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CHARACTERIZATION OF BEEF CATTLE FARMING IN THE ATLANTIC ZONE OF COSTA RICA

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CENTRO AGRONOMICO TROPICAL DE
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The Research Program on Sustainability in Agriculture (REPOSA) is a cooperation between Wageningen Agricultural University (WAU), the Center for Research and Education in Tropical Agriculture (CATIE), and the Costa Rican Ministry of Agriculture and Livestock (MAG). In addition, REPOSA has signed memoranda of understanding with numerous academic, governmental, international, and non-governmental organizations in Costa Rica.
The overall objective of REPOSA is the development of an interdisciplinary methodology for land use evaluation at various levels of aggregation. The methodology, based on a modular approach to the integration of different models and data bases, is denominated *USTED* (*Uso Sostenible de Tierras En el Desarrollo*; Sustainable Land Use in Development).
REPOSA provides research and practical training facilities for students from WAU as well as from other Dutch and regional educational institutions.
REPOSA's research results are actively disseminated through scientific publications, internal reports, students' thesis, and presentations at national and international conferences and symposia. Demonstrations are conducted regularly to familiarize interested researchers and organizations from both within and outside Costa Rica with the *USTED* methodology.
REPOSA is financed entirely by WAU under its Sustainable Land Use in the Tropics program, sub-program Sustainable Land Use in Central America. It operates mainly out of Guápiles where it is located on the experimental station *Los Diamantes* of MAG.

REPOSA (*Research Program on Sustainability in Agriculture*, o sea Programa de Investigación sobre la Sostenibilidad en la Agricultura) es una cooperación entre la Universidad Agrícola de Wageningen, Holanda (UAW), el Centro Agronómico Trópical de Investigación y Enseñanza (CATIE) y el Ministerio de Agricultura y Ganadería de Costa Rica (MAG). Además REPOSA ha firmado cartas de entendimiento con organizaciones académicas, gubernamentales, internacionales y non-gubernamentales en Costa Rica.

REPOSA ha desarrollado una metodología cuantitativa para el análisis del uso sostenible de la tierra para apoyar la toma de decisiones a nivel regional. Esta metodología, llamada USTED (Uso Sostenible de Tierras En el Desarollo) involucra dimensiones económicas y ecológicas, incluyendo aspectos edafológicos y agronómicos.

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REPOSA publica sus resultados en revistas científicas, tesis de grado, informes, y ponencias en conferencias y talleres. REPOSA regularmente organiza demostraciones para investigadores de Costa Rica y de otros países para familiarizarlos con la metodología USTED.

REPOSA es financiado por la UAW bajo su Programa del Uso Sostenible de la Tierra en los Areas Trópicos. La sede de REPOSA está ubicada en la Estación Experimental Los Diamantes del MAG en Guápiles.

Preface

This report is the result of a practical period from May to beginning of September 1996 at the REPOSA (REsearch Program on the Sustainability of Agriculture) in Costa Rica. The practical period consisted of interviewing farmers, analysis of the data and the building of two Animal Production System at a defined Technology (APST's). These APST's are used in the USTED methodology, developed at REPOSA, for analysis and evaluation of alternative scenarios for profitable land use at the farm, (sub)regional and, possibly, national level.

In Costa Rica, I was supervised by Dr. ir. S.L. Efde and Dr. ir. A. Nieuwenhuyse. I would like to thank them for their help and the 'expert knowledge' of André on beef cattle farming. My supervisor at the Agricultural University Wageningen was ir. F.C.T. Guiking.

Further, I would like to thank Carlos Aragón for his help with interviewing the farmers and also V. Mora, Dr. Rosendo and M. Hernandez of the extension offices of MAG Siquirres, Guácimo and Guápiles who helped me with my fieldwork.

Summary

Cattle farming is after banana the most important agricultural activity in the Atlantic Zone. In the Atlantic Zone specialized milk production, double purpose (i.e. milk and meat production) and beef production can be found. Beef production is, within the cattle production, the most important activity. So far, not much research has been done on beef cattle.

The most important systems that can be found in the region are 'cria' and 'engorde'. Cria is the rearing of calves which are sold at weaning. Engorde is the fattening of male animals up to a weight of 400-500 kg.

The most common grass species in the Atlantic Zone is Ratana. It is well adapted to infertile soils. The grass allows relative high stocking rates but the nutrituve value is often low.

The amount of external inputs differed between the farms but all the farms can be classified as having 'low external inputs'. Beef cattle farming is an extensive form of production. The production per hectare is low.

The major problem is the amount of feed available and the nutritive value of the grasses. For cria, poor state of forrages is reflected in a low reproduction of the cows and for engorde in a low live weight gain of the animals.

Personal

This practical period was my first experience with working in the tropics and in a multi-disciplinary project. It was a time I enjoyed very much. Although the collection of data was not always easy, the field work was a part of the work that gave me the chance to see more of the Atlantic Zone.

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1 Introduction

This practical period focussed on the characterization of beef production systems in the Atlantic Zone, Costa Rica. Until now, not much research on beef production has been done by the REPOSA project. Most important activity in the practical period was data collection.

1.1 REPOSA and the USTED methodology

The research was carried out within the context of REPOSA (REsearch Program On Sustainability in Agriculture).This program is a cooperation between the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Wageningen Agricultural University (WAU) and the Ministerio de Agricultura y Ganaderia (MAG) of Costa Rica. The program started in April 1986 and has a long-term objective in multidisciplinary research aimed at a rational use of the natural resources in Costa Rica, with emphasis on the small farmer. The main disciplines involved in REPOSA are soil science, agronomy, economics and marketing.

Since 1991, the research of REPOSA has focussed on the development of an interdisciplinary methodology, called USTED (Uso Sostenible de Tierras En el Desarrollo), for the evaluation of alternative land use scenarios. The methodology should generate alternative land use scenarios and evaluate them in terms of e.g. production and sustainability.

The frame work of USTED consists of the following modules:

1. A linear programming (LP) model, to calculate optimal land use given a goal, a set of constraints and a series of technical coefficients reflecting the options for land use. Goal and constraints can include socioeconomic and biophysical aspects.
2. A geographic information system (GIS), to facilitate storage and analysis of spatial data.
3. A data management tool, MODUS (MOdules for Data management in USted), to facilitate data transfer with USTED; and to calculate the technical coefficients for the LP model.

Inputs for MODUS are the discription of crop and livestock activities. Crops are described through a LUST (Land Use System at a defined Technology), which is a specific form of describing land use that includes a quantification of the technology (Jansen & Schipper, 1995). The body of each LUST description is formed by a chronological and quantative description of a particular operation sequence, that comprises at least one full crop cycle.

Apart from systems that use land, also systems using products of land use are recognized in USTED. Most important is APST (Animal Production System at a defined Technology). Like LUST's, APST's are a chronological sequence of quantitatively described operations.

USTED aims at the analysis of the effects of changes through e.g. policies on agricultural land use in a sub-region. It maximizes total net farm income in a sub-region on the basis of a set of constraints for different farm types and for the sub-region. The farm types are defined on the basis of farm size and soil distribution on the farm (Jansen *et al*, 1995).

Sofar this model was developed to analyze the Atlantic Zone. The model will now be run for a new research area, Guanacaste, with the idea to use as little data input as possible.

1.2 Objectives

The objective of my research is to characterize two beef production systems, breeding (cria) and fattening (engorde), in the Atlantic Zone. The characterization is expressed in APST's. An APST corresponds with an animal production system with a certain management. At least two APST's should be made: one for cria and one for engorde. If it is needed to make more than one APST per system because of a difference in management, these can easily be made using the already existing APST's.

