 2 videos which have been distributed to farmers, students and a number of agricultural institutions both in the Santa Cruz department and elsewhere in Bolivia.

The project has also received wide television coverage consisting of monthly interviews with the TCO Animal Nutritionist on current topics and progress of the project. The two videos have also been shown by TV stations throughout the Department.

#### **4.1.1. SILAGE PRODUCTION**

Silage production was introduced as the most suitable method of conserving forage for dry season feeding in the central zone of the milk catchment area. Forages recommended were maize, sorghum, Pampa Verde (a hybrid grain x forage sorghum) and Taiwan.

After a slow start the enthusiasm for silage making is now definitely established, demonstrated by the setting up of a year round silage making service by the PIL-SAM milk plant's technical department consisting of 2 teams which have to date made between 600 and 700 tons of silage.

#### **4.1.2. CHOPPED SUGAR CANE WITH UREA + AMMONIUM SULPHATE**

As sugar cane is grown by the majority of livestock farmers in Santa Cruz the feeding of supplemented chopped sugar cane was introduced as a dry season forage alternative to silage production. Unfortunately, because of poor feeding practices farmers were initially unwilling to adopt this, based on their experience that it caused "acid milk".

By on-farm trials it was demonstrated that this was the result of feeding the high fibre, high energy forage with no protein supplement, which deprived the rumen bacteria of the nitrogen required to digest it, thus causing the condition known as "acid milk."

Urea supplemented chopped sugar cane has now become a popular dry season forage, (1200kgs urea + 108kgs ammonium sulphate have been sold by FEDEPLE in the last 8 months - sufficient to supplement 2400 KGs chopped sugar cane). Two popular taboos were therefore overcome at the same time (urea and sugar cane).

#### **4.1.3. HYDROLYSED BAGASSE + MOLASSES + YEAST**

Another dry season forage alternative available in Santa Cruz is the sugar cane by-product, bagasse, which is steam treated by two of the five processing factories and offered for sale for animal feeding at economical prices.

Demand for this product was very low as it was also blamed for causing "acid milk". As in the case of sugar cane, bagasse was traditionally fed unsupplemented and in this case both protein and energy supplements were required for a balanced diet.

Trials were carried out on 18 farms with a total of 141 cows by the DCNP in co-operation with one of the sugar factories. A balanced diet of bagasse (fibre) + molasses (energy) + spent yeast (protein) was formulated by the DCNP and provided free by the factory. Results demonstrated not only that bagasse, properly supplemented, did not produce "acid milk", but that all the chronic cases of the condition disappeared with this balanced diet.

As results of the trials, namely increased milk production, improved body condition and disappearance of acid milk, became known the demand for the products became so high that the sugar factories were unable to produce them in sufficient quantities.

Although this feeding practice was widely adopted, the limiting factor, yeast, is produced in diminishing quantities as the demand for molasses increases and fuel alcohol decreases. This restricts its use to the more affluent farmers.

#### **4.1.4. TAIWAN + UREA/MOLASSES SOLUTION**

Taiwan was greatly under utilised due to poor management which resulted in a high fibre forage of low nutritive value and low digestibility. The practice of supplementing the fresh chopped forage with a urea/molasses solution was introduced by the DCNP together with better management practices which greatly enhanced its value as a forage for milk production, especially in the dry season.

The use of Taiwan as a potential silage crop was also introduced with on-farm demonstrations using a 5% molasses + 0.5% urea solution to increase its fermentation properties and nitrogen content, respectively. It was explained to the farmers that the previous poor results they obtained were due to the normally low sugar content of tropical pastures which resulted in inadequate production of lactic acid for good forage preservation. Taiwan is now widely accepted as a suitable silage crop.

#### **4.1.5. UREA TREATED MAIZE STOVER**

The treatment of mature maize stover with a urea solution was demonstrated to the small farmers in the mesothermic valleys of Santa Cruz which is one of the new areas covered by the FEDEPLE expansion programme where maize is grown for grain by the majority of small farmers as a cash crop.

The practice of leaving the stover, often the only source of dry season fodder for dairy cows, standing in the field after harvest causes a high degree of wastage due to trampling and rapid drying out with the concomitant loss of nutritive value.

Field days were held in Mairana, Vallegrande and Comarapa with talks and demonstrations, where dry maize stover, chopped and unchopped, was sprayed with a urea solution and sealed in plastic bags of 50 KGs.

After a period of three weeks the digestibility of the stover improved by >10% and the crude protein by >5% due to the breakdown of urea to ammonia which attacks the lignin of the stover rendering it more digestible, and at the same time increases the nitrogen content of the material.

Further field days were held when the bags were opened and the material examined. After dispersion of the gas, the material was fed to the cows and was accepted straight away.

An average of 16 farmers attended each of the six field days and several farmers have already prepared their own treated fodder with good results.

#### **4.1.6. PASTURE MANAGEMENT**

Improved pasture management practices promoted by the DCNP are:

- i) Rotational grazing using the paddock system.

This practice is gradually being adopted by the farmers although, as it involves a large capital outlay either for purchasing electric fencing or dividing up large fields, progress is slow.

The indigenous communities of San Javier, an expansion area of FEDEPLE, have purchased 450KGs of wire, sufficient for 16 km of fencing for their pastures, on credit from the technical department of the PIL-SAM milk plant, funded by the World Food Programme.

- ii) Pasture renovation

The use of a Rome plough for pasture renovation, one of the recommendations made by the pasture consultant, Dr. Paterson, has shown spectacular results on various farms where compacted soils had restricted pasture growth.

Unfortunately, this involves use of machinery which restricts its use to the more affluent farmers.



### iii) Soil fertility

The high cost of inorganic fertilisers in Santa Cruz means that their use is almost universally restricted to cash crops and fertilisation of pastures has been totally neglected.

The introduction of leguminous species and poultry manure (found in abundant quantities in Santa Cruz) as an organic fertiliser, has been recommended as methods of improving soil fertility.

Adoption of these methods by the farmers is slowly gaining popularity as positive results are observed.

## 4.2. PROTEIN AND ENERGY FEED SUPPLEMENTS

A total of 35 locally available protein and energy supplements were identified (including 5 commercial concentrates), samples of which were sent to NRI, UK for analysis. Several of the supplements were severely under utilised by the milk producers who preferred to stick with those they were well familiar with such as maize, Soya, wheat bran, cotton seed.

Cheaper replacement sources, such as poultry manure and Soya bean hulls which were previously discarded are now in short supply due to high demand.

Urea, previously rejected as a feed supplement due to the misconception that it was poisonous, is now a well utilised rumen nitrogen source in a number of different feeding regimes, with, for example, chopped sugar cane, fresh cut Taiwan; as an addition during silage making and in the treatment of maize stover and wheat straw.

The introduction of liquid urea/molasses feeding and supplement feed blocks has not been successful. Despite several efforts to promote their use the farmers are not keen to adopt them, the former probably due to the logistics involved and the latter due to the cost.

Brazil nut pulp, a by-product of the Brazil nut export industry in the Beni department, was offered to FEDEPLE as a protein supplement. Its suitability as a protein supplement for the Beni, which has to transport all animal feed supplements from Santa Cruz, is being investigated by the DCNP in conjunction with the University of Trinidad and is the subject of a student thesis. The main constraint to its acceptance is its susceptibility to aflatoxin contamination but this can probably be overcome by improving extraction and storage practices.

## 4.3. CALF REARING

One of the important aspects of dairy herd management, the rearing of herd replacements, was seriously neglected on many farms which resulted in weak,

undernourished heifer calves which were prone to disease (average mortality rate in Santa Cruz was 10%) leading to low live weights and delayed puberty.

Improved calf nutrition and rearing practices, such as the provision of fresh water, calf concentrate and appropriate roughage while feeding milk, previously neglected, have now been adopted on many farms.