1.3 Description of an APST

An APST describes the management of a herd and is made out of the following parts:

-identification section. Every APST has an identification section that contains the name of the APST, a description of the APST and a reference date.
-operation code. The main body of an APST description is formed by a sequence of operations (e.g. sowing or feeding animals). All the operations are given a code.
-date. Every operation is given a date.
-traction. A machine that provides power to equipment is called traction. Every type of traction is given a code (e.g. tractor or motorsaw). A maximum of two types can be indicated per operation.
-equipment. A tool that does not generate power is called equipment (e.g. syringe or salt trough). Also code a is given to the equipment and two types can be indicated per operation.
-code of material. This gives the code of the type of material. A material is defined as a good that is consumed during the operation, e.g. herbicides or medicins for animals. A maximum of two types of material can be indicated per operation.
-amount of material. This indicates the amount of material that is used in the operation.
-unit of material. This is the unit to express the amount of material.

The characterization is based on data collected through interviews with farmers. A large part of the time was used for gathering a complete data set so future fieldwork will be limited. The interview was designed to give a complete overview of the management aspects of the grasslands and herd. On basis of these interviews APST's were made.

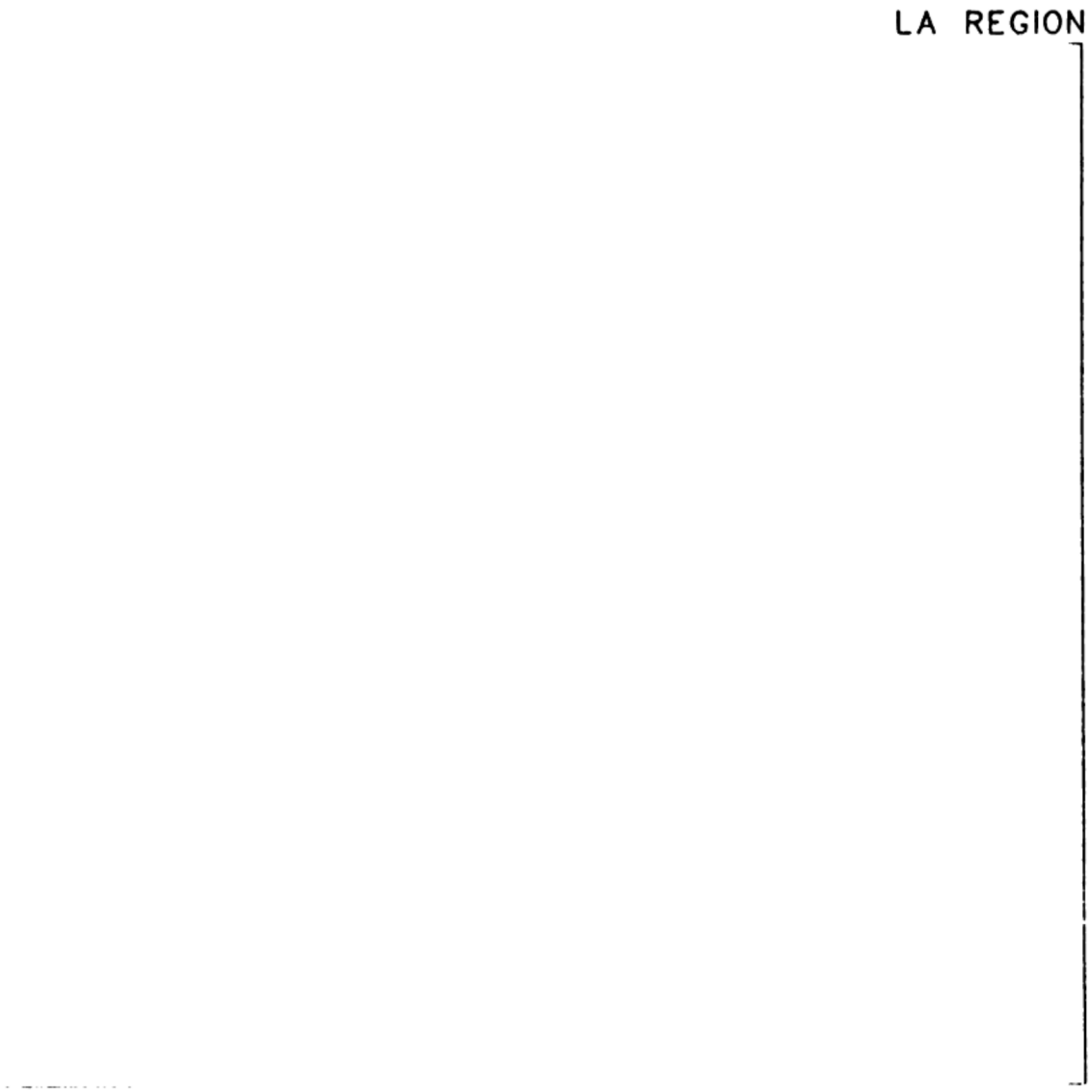
Pasture LUST's will not be made because of the limited time of the practical period. Nevertheless, part of the data needed for making LUST's were collected.

The APST's can be used in a linear program to calculate options for sustainable land use. This can be done with the LP-module of USTED.

2 The Atlantic Zone

2.1 Study area of REPOSA

The study area of REPOSA is defined as the province of Limón north of the 9°59' meridian and the eastern part of the province of Heredia, east of the river Puerto Viejo (continuing in the River Sarapiquí) (See Figure 1.). Total area is 540.000 ha (Stoorvogel, 1995).



2.2 Climate

The Atlantic Zone has a humid tropical climate. The mean annual rainfall varies between 3000-6000 mm. The months of February, March and April represent a relatively dry period with mean monthly precipitation between 100 and 300 mm.

The mean annual temperature is 26°C. Daily temperatures vary little, and differences in day and night temperatures are small (max. 12°C) (Huising, 1993).

2.3 Soils and the relation to land use

The soils of the Atlantic Zone have been described and clustered into three major soil types. The clustering was based on the fertility and drainage properties of the soils:

-fertile, well-drained soils (SFW) 138.000 ha
-fertile, poorly-drained soils (SFP) 171.000 ha
-infertile, well-drained soils (SIW) 145.000 ha

Peat soils (68.000 ha) and soils on volcanic ash (18.000 ha) at higher altitudes are excluded from analyses because of their very different chemical and physical properties and their limited relevance for land use.

These three soils types are called Land Units (LU's) and in combination with Land Use Type (LUT) they make a Land Use System (LUS). A LUS gives a description of land use on LU level. The term 'Land Use System at a defined Technology" (LUST) is a specific form of describing land use that includes a quantification of the technology.

For specific information on soils of the Atlantic Zone, see Nieuwenhuyse, 1996.

2.4 Land use

Although the area under grazing land in Costa Rica has increased during the last 30 years, the beef production has not shown a great increase in this period because it is an extensive form of production with low production per hectare (Aragón, 1992). The most important economic activity in the Atlantic Zone is banana production, which occupies less then 10% of the area. Cattle farming is the second most important economic activity. It is estimated that about half of the zone is used for grassland, although great differences exist between grass species and presence of shrubs and trees.

Other important crops in the Atlantic Zone are plantain, cocoa, pejibaye/palmito, maize, ornamental plants and cassava.

3 Animal production in the Atlantic Zone

3.1 History of the animal production in the Atlantic Zone

In the beginning of the development of the cantons of Guácimo, Pococí and Siquirres (See Figure 1.), approximately 80 years ago, the most important agricultural activity was animal production. The market for crops and animal products was located in the Central Valley, which was too far away. The only product that could be sold there was live cattle. At the end of the sixties animal production in the north of Guápiles began to develop. Animal production to the north of Las Palmitas and in the area of Barra Tortuguero began to develop more recently (Hijfte, 1989).

In the beginning of the eighties the export of beef started to decrease, especially to the United States. The reduction was due to the strong competition on the international beef market and restrictions on the import of meat in the USA (Hijfte, 1989 and Paz, 1996). To increase their income, the farmers started milking their cows. Since the opening of the San José-Limón highway in 1987, the markets for milk and meat are more accessible (Koffeman, 1989).

3.2 Animal production systems

Beef cattle farming is the most important animal production system in the Atlantic Zone (66% of the animals). Other systems are dual purpose (19% of the animals) and milk production (11% of the animals). The production of veal consists of only 3% of the animals in the province of Limón (Table 3.1).

Table 3.1 Division of animals by production purpose in the province of Limón (1991).

	meat	milk	dual purpose	calf	oxen	total	%
Central	5,244	1,109	3,599	232	77	10,261	7
Pococí	40,617	4,837	11,133	1,533	234	58,379	41
Siquirres	14,459	4,015	6,291	693	126	25,584	18
Talamanca	4,214	601	1,108	205	33	6,616	4
Matina	4,880	1,218	1,820	262	28	8,208	6
Guácimo	24,720	4,850	4,850	703	103	34,948	24
Total	94,134	26,801	26,801	3,653	606	143,541	100
%	66	11	19	3	0	100	

Source: Jansen and Tilburg, 1996.

Dairy farming in the Atlantic Zone is dominated by relative large-scale farmers and a relatively high level of technology (i.e. mechanized milking, use of concentrate feeds and regular veterinary controls) (Jansen and Tilburg, 1996). Breeds that are used are almost pure Holstein-Frisians, Yersey and Brown Swiss. Milk production per animal is about 7 liters per day (Urgiles, 1996).

Dual purpose is a system characterized by production of milk and calves. The calves can drink milk and some of the milk is milked. (Aragón, 1992). Milk production is about 3-4 liters a day. The milk is used in the household or sold. Many farmers also produce cheese.

Beef production systems can be divided in breeding ('cria'), early growth ('desarrollo') and fattening ('engorde') (Aragón, 1992). It is common that farms are specialized in one of the systems. Although, they may be mixed within one farm.

In the Atlantic Zone also a combination of the following cria and engorde systems can be found:

- cria+engorde: the male calves that are born on the farm are, after weaning, put in a separate group to be fattened (450-500 kg).
- cria+engorde and buying of male animals: same as cria+engorde but also male animals of 200 kg (8 months) are bought and fattened.
- cria+desarrollo: same as cria+engorde but fattening up to ±350-450 kg.
- cria+desarrollo and buying of male animals; same as cria+engorde+buying of male animals but fattening up to ±350-450 kg.

Cria is rearing of male calves, which are sold at 8 months and approximately 200 kg. A number of the female calves and older unproductive cows are sold to keep a stable herd. Calves are sold at the cattle auction (subasta) or to cattle traders (middle-man). Important in cria systems is to reach a good reproduction of the cows.

Desarrollo/engorde farmers buy weaned male calves and fatten them. In desarrollo they are kept to a weight of ±350-450 kg at approximately 20-26 months. In engorde they are fattened to ±450-500 kg at 26-36 months. Fattened steers are sold at the cattle auction, middle-man or to a slaughterhouse. A high live weight gain is important in desarollo/engorde systems.

Desarrollo is not much practised in the Atlantic Zone. In practice there is no clear difference between desarrollo and engorde. For this reason, only the terms cria and engorde are used for this research. Engorde, in this report, will refer to a system of fattening animals up to a weight of 400-500 kg.

3.3 Grasslands

Most common grass species in the Atlantic Zone are Ratana (*Ischaemum ciliare*) and native species (*Axonopus compresus* and *Paspalum conjugatum*) (Table 3.2). The table is given for the planning region Huetar Atlantica. Huetar Atlantica is part of the Atlantic Zone.

Table 3.2 Division of grass species in Regio Huetar Atlantica.

	Area (ha)	%
Total	329,825	100
Naturalized & native	253,966	77
-Ratana	89,143	27
-Native	117,719	36
-Other (incl. Tanner)	47,165	14
Sown grasses	75,860	23
-Brachiaria spp.	21,371	6
-Estrella africana	44,716	14
-Other	9,565	3

Atlas Agropecuaria de Costa Rica, 1994.

Ratana was introduced in 1977. It is a persistent species which gives a good, close ground cover (Hijfte, 1989). Once established, it never has to be sown again. It is adapted to soils with a low fertility as well as to rather poor drainage and allows a relatively high stocking rate without causing damage to the grass. Because Ratana gives a dense ground cover, there are little or no weeds.

The tendency in pasture development is an increase in the area of Ratana. Sown species, like Estrella, diminish in area because of the strong competition of Ratana. *Brachiaria brizantha* is a species that is recently introduced in the Atlantic Zone. *Brachiaria brizantha* does not grow well in very humid parts or on soils with a low fertility. Because of the high rainfall in the Atlantic Zone and the extensive ocurrance of such soils in the study area, the persistence of is a problem. Also the attack of fungus during the wet periods, which is detected recently causes problems for the persistence of *Brachiaria brizantha* (S. Abarca, pers. comm.).

Brachiaria brizantha gives the highest production in the wet as well as the dry season (Table 3.3). The production of natural grasses and Ratana is low compared to other species. This means that on Ratana and natural pastures less animals per hectare can be held than on other types of pasture. The differences in nutritional value between Brachiaria species and Ratana are little. The young leaves of Ratana is feed of good quality. Important problems are overgrazing and the flowering of Ratana which reduces the overall nutritional value of the pasture. The production per hectare of the animal systems on Ratana and natural species are low.

Table 3.3 Production and quality of pastures in the Atlantic Zone

Pasture	Dry matter[1] (kg/ha) dry	wet	%DMD[1]	%CP[1]	P[1]	K[1]
Natural	1523	1821	52.0	6.61	0.14	1.07
Ratana	1910	1100	59.5	10.23	0.12	1.76
Tanner	1880	1500	56.3	7.90	0.13	2.68
Estrella	1763	1312	56.1	9.98	0.15	1.87
Br. brizantha	3835	2095	65.0	9.70	0.13	2.68
Br. ruziziensis	3603	1548	62.8	9.50	0.14	2.68
Br. decumbens	2218	1750	61.8	11.00	0.13	2.68
Aleman			-	10.58	0.14	2.25

Sources: Vargas and Fonseca, 1989. Atlas Agropecuaria de Costa Rica, 1994.
M. Hernandez, MAG Guápiles, pers. comm.

[1] Dry matter production for the dry and wet season; DMD=dry matter digestibility; CP=crude protein; P= phosphorus; K=potassium.

Feed quality has also an effect on reproduction. Feed of low quality lowers the reproductivity (see 3.5).

Estrella africana and recently *Brachiaria brizantha* is used to improve the pastures. Other species are not much used. Improved pastures produce a higher dry matter production and have a higher nutritive value. Many farmers know that the technology of improved pastures exists, but they think it is difficult to do. Lack of enough knowledge and experience are two reasons why the farmers do not adopt the new technology. Some farmers think that their production level is already sufficiently high or that there is no market for the increased output. High establishment costs is also a reason not to sow improved grass species (Joenje, M., 1996).