Improved calf management has led to a fall of 50% in dairy calf mortality, (now 3-5%).

#### **4.4. DIGESTIBILITY OF FEEDS ANALYSIS**

The Gas Production Method for the *in vitro* analysis of the digestibility of animal feeds was set up in August '97 in the analytical laboratories of CIAT with funds from the DCNP on the recommendation of the TCO animal nutritionist. The complete basic analysis of animal feeds can now be carried out by CIAT instead of the need to send samples out of Bolivia for digestibility determinations.

### **5. TERMS OF REFERENCE (TORs)**

**TOR 1.** *Sample available feeds (concentrate and forage) and arrange for chemical analysis through ODA's Natural Resources Institute (NRI).*

A total of 255 samples of locally available forage and concentrate feeds were collected and despatched to NRI for Proximate Analysis, Tilley and Terry digestibilities and in some cases neutral detergent fibre (NDF) acid detergent fibre (ADF). Mineral analysis on a selection of samples was carried out by CIAT laboratories.

Results have been published in 2 pamphlets, giving the nutritive values of 35 protein and energy supplement feeds (No1) and 27 pastures and forage species, (No 2).

Copies of the pamphlets have been widely distributed to farmers, feed compound manufacturers, livestock institutions and organisations, and educational establishments, and have also been sent to FAO, Animal Production and Health Division in Rome.

**TOR 2.** *Assist and advise the Directors of FEDEPLE and counterpart extension staff in relevant aspects of formulation of least cost feed rations, pasture utilisation and forage conservation with emphasis on small/medium scale farmers.*

A total of 350 balanced dairy cattle rations have been prepared to date, on request by farmers and feed companies using the nutritive values obtained, 260 of which have been prepared by Fedepale counterpart, Fernando Cadario, using the least cost ration computer program, Ultra-Mix.

Ration formulations are very popular with the farmers and the number of requests is increasing every month, (86 during July-September).

Introduction of rotational grazing and paddock fencing together with the establishment of legume/grass swards and pasture renovation have demonstrated the benefits of improved pasture management.

A total of 580KGs of improved grass and forage (*B. brizantha* and Pampa verde) seed were purchased in 1996 by the five indigenous communities of San Javier on credit from the milk plant under the WFP aid package.

Silage making has finally become accepted as one of the most practical and economical methods of preparing for the dry season feed shortages, demonstrated by the establishment of two silage making teams set up by the PIL-SAM milk plant technical department which have produced approximately 700 tons of silage this year.

A total of 200 KGs of maize seed has been purchased on credit from the milk plant by the indigenous communities of San Javier for the production of maize silage next year.

**TOR 3.** *Identify existing limitations to management generally and feeding practices in particular.*

Incorrect management and feeding practices were identified as follows:

- i) Absence of dry season feeding strategies
- ii) Insufficient feed dry matter intake leading to general failure to provide sufficient nutrients for the cow's daily requirements.
- iii) The lack of balanced diets leading to protein and/or energy deficits.
- iv) Insufficient time allowed for grazing.
- v) Inadequate or non existent pasture management resulting in pasture of low nutritive value.
- vi) Failure to make use of locally available economical feed supplements due to unawareness of their value as dairy cattle feed, e.g. poultry manure, urea, Soya bean hulls, hydrolysed bagasse, yeast (by-product from alcohol production from molasses), Soya stover, cassava leaves.
- vii) Poor calf management and nutrition
- viii) Insufficient shade and water provision for dairy animals.

**TOR 4.** *Develop recommendations on improved feeding practices including grazing management.*

Improved feeding and grazing practices introduced and adopted by the farmers are as follows:

i. Formulation of balanced feed rations based on the data obtained from the analysis of 255 pasture and forage samples and the determination of the dairy cow's nutritive requirements according to live weight and milk production.