LUST descriptions have to be based on the Land Unit (LU) and type of pasture. For the grass species that are common in the Atlantic Zone, the soils types on which they can grow have been identified as follows:

-Natural: SFW, SFP[1]
-Ratana: SFW, SFP, SIW
-Tanner: SFP
-Estrella: SFW, SFP
-Br. brizantha: SFW
-Br. ruziziensis: SFW, SFP
-Br.decumbens: SFW
-Aleman: SFP

[1]SFW=soil fertile, well drained; SFP=soil fertile, poorly drained; SIW=soil infertile, well drained.

3.4 Breeds

Zebu cattle (*Bos indicus*) is the most common livestock in the tropics. It is a species well adopted to the climatical conditions of the tropics and subtropics.

For meat production the most common breeds are Brahman, Indobrasil, Nelore and Gyr. Also crossings between Zebu and 'criollo' or European breeds occur frequently. This gives an animal with a good adoption to the climate and a good corporal development (Castro Ramirez, 1984).

3.5 Reproduction

From the point of view of a cost-effectiveness a high reproduction is very important. This is often a problem in The Atlantic Zone. There are several reasons for the low reproductivity for the cows:

1. Zebu-bulls are slow breeders. There is reason to believe that Zebu-bulls are slower in their reaction towards cows in estrus and in accomplishing mounting behavior when compared to *Bos Taurus*. For a good reproduction of the cows, it is important to keep this in mind when deciding the bull to female ratio. About 85% of Zebu breeding in the tropics occurs by natural mating. Approximately 30% of the bulls used for breeding have reproductive problems (Galina *et al*, 1993)
2. age at first birth of cows is high. For the Atlantic Zone, the age at which the Zebu-cow first reproduces is about 36 months (Taylor, 1994)
3. nutrition. It is important that a cow during gestation and lactation does not loose weight. When a cow does loose weight during gestation or lactation the ovaric activity after birth of the calf will be retarded and the interval between births will be large (Galina, n.d.)

A common practice is 'continuous' mounting. The bull is always with the cows, so their is no control over mounting period. Because of the problems with reproduction the MAG promotes a system of controlled mounting. The bull is only for a selected period of the year with the cows. Mounting takes place in that time of the year that cows are in good condition. The time when the calves will be born (when there will be enough forage until weaning) can also be selected. So far, no results about the controlled mounting practice are published.

The mortality rates for calves in the Atlantic Zone is 6-8% and for older animals 1 %.

4 Materials and methods

4.1 Selection of the farms

The interviews were held with cria-farmers and (cria-)engorde-farmers. The selection was made on basis of the expert knowledge of the people of the extension offices of MAG in Siquirres, Guácimo and Guápiles. The farms were selected on size (no very large farms, e.g. more than 500 ha) and suitability for the interview (if they kept records etc.). Carlos Aragón of REPOSA and the workers of the extension offices assisted in the fieldwork.

4.2 Interview

The interview is divided in general, technical and socioeconomic information (See Annex 1). It covers aspects of herd and pasture management.

4.3 Selection of a typical finca

To make an APST, the description of a typical farm on basis of the interviews is required. A typical farm for both systems was choosen from the interviews. This was done by comparing management aspects of the herd. However, the APST description is not necessarily an exact copy of the management of the typical farm. Some management aspects have been modified after practices found on other farms. When large differences occur within a production system (cria or engorde), more then one APST should be made. The difference can be the amount of external inputs or size of the farm and the related management.

4.4 Herd description

Before making the APST, the composition and structure of the herd needs to be known. For the herd, the nutrient requirements need to be calculated. The tables of the National Research Council (NRC, 1989) were used. These requirements are a part of the APST. For the herd description and calculations of stocking rate, Tropical Livestock Units were used (Table 4.1). A Tropical Livestock Unit is related to the metabolic weight of the animal. One TLU is an animal of 400 kg and a metabolic weight of 89,44 kg (400 to the power 0,75). The conversion is as follows:

Table 4.1 Conversion of body weight to TLU.

Animal	Body weight (kg)	Metabolic weight (kg)	TLU
female calf	100	31.62	0.35
female 1- 2 yrs	225	58.09	0.65
female 2-3 yrs	400	89.44	1.00
cow	400	89.44	1.00
male calf	115	35.12	0.39
male 1-2 yrs	350	80.92	0.91
male >2 yrs	500	105.74	1.18
bull	500	105.74	1.18

4.5 APST description

The APST's are made according to the procedure described in the Introduction. Most operations can be described in a single line but when the operation is complex (e.g. a combination of operations) more than one line can be used. The APST's are made in the spreadsheet program EXCEL.

4.6 Attribute files

The codes that are given to operation, equipment, material and unit correspond with the attribute files. These files contain information about actual prices, units, lifetime of materials, amount of material and when necessary the amount of labor. New codes that are used in the description of the cria and engorde APST and that are not in the existing attribute files can be found in Annex 2. These codes need to be added to the attribute files.

5 Results

5.1 Fieldwork

A total of 23 interviews were held, from June 17 until August 2, 1996. Five of these interviews were not used for the data set because they were incomplete.

The interviews were held at the farm house, and when possible, the fields were visited. Attention was paid to the pastures (weeds and grass species), to the fences (how they were constructed), and to the animals (what shape they were in). In this way, the answers of the farmers where checked and more about pastures and herd could be asked. Out of the remaining 18 interviews, four were selected to be visited again. Doubts and questions that remained after revising the interviews were cleared.

The APST's are based on these interviews. Management of the herd, in general, did not vary very much between farms, so it was decided to describe only one APST per system. No use was made of statistical programs or other methods, because only 18 interviews were availabe so that the reliability of the statistical calculation would not be very high. It was thought that common sense would be just as good as statistical programs and it would save a lot of work.

5.2 General

The animal production systems are found in the whole Nothern Atlantic Zone. The pastures are found on fertile 'black' soils (SFW), fertile soils having drainage problems (SFP) as well on infertile 'red' soils (SIW). The area under pasture of the farms varied from 7 to 400 ha. In total 7 engorde farmers and 11 cria farmers were interviewed.

In this report, summaries of the interviews of 3 engorde farms and 2 cria farms are given (see Annex 3). Unclear or incomplete information is left out. In Annex 4 prices, quantities and units of different products used at the farm (herbicides etc.) are given.

5.2.1 Pastures

The average area of pasture for engorde farms is 144 ha and for cria farms 64 ha. Stocking rate is lower for engorde farms than for cria farms (resp. 1,40 TLU/ha for engorde and 1,90 TLU/ha for cria). The lowest stocking rates (0,87 TLU/ha) was found on an engorde farm. When engorde and cria were present together, the stocking rate was higher than for systems with only engorde.

The common pasture types in the survey are Ratana+Natural and Tanner (Table 5.1).

Table 5.1 The division of pasture types (%) and the stocking rate over the two production systems on the investigated farms

Pasture type	Engorde	Cria
Natural+Ratana	68	73
Tanner	22	12
Estrella	3	10
Others	7	5
TLU/ha	1.4	1.9

Tanner is a species that grows well on 'wet' soils. The percentage of Tanner is high for the engorde. This is because two of the nine interviews were held in Palacios, which is a part of the Atlantic Zone which is dominated by fertile, poorly drained soils. Tanner is planted on those two farms. One other farmer planted Tanner.

Estrella is a species that is planted. Only one farmer has planted Estrella this year. Most of the Estrella that is present now, was planted a few years ago and will be gone in a few years. Ratana will take over the place of Estrella.

Only two farmers classified their soils as 'red', infertile soils. The pasture type on those soils was Ratana. Other farmers classified their soils as good for pasture. All the above mentioned grass species grow on these soils.

Only one farmer uses fertilizers for his pasture. It is applied to a small plot of *Brachiaria brizantha*.