Introduction of least cost rationing using the computer program, ULTRA-MIX.

ii. Forage conservation : silage production

iii. Dry season feed alternatives:

- Urea supplemented chopped sugar cane
- Taiwan supplemented with molasses/urea solution
- Hydrolysed bagasse with molasses and yeast
- Maize stover and wheat straw treated with urea

iv. Alternative more economic feed supplements:

- Poultry manure
- Soya bean hulls
- sunflower seed hulls
- cassava leaves
- dried cassava chips
- molasses
- urea

v. Pasture management

- Rotational grazing using paddock system
- Introduction of legume/grass swards
- Pasture renovation using the Rome plough
- Organic fertilisation using poultry manure.

The introduction and adoption of a combination of the afore mentioned feeding practices has resulted in almost erasing the dry season fall in milk intake at the PIL SAM milk plant and in reducing to insignificance the acid milk problem.

PIL-SAM AVERAGE DAILY MILK INTAKE (LTRS)

YEAR	OCT - MAR (WET SEASON)	APRIL- SEPT (DRY SEASON)	DRY SEASON FALL	No. OF PRODUCERS	AVERAGE DAILY DECREASE PER PRODUCER
94-95	91,949	74,475	17,474	796	21.95
96-97	99,321	89,325	9,996	872	11.46

Average daily decrease in intake was 11.46 litres/producer in 96/97 compared to 21.95 litres in 94/95, equivalent to a 52% decrease in the gap between wet and dry season milk production. (ANNEX 2)

This is attributed almost totally to improved animal nutrition practices especially during the dry season by FEDEPLE and the PIL-SAM milk plant.

**TOR 5.** *Assist in the preparation of extension leaflets on feeding, grazing management and husbandry.*

A total of 10 extension leaflets have been prepared covering feed formulation, pasture and grazing management, silage making, tropical legume management, calf rearing, mineral requirements, economic feeding strategies and nutrient values of local feeds.

In addition 50 information sheets on specific topics, such as the preparation of chopped sugar cane with urea + ammonium sulphate; the preparation of urea/molasses solution; feeding brewers grains, etc. have been produced.

Bound copies of the collection of information sheets have been prepared by FEGASACRUZ for distribution.

**TOR 6.** *Conduct training courses for staff of FEDEPLE and related institutions - FEGASACRUZ, CIAT, LIDIVET and UAGRM on the interpretation of data on feed composition, formulation of rations and potential feeding systems.*

A total of 36 training events were held on the principles of dairy cattle nutrition and silage making. Topics covered included formulation of balanced dairy cow rations and the nutrient values of feeds.

Talks and demonstrations were given to each of the 7 FEDEPLE Associations as well as other milk producer associations, e.g. Beni, San Javier, Mairana, Concepcion, and to FEGASACRUZ beef producers associations e.g. Pailon,

Santa Cruz. All talks were also well attended by local university and college students.

Seminars were held on Pasture management, Agri-business management and the Gas Production Method for *in vitro* digestibility analysis where the speakers were visiting consultants to the project.

**TOR 7.** *Submit quarterly progress reports to ODA, copied to Dr. Gill of NRI.*

Copies of a total of 13 quarterly progress reports and two back-to-office reports, (following visits to Brazil and Costa Rica), have been submitted to LACAD, ODA/DFID, Dr. Margaret Gill, NR International, the British Embassy - Aid Section, and the Bolivian Government - Ministry for External Affairs.

## 6. CONSULTANCIES AND MONITORING VISITS

The project received the following visits during the 3 year period:

11th - 19th October 1995	Dr. Margaret Gill	Monitoring visit
3 <sup>rd</sup> - 17th May 1995	Dr. Robert Paterson	Pastures management consultant
17th October 1995	Ms Lindsay Bell	Monitoring visit
19th - 23 <sup>rd</sup> August 1996	Dr. Margaret Gill	Mid-Tour Review
	Mr. Geoff Gilman	
	Ms Diane Brooks	
19th Nov - 11th Dec 1996	Sr. Jorge Caballero	Agri-business consultancy
24th Aug - 27th Sept 1997	Mr. Tim Machen	Agri-business consultancy
31 <sup>st</sup> Aug - 6th Sep 1997	Dr. Margaret Gill	Final Impact review
	Mr. Geoff Gilman	

## 7. TRAINING SCHOLARSHIPS

A total of 3 overseas training scholarships were awarded to FEDEPLE;

**7.1.** Dr. Fernando Cadario - FEDEPLE counterpart Animal Nutritionist, obtained an MSc in Animal Production and Forage from the University of Reading in 1996.

**7.2.** Dr. Maria Cruz Limpas - FEDEPLE counterpart Animal Nutritionist, obtained an MSc in Dairy Animal Science from the University of Reading in 1997.

**7.3.** Juan Carlos Barba is studying agro-industrial processing at ECAG, Costa Rica. He commenced the 3 year course in February 1997 and is progressing well.

## **8. SUSTAINABILITY OF FEDEPLE DAIRY CATTLE NUTRITION DEPARTMENT**

### **8.1. AGRI-BUSINESS MANAGEMENT**

**8.2.** A consultant economist, Jorge Caballero, was contracted by DFID to advise FEDEPLE on ways of ensuring the sustainability of their nutrition department. Unfortunately, the recommendations made did not satisfy FEDEPLE's requirements.

A second consultancy was requested from BESO on the recommendation of the TCO animal nutritionist, with the provision that FEDEPLE detail their exact requirements.

Mr. Tim Machen, a specialist in Agricultural Economics, carried out a five week consultancy in September 1997.

After visits to fourteen farms and three Associations, Mr. Machen produced a computer model for the financial analysis of dairy farms to assist FEDEPLE in obtaining credit packages based on individual farmers' requirements.

He also drew up a credit proposal for FEDEPLE for the forward bulk purchasing of animal feed "straights" for onward sale to members, with profits directed towards the running costs of the nutrition department.

The suggestions were approved by FEDEPLE and if carried out should make a positive contribution to the sustainability of the nutrition department where the main risk to its continuance is financial.

### **8.2. ON-FARM MONITORING OF PROGRESS ON FEDEPLE DAIRY FARMS**

The possibility on FEDEPLE participating in the Farming Systems Modelling Project, using the VAMPP software package for the recording of on-farm data in an RNRRS (Renewable Natural Resources Research Strategy) funded project being carried out by CIAT and the University of Edinburgh, was discussed during the Project Final Impact Review.

It was proposed that a total of 210 dairy farms could be monitored, 30 from each of the seven FEDEPLE Associations, which would require the purchase of a licence and "sentinels," costing approximately 10,000\$us. The suggestion was made by the review team that the equipment could be purchased by DFID with remaining project funds.

This could be an excellent way of integrating the work of FEDEPLE with other national and international organisations, thus raising the profile of the department which should contribute towards its sustainability.

### **8.3. MERGING OF FEDEPLE NUTRITION DEPARTMENT WITH PIL-SAM MILK PLANT TECHNICAL DEPARTMENT**

The proposed merger of the nutrition department with the milk plant technical department, which at present receives funding from the WFP, seems to be a logical step in combining human, technical and financial resources of these two similar departments which are both managed by FEDEPLE. It should also help to contribute to the sustainability of the nutrition department.

### **8.4. JOINT PROJECTS WITH OTHER INSTITUTIONS**

Since December 1995 the DCNP has been collecting data on individual dairy cow milk yields and live weights from nine farms for the Livestock Production Programme of DFID's RNRRS.

The data has been sent to Dr. Peter Thorne of the NR Institute who has provided some of the farmers with graphs showing the relation between body weight and lactation curves to dry and wet season feeding practices.

Dr. Thorne proposes to organise a workshop for the dairy farmers of Santa Cruz once he has analysed all the data. This is planned for 1998.