5.2.2 Weed control

From the interviews, it can be deduced that a weed control with herbicides in combination with chapias (cutting and pulling out of weeds) is done normally. One to three times a year the weeds are controlled with chapias. Herbicides are applied after a chapia, once or twice a year. However, some farmers have a less strict weed control (e.g. interview 20, Annex 3). A mixture of herbicides, which consists of 2,4 D and Tordon 101 is used most often. The ratio of 2,4 D en Tordon 101 in the mixtures varies from 4:1 to 1:1. The quantities applied per hectare also varies. Against persistent broad-leave weeds, Combo is sometimes used. Other products that are used are Diuron, Kuron and Gramoxon. These products, are used only to kill the most persistent weeds. They kill all vegetation, including grass. These products are used in only small amounts.

5.2.3 Fences

The most common type of fence is a combination of dead and living posts. The living posts that are most common used, are Madero negro (*Gliciridia sepium*) and Poró (*Erytrina spp.*). Most common dead posts are Gavilan (*Pentaclethra macroloba*) and to a lesser extent Manu platano. The posts are obtained on the farm or are bought. The distance between the posts differ between farms. Approx. 20 to 50 dead posts combined with approx. 50 to 100 living posts are put in 100 meters of fence. The number of barbed wires is put at 3 for the internal fences and at 4-5 for the external fences. Most often Caiman wire is used.

5.2.4 Healthcare

All the farmers inject their animals with Bacterine Doble. B. D. is a vaccination against septicemia (cattle fever, caused by the bacteria *Pasteurella multocida*, type1) and pierna negra (black leg, caused by the bacteria *Clostridium chauvoei*). The vaccination is given twice a year. Few farmers give it only once a year. A vaccination against Brucellosis (Brucellosis abortus) for the cows is also common practice. The vaccination is given to female animals younger than one year.

Dectomax, Duotin and Ivomec are the most common products used against internal and external parasites. Dectomax or Ivomec is given to newly born calves. Young animals are vulnarable to parasits so regular use (every two months, for some time) of these products is required. Older animals are injected twice to four times a year. Against external parasites only, the animals are regularly sprayed with the products Neguvon and Nuvan (2-6 times a year).

Vitamins are used only by a few farmers.

5.2.5 Reproduction

The reproduction of the cows varied between 73-100%. Reproduction is defined as number of calves born per year, devided by the number of cows. The highest reproduction (100%) was found on a farm with 15 cows. Second highest reproduction (91%) was found on a with farm of 11 cows. Not all farmers kept a register so that these figures are not very reliable.

The mortality rates corresponded with the rates already reported as general for the Atlantic Zone (6-8% for calves and 1% for older animals).

5.3 APST's

Two APST's are made. One for engorde and one for cria. Both APST's can be combined to make one cria-engorde APST.

5.3.1 APST for engorde (fattening)

The engorde APST was made by using two interviews (no. 6 and no.21). These were chosen because the management of the herd was considered to be representative for the engorde systems. The APST is a synthesis of the two farms. In Annex 5 the APST of engorde is presented.

Herd

The herd consists of 120 male animals. They are divided into three groups of 40 animals each. The groups have at the beginning a mean body weight of resp. 225 kg 300 kg and 375 kg. Animals are bought at a weight of 225 kg and sold after 15 months at a weight of 450 kg. A live weight gain of 500 g/day is kept constant over these 15 months. A constant live weight gain is a simplification of the reality because live weight gain is not constant but decreases with increasing body weight and thus with age.

A farmer may loose an animal once in a while. For instance, animals may die of diseases, brake a leg or may be bitten by snakes. This was taken into account by selling once a year a group of only 39 animals instead of 40 animals.

Corral

At the beginning of the APST a corral of 150 m^2 suited for 50 animals is build (See Annex 7). This corral is chosen because a herd size of 50 animals is consiserd to be easily manageble. If groups are larger, attention to the animals individualy may become suboptimal. The corral is build with manu negro wood. The costs of a corral without a roof (as calculated by A.Nieuwenhuyse and C. Aragón) are $1480,- US (310875 colones, price at the beginning of august 1996). The costs of a roof are $1348,- US (282820 colones). For the APST a corral with a roof is chosen. The lifetime of the corral is estimated at 30 years. The corral can be build by two man.

Salt troughs

At the beginning of the APST 9 salt troughs are build. Every field has a salt trough. The troughs are made of wood and have a zinc roof. Costs of a salt trough are $20,- US (price at the beginning of August 1996). The troughs need to be replaced every 10 years.

Calculation of the nutrient requirements

For the herd the required metabolizable energy (MCal), crude protein (kg), dry matter (kg), neutral detergent fiber (kg) and phosphorus requirements were calculated. The calculations of the metabolizable energy, crude protein and phosphorus were made with the tables of the National Research Council (NRC, 1989). The nutrient requirements depend on body weight, live weight gain and reproduction (Table 5.2). The tables for small breed growing males were used. These tables were chosen because they correspond best with the breed of the animals that is used in the production system.

It is assumed that the herd composition during the 15 month period (in which the APST is made) does not vary much. For this reason the animals are divided in three groups according to age and the mean body weight over 5 months is calculated.

Table 5.2 Daily nutrient requirements for steers of different weight per day.

Body weight (kg)	LWG[1] (g/day)	ME[1] (MCal)	CP[1] (g)	P (g)
262.5	500	12.77	625.3	16.3
337.5	500	15.55	794.0	17.8
412.5	500	17.86	981.0	19.0

NRC, 1989.

[1] LWG=live weight gain, ME=metabolizable energy, CP=crude protein, P=phosphorus

The requirements of metabolizable energy and crude protein for the APST are calculated for the whole herd for one month. The herd needs a minimum of 55416 MCal of metabolizable energy and 2880 kg of crude protein per month.

Phosphorus can be in short supply in the diet of the animals, because of the poor nutritive value of the pastures. Phosphorus is important in the formation of strong, healthy bone in the growing animal. Phosphorus deficiency, which is relatively common, causes reduced growth rate and appetite, reduced milk production in the lactating cow and consequent decreased growth rate of the calf prior to weaning (Hill, 1988). The requirement of phosphorous of the herd is 63,6 kg per month.

The intake of dry matter is put at 2.5% of the body weight (Table 5.3). This is a maximum, so that not more than 2.5% of the body weight of dry matter can be eaten by the animals.

The amount of what the animal will voluntarily consume is affected by various factors. Intake depends on the quantity of herbage on offer. Cattle consume more when availability of herbage is high. Intake is also dependent upon lenght of grazing time. When grazing time is reduced (e.g. during hotter times of the day when animals have to seek shade or if they are not allowed to access pasture) the intake is naturally diminished. High temperatures also have a depressant effect on intake as do inadequate supplies of water. Low intake is associated with low levels of digestibility and protein levels. The low digestibility is associated with slower rates of passage through the gut. This occurs with increasing cell wall content of feeds. The low level of protein occur possibly because of a reduction in the rate of cellulose digestion. It is apparent that many factors associated with mature grasses in the tropical environment leads to decreased forage intake (Hill, 1988). An other factor influencing dry matter intake is the breed of the animal.

Table 5.3 Dry matter intake of steer of different weight (kg/day).

Body weight (kg)	Dry matter intake (kg/day)
262.5	6.56
337.5	8.44
412.5	10.31

Per month the herd needs 30375 kg of dry matter.

Supplementation

Per month 90 kg of common salt is given to the 120 animals (0.75 kg per animal per month). The common salt is mixed with mineral salt (30 kg per month or 0.25 kilo per animal per month). Mineral salt contains minerals that the animals need for their metabolism and that can be in short supply in the grasses. Furthermore, 110 liters of melasse (a by-product of the sugar cane industry) are given per month (0.92 liter per animal per month), mixed with common salt and mineral salt to make the salt more palatable for the animals (prices in Annex 4).

The operation of mixing common salt, mineral salt and melasse and bringing it to the field is combined with bringing the animals to an other field. Per month this operation requires 10 hours of labor.

Health care

When new animals enter the farm they receive a treatment of several injections. The animals are injected with Bacterine Doble, Dectomax, Vitacon (an injection with several vitamins) and B12-complex (vitamin), (total required labor for these operations is 8 hours). The animals that are longer on the farm also receive this treatment but they are not injected with B12-complex.

Bacterine Doble and Vitacon are injected every 5 months. A treatment against internal parasites is given every 3 months. Products that are used are Dectomax, Panacur and Albendazole (total required labor per operation is 2 hours). Four times per year the animals are sprayed against external parasites with a mixture of Neguvon and Nuvan (total required labor is 3 hours). For these treatments the animals are brought to the corral. Quantities and prices are given in Annex 4.

Selling and buying of animals

Every 5 months 39 or 40 animals of approximately 450 kg are sold. The are taken to the subasta with a truck which is rented. Also every 5 months a group of 40 steers of 225 kg are bought. Subasta prices are given in Annex 4.

5.3.2 APST for cria (breeding)

The cria APST is mainly based on interview no. 20. This farm represents a farm with low external inputs but some adjustments have been made to make it more representative for the whole region. Still the management of the herd is of low input. More intensively managed farms have a better health care and/or give more supplements. In Annex 6 the APST for cria is presented.

Herd

The herd dynamics of a cria herd is more complicated than of the engorde herd. Calves are born throughout the year and the animals are sold throughout the year.
The herd is composed of about 40 cows and 1 bull (Table 5.4). In one year 14 female calves and 15 male calves are born. The bull is not included in the calculation because it is changed only once every 2-4 years. Common practice is to change an older bull (with destination slaughterhouse) for a younger bull. All the male calves and 6 of the female calves are sold at weaning (approx. 200 kg for males and approx. 175 for females). Of the 8 female calves 5 are selected to become cows and the other 3 are sold at an age of 2.5 years. Each year 5 old cows (of 8 years or more) are sold and 5 young cows enter the group. Mortality of adult animals is set 1 female animal between 1-2 yrs per year. Mortality of calves is taken into account in the number of calves which are born every year. The birth rate is set somewhat lower than actually occurs because almost every year some newly born calves die.

Table 5.4 Number of animals in the herd throughout one year.

Month	female calves	female animals 1-2 years	female animal 2-3 years	cows	male calves	bull
January	7	8	8	40	7	1
February	8	8	8	40	8	1
March	8	8	9	41	8	1
April	8	8	9	42	10	1
May	9	8	10	42	13	1
June	9	8	10	43	15	1
July	6	8	10	44	8	1
August	6	8	11	45	9	1
September	8	8	11	45	12	1
October	8	8	8	40	12	1
November	9	7	8	40	13	1
December	7	8	8	40	7	1

Changes over the year are adjusted to availability of pasture: during the period Dec.-Feb. pasture growth is relatively slow, thus in that period the herd consists of a relatively low number of animals. Live weight gains differ for every group. For the calculation of the nutrient requirements an 'average' herd over the year is used. The total number of animals per class per year is calculated and divided by 12. Nutrient requirements are calculated for one month.

The female animals that are in the group of 2 to 3 years are the animals that can bear a calf for the first time. Percentage of reproduction (no. of calves born/no of cows) is 73%.

An extra operation in the management of a cria herd is the assisting at the birth of the calves and desinfection after birth.

Corral

For the cria APST a corral with roof was chosen. Newly born calves need to be protected against rain. The same corral as in the engorde APST is used (150 m^2).

Salt troughs

At the beginning 6 salt troughs. Every field has a salt through. They are bought at a price of $ 20,- US (August 1996). They are made of zinc and need to be replaces every 10 years.

Nutrient requirements

The same procedure as for the engorde herd was followed. Metabolizable energy (MCal), crude protein (kg), dry matter intake (kg), phosphorus (kg) and neutral detergent fiber (kg) requirements were calculated for the herd for one month.

The live weight gains depend on age, weight and sex. Calves have a high live weight gain and male calves grow faster than female calves. The live weight gain diminishes when the animals get older. The nutrient requirements of mature bulls and cows are decided by their requirements for maintenance. For cows in production extra nutrients are required for gestation or milk production (Table 5.5).

The tables for small breed animals and the table for lactating and pregnant cows were used.

Table 5.5 Metabolizable energy (MCal) and crude protein (g) and phosphorus (g) requirements per day.

Animal	Body weight (kg)	LWG[1] (g/day)	ME[1] (MCal)	CP[1] (g)	P (g)
Female calf	100	550	7.22	440	8.50
Female 1-2 yrs	225	325	10.38	513	13.00
Female 2-3 yrs[2]	400	maint.	15.26	890	16.00
Cow[3]	400	maint.	15.46	570	16.49
Male calf	150	600	9.16	563	11.00
Bull	600	maint.	18.10	905	15.00

NRC, 1989.

[1] LWG=live weight gain, ME=metabolizable energy, CP=crude protein

[2] Maintenance plus last two months of gestation

[3] Maintenance plus production of 3 liters milk per day with 3.5% fat

The body weights of the animals were calculated from data of the MAG (MAG, 1993) and the interviews. Per month the herd needs 31104.3 MCal of metabolizable energy, 1360 kg of crude protein and 34 kg of phosphorus.

The neutral detergent fiber was calculated (Table 5.6). The requirement of neutral detergent fiber depends on the age sex and body weight.

Table 5.6 Minimum requirements of neutral detergent fiber (g) per day.

Animal	Body weight (kg)	Minimum NDF[1]/ 100 kg BW[2] (g)	Minimum NFD/ day (g)
Female calf	100	0.175	0.175
Female 1-2 yrs	225	0.175	0.394
Female 2-3 yrs	400	0.160	0.640
Cow	400	0.130	0.520
Male calf	150	0.175	0.263
Bull	600	0.160	0.960

Reid *et al*, 1988 and Paz, 1996.

1 NDF=neutral detergent fiber

[2] BW= body weight

The requirement of neutral detergent fiber for cows is lower than of other animals because for cows in production the requirements of crude protein and energy needed for milk production are more important. The calves and females of 1 year old require more neutral detergent fiber. It is needed for the development of the rumen of growing animals (Paz, 1996).
For one month, the herd needs 1071 g of neutral detergent fiber.

Dry matter intake was set at 2.5% of the body weight (Table 5.7)

Table 5.7 Dry matter intake (kg) per day.

Animal	Body weight (kg)	Maximum dry matter intake (kg/day)
Female calf	100	2.5
Female 1-2 yrs	225	5.6
Female 2-3 yrs	400	10.0
Cow	400	10.0
Male calf	150	3.8
Bull	600	15.0

Per month the herd needs 18375 kg of dry matter.

Supplementation
All the animals receive a mixture of common salt, mineral salt and melasse. Per month 60 kilos of common salt, 6 kilos of mineral salt and 70 liter of melasse is given to the animals. The ratio common salt to mineral salt is low (10:1) but this often found in low input systems.

Health care
All the animals are given the vaccination Bacterine Doble twice a year. The female animals that stay on the farm and some others are vaccinated against Brucellosis. The new born calves (<1 month) are injected with Dectomax and it is repeated at 3 and 5 months. Other animals are injected with Panacur or Ripercol twice a year. For external parasites Butox and a mixture of Nuvan and Neguvon is used. the animals are sprayed six times per year.