With the setting up of the Gas Production Method for feed digestibility determinations, proposals have been put to DFID for collaborative research projects between FEDEPLE, CIAT and the NR Institute, by Dr. Chris Wood of the NR Institute, who set up the method.

As FEDEPLE becomes more closely involved in external research projects this should also contribute to sustainability of the nutrition department by possibly bringing in funding and also raising the department's profile.

### **8.5. PROJECT TRANSPORT**

It was agreed by DFID that the TCO vehicle should be sold at the end of the project and that two smaller vehicles should be purchased with the proceeds for the two nutrition counterparts. This is a major contribution to the sustainability of the nutrition department as FEDEPLE does not have transport available for the exclusive use of the nutrition department.



## **8.6. COST RECOVERY**

As the majority of the 10 extension pamphlets have been reprinted at least once, FEDEPLE has finally agreed to the suggestion that they should make a charge for the pamphlets to cover their costs. This does not seem to have discouraged demand and will contribute to covering the daily running costs of the department and hence its sustainability.

## **9. ACKNOWLEDGEMENTS**

I would like to thank all the people who have collaborated with the project to help make it a success, especially the three FEDEPLE presidents, Srs. Luis Fernando Antelo, Ruben Costas and Javier Suarez and their directors and staff, especially the two nutrition counterparts, Fernando Cadario and Maria Cruz Limpas and project secretary, Lynne Webb, who have given me full support during the project.

I also wish to thank the milk producers of Santa Cruz department and those of the Beni together with the University of Trinidad and Dr. Carlos Nagashiro, whose enthusiasm for the project has been most stimulating.

I would also like to thank the staff of Lidivet, both British and Bolivian, to CIAT, especially Ing. Willy Fernandez, and to the technical department of the PIL-SAM milk plant, especially Ing. Luis Padilla, for their co-operation and assistance on numerous occasions.

Finally, but not least, I would like to thank Dr. Maggie Gill for her support and advice, given when needed and to the staff of LACAD assisted by the British Embassy, who kept the project running smoothly.

I have enjoyed working with FEDEPLE and this project has given me a great deal of job satisfaction.

## TERMS OF REFERENCE

### ANNEX 1

#### TCO ANIMAL NUTRITIONIST, Dairy Cattle Nutrition Project, Bolivia.

Duration of Post : 24 months (excluding leave)  
Duty Station : Santa Cruz, Bolivia

#### Qualifications and Experience

The selected Technical Co-operation Officer (TCO) will be a veterinary/animal science graduate with a post-graduate degree in animal nutrition and previous experience of dairy farming in the tropics. The TCO Animal Nutritionist will have strong training abilities with sound practical experience of improved animal feeding practices in the tropics. The candidate will work in an advisor role to the Directors of ADEPLE and act as counterpart to the appointed Bolivians in implementing the agreed project.

#### Duties

- Sample available feeds (concentrate and forage) and arrange for chemical analysis, through ODA's Natural Resources Institute (NRI) in the first instance.
- Assist and advise the Directors of ADEPLE and counterpart extension staff in relevant aspects of formulation of least cost feed rations, pasture utilisation and forage conservation with emphasis on small/medium scale farmers.
- Work in collaboration with TCO Veterinary Extension Officer at LIDIVET, and with counterparts at ADEPLE to identify existing limitations to management, generally, and feeding practices, in particular.
- Develop recommendations on improved feeding practices, including grazing management, in collaboration with CIAT, PMGB (JICA bovine genetic improvement project), and the Gabriel Rene Moreno University (UAGRM).
- Assist in the preparation of extension leaflets on feeding, grazing management and husbandry in collaboration with CIAT, UAGRM and LIDIVET.
- Conduct training courses for staff of ADEPLE and related institutions - FEGASACRUZ, CIAT, LIDIVET and UAGRM on the interpretation of data on feed composition, formulation of rations and potential feeding systems.
- Submit quarterly progress reports to ODA, copied to Dr. Gill of NRI.