After birth the calves, the umbilicus is disinfected. Per year a cows needs to be treated, for what ever reason, with Emicina (antibiotic). Quantities and prices are given in Annex 4.

Buying and selling of animals
Animals are not bought because the system breeds females animals. All male calves are sold at weaning (8 months). In total 5 female calves, 3 females between 1 and 2 years and 5 cows are sold. The calves and young cows are sold at the subasta. The cows are sold at a age of 11 years (after 5-6 births). The cows are sold to Coope Montecillos (slaughterhouse).

6 Discussion and conclusions

Beef cattle production can be found in the whole of the Atlantic Zone, on all the soils types. Even on the unfertile, well drained soils ('tierras rojas') grass growth is still possible. The production is not high but stocking rates are adjusted to that. These soils are not suited for most annual and perennial crops. The most common grass species is Ratana.

The farm size of the cria-farms is smaller and the stocking rate at these farms is higher compared to engorde-farms. For engorde the live weight gain of the animals is most important. When the animals are put under stress (e.g. reduced feed availability, inadequate healthcare) a reduction in live weight gain can be observed.

Because of the importance of live weight gain the stocking rate is lower than for cria. When animals in the cria system are put under stress, the visable effects are not as obvious as the effects on the engorde system. A reduction in the availability and nutritive quality of the grasslands causes the cows to loose weight during gestation and lactation. It takes some time before the cows are ready for the next gestation. The amount and quality of the feed is a major factor affecting the reproduction rate of the cows. Factors like an inadequate healthcare, cow:bull ratio and mounting practice are factors that also affect the reproduction. A low reproduction rate of the cows can not be observed easily. A good insight in reproduction can only be given when the farmers keep an accurate record of births.

The management of the pastures and the herd differs between the farms. None of the farms are of 'high input', but still the differences in the amount of inputs are large. Improvement of pastures is little practiced. There are possibilities for improvement but still little is known about the persistence of improved grass species. This seems to be a problem in the Atlantic Zone.

For describing APST's and LUST's an accurate data set is needed. The collection of these data is a problem. The farmers were not always able to give figures on amount of herbicides, amount of labor etc. After revising the interviews it was often found that data were incomplete or lacking. The verification of the data is also a big problem. It is impossible to verify all the data that a farmer gives. Only few farmers keep records of the herd dynamics and amounts of products that they use for the herd and the pasture. And even if the farmer keep a record, the record is not very exact. The problem of the data collection is not a new problem. Many people have dealt with this problem and it is still difficult to collect data with interviews.

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Annex 1 Interview

REPOSA

CATIE - UAW - MAG

FORMULARIO DE ENCUESTA
Sistemas de producción animal
junio 1996

No. de encuesta: . . . . . .

Fecha: día . . . . . mes . . . . . año . . . . . .

Nombre del gandero: . . . . . .

Provincia: . . . . . Cantón . . . . . Distrito . . . . . .

A. INFORMACION GENERAL

1. Area de la finca: . . . . . (ha)

2. Area de pasto: . . . . . .(ha)

3 Otras actividades en la finca . . . . . .
. . . . . .
4. Otras actividades aparte de la finca . . . . . .
. . . . . .
5. Suelos con pastos: Que tipo de suelos tiene su finca: . . . . . .
. . . . . .
Que piensa sobre la calidad de sus suelos: . . . . . .
. . . . . .
. . . . . .

B. ASPECTOS TECNICOS

1. Manejo de pastos:

Manejo de pastos	Area (ha)	Especie	No. apartos	Tipo pastoreo	Tiempo pastoreo	Días descanso
Pasto natural						
Pasto mejorado						
Asociaciones						
Sitios						
Tacotales/ charrales						
Pasto para heno/ensilaje						
Otros pastos						

2. Meses de abundancia de pasto: E F M A M J J A S O N D

3. Meses de escasez de pasto: E F M A M J J A S O N D

4. Establecimiento de pasturas:

Preperación del terreno: manual □ : tracción animal □ : tracción mecánica □

Desmonte □ : Quema □ : Otro . . . . . .

Tipo(s) de herramientas . . . . . .

. . . . . .

Cuándo prepara el terreno (cada año?) . . . . . .

Aplicación de herbicida: antes □ : después □ : de preparar el terreno (no uso regular!): . . . . . .

Que producta(s) usa: . . . . . .

Costo de herbicida: . . . . . .

Costo de mano de obra: -Desmonte manual . . . . . horas o ¢/ha
Equipo: . . . . . .
-Desmonte máquina . . . . . horas o ¢/ha
Equipo: . . . . . .
-Preparación manual: . . . . . horas o ¢/ha
Equipo: . . . . . .
Preparación mecanizado: . . . . . horas o ¢/ha
Equipo: . . . . . .

Costo de herramientas . . . . . ¢
. . . . . .

Costo de semilla . . . . . ¢/kg
Costo de mano de obra para sembrar . . . . . .
Equipo para sembrar . . . . . .

5. Usa fertilizantes? . . . . . .

Tipo de fertilizante	Nombre	Cuándo y cuántas ha	Cantidad sacos (....kg)
Orgánico			
N-fertilizante			
P-fertilizante			
K-fertilizante			
N-P-fertilizante			
N-P-K-fertilizante			
Otros			

Costo de mano de obra de fertilización: . . . . . horas/h o ¢/ha
Equipo . . . . . .

6. Como controla la maleza: manual □ : químico □ : mecánico □
   Tipo de equipo de aplicación . . . . . .
   . . . . . .
   Nombre de herbicida(s) . . . . . .
   . . . . . .
   Cuántas veces controla en el año . . . . . .
   Cuándo aplica herbicida(s) . . . . . .
   . . . . . .
   Cuántas hectáreas . . . . . .
   Cantidad aplicada cada vez . . . . . .
   . . . . . .
   Costo de herbicida(s) . . . . . ¢/kg /l
   . . . . . .

   Costo de mano de obra de aplicación de herbicida . . . . . horas
   o¢/ha . . . . . .
   Costo de equipo . . . . . .

7. Costos de establecimiento de cercas:
   Tipo de postes: vivos : □ Tipo de plantas/árboles: . . . . . .
   muertos : □
   Cuántos apartos tiene su finca: . . . . . .
   Cuántos rollos de alambre y que marca para construir las cercas: . . . . . .
   Cuántos hilos: . . . . . .
   Costo de alambre: . . . . . .
   Cuántas grapas para construir las cercas: . . . . . kg
   Costo de grapas: . . . . . ¢/kg
   Cuántos postes (por km.) y costo:
   muertos: . . . . . .
   vivos: . . . . . .
   Costo de mano de obra para construir las cercas (por km.?): . . . . . .
   . . . . . .
   Equipo . . . . . .

8. Costos de mantenimiento de cercas:
   Costo de alambre . . . . . .rollos, grapas . . . . . .kg
   Costo de mano de obra . . . . . horas /mes
   Poda/corta las cercas: . . . . . .
   Usa las cercas vivas para alimentar los animales: . . . . . .
   Costo de mano de obra . . . . . horas o ¢
   Equipo . . . . . .

9. Manejo del hato:

Categoría	No.	Vacuna tipo y veces/año	Desparac. tipo y veces/año	Suplement . sal común	Suplement . mineral
Vacas total					
Hembras <1 año					
Hembras 1-2 años					
Hembras 2-3 años					
Machos <1 año					
Machos 1-2 años					
Machos 2-3 años					
Toros					

Costos de las vacunas: . . . . . ¢
Costo de desparacitante . . . . . ¢
Cantidad de sal: . . . . . .
. . . . . .
Cantidad de mineral: . . . . . .
. . . . . .
Como mezcla sal y suplemento mineral: . . . . . .
Costo de suplemento de sal . . . . . ¢/quintal (45 kg)
Marca y costo de suplemento mineral . . . . . ¢/saco (... kg)
Tiene saladeros (permanentes): . . . . . .
. . . . . .
Hay sal siempre (en los saladeros) . . . . . .

10. Alimentación suplementaria/animal/día

Tipo	Cantidad	Cuándo y cuánto tiempo	Costos (¢/kg)	Categoria animal*
Concentrado				
Banano				
Vastacos de platano				
Melaza				
Caña de azucar				
Gallinaza				
Heno				
Ensilaje				
Otros				

* 1 = vacas en producción
2 = vacas
3 = toros
4 = novillos/novillas 1-3 años
5 = terneros
6 = terneras

Mano de obra para alimentar los animales . . . . . horas/día

11. Aspectos productivos

Cuántos animales hay en su finca normalmente . . . . . .

Y máximo . . . . . .
Y mínimo . . . . . .
Cuándo compra animales y cuántos . . . . . .
. . . . . .
Compra animales: . . . . . años, cuántos: . . . . . precio: . . . . . .
. . . . . años, cuántos: . . . . . precio: . . . . . .
.
. . . . . .años, cuántos: . . . . . precio: . . . . . .
Donde? . . . . . .

Edad y peso de venta de toros . . . . . años, # . . . . . .
. . . . . kg
Precio de venta . . . . . ¢/a bulto/kg

Edad y peso de venta de vacas . . . . . años, # . . . . . .
. . . . . kg
Precio de venta . . . . . ¢/a bulto/kg

Venta de novillos/novillas . . . . . años, # . . . . . .
. . . . . kg
Precio de venta . . . . . ¢/a bulto/kg

Venta de terneros. . . . . , # . . . . . .
. . . . . kg
Precio de venta . . . . . ¢/a bulto/kg

Venta de terneras . . . . . , # . . . . . .

Donde vende los animales: finca □ : subasta □ : empacadora/planta □

12. Aspectos reproductivos
Qué razas tiene en su finca? . . . . . .
. . . . . .
Quales razas son en las vacas (que tipo de cruza)? . . . . . .
Quales razas son en el toro ? . . . . . .

Cuántos terneros nacieron en el ultimo año . . . . . .
Lleva registro de los partos en otros años? . . . . . .
. . . . . .
Cuántos terneros murieron al nacimiento o poco después (el ultimo año) . . . . . .
Cuántas otras animales murieron . . . . . .

Edad al primer parto . . . . . .
Cuántos meses entre el primer y segundo parto . . . . . .
Cuántos meses entre los otros partos . . . . . .
Edad al destete . . . . . .
Cuántas vacas tiene por toro . . . . . .
Donde compra toro? . . . . . .
Compra toros registrados? . . . . . .
Valor de toro cuándo lo cambia? . . . . . .

13. Instalaciones y equipo

Tipo	No. y/o tamaño	Costo	Tipo de material
Casa de peor			
Granero			
Bodega			
Corral			
Equipo de ordeño			
Vehículos			
Equipo sanitario			
Bomba de espalda (manual/motor)			
Machetes/ motogüadaña			
Motosierra			
Azadones/palas			
Rastrillos			
Arado			
Maguares y/e otro equipo de riego			
Bebederos			
Saladeros			
Otros			

C. ASPECTOS SOCIOECONOMICOS

1. Trabaje independiente ☐ : cooperativa ☐ : otro .....

Recibe Ayuda técnica : sí ☐ no ☐

Cuántas veces por año .....
De quien .....

Utiliza crédito: sí ☐ no ☐ Para que .....

Mano de obra: Familiar .....
Epoca .....

Permanentes .....
Costo .....
Contratada casualmente .....
Epoca .....
Costo .....

2. Situación social de la familia.
Número de hijos ..... hijas .....
Cuántas personas de su familia viven en la finca .....
Cuántas personas estan a su cargo .....

Annex 2 New codes to be added to the attribute files

New code	Description
Equip.dat-file	
7404.5	Construction of a corral as calculated by A. Nieuwenhuyse and C. Aragón.
Animal.dat-file	
5050.12	Male animal, Brahman×Indobrasil, 225 kg.
5050.13	Female animal, Brahman×Indobrasil 180 kg.
5050.2	Male animal, Brahman×Indobrasil, 300 kg.
5050.3	Male animal, Brahman×Indobrasil, 375 kg.
5050.4	Female animal <1 year, Brahman×Indobrasil, 100 kg.
5050.5	Female animal 1-2 years, Brahman×Indobrasil, 225 kg.
5050.6	Female animal 2-3 years, Brahman×Indobrasil, 400 kg.
5050.7	Cow, Brahman×Indobrasil, 400 kg.
5050.8	Bull, Brahman, 600kg.
Animmed.dat-file	
2601.2	Nuvan
2601.3	Neguvon (oral)
2601.4	Butox
2610.2	Dectomax
2610.3	Bayverm
2610.4	Verminum
2620.3	Vitacon
2620.4	B12-complex
2620.6	Emicina
2620.5	Brucellosis vaccin
2640.4	Panacur
2640.5	Ripercol
Animfeed.dat-file	
2994	Phosphorus requirement
Mater.dat-file	
1993	Salt trough

Annex 3 Overview ENGORDE and CRIA

ENGORDE

Interview 6. Marvin Jiménez

The farm is located is Palacios, Cariari, Pococí. Total area of the farm is 200 ha: 150 hectares are pasture and 125 ha is used for engorde. The other 25 ha are used for cria. The remaining 50 ha are forest. The farmer classified his soils as 'humid' but good for pasture.
According the soil grouping for the NAZ used at REPOSA, all soils on his farm belong to the fertile, poorly drained soils.

Pasture

Of the 150 ha of pasture, 130 is Tanner (Brachiaria radicans) and the other 20 ha Ratana. The farm is divided in 12 fields and a system of rotational grazing is applied. The animals are approx. 8 days in one field and the field is left ungrazed for approx. 22 days. If the farm would be rectangular and fields would be of equal size, about 11.5 km of fence would be necessary. Actually, probably 12 to 13 km exist.

When new pasture was established, Tanner was 'sown' by putting 'estacas' (stems of the grass) in the ground. This takes 16 hours per hectare. No fertilizers are used. One established, no resowing has taken place. On dryer areas of his farm it was observed that Ratana was mixed with Tanner.

Weeds are controlled once a year with chemicals and once a year with 'chapias' (hand weeding with a machete). Marvin claims that chapias cost about 3000 colones per ha, which seems expensive if indeed each year the whole area is treated with both chemical and chapias. Chemical weed control: For one hectare 1/2 gallon of a mixture of 20% Diuron, 20% Tordon 101 and 60% 2,4 D. is used. The whole farm is treated with herbicides. It takes one person 5 hours (one "jornal) to spray 2 ha.

The fences are made out of dead posts (Gavilan) who are sawn by Marvin himself on the farm (where still considerable forest and individual trees in the pastures are left) at a rate of about 60 posts a day, and of living poles. The living poles that are used are madero negro (Gliricidia sepium) and poró (Erytrina spp.). Each are placed at 2 m, so a in kilometre of fence, 500 dead posts and 500 living poles are placed. Dead posts have a lifetime of 5 years. The living poles are cut from other living poles (trees). Since he has just started to use living poles they were bought in other farms at 20 colones each. Because of the young age of the poles, no data on time needed for pruning could be given. The fences have 4 barbed wires (name Caiman). The wires close to the ground are changed every 4/5 years, the two higher wires every 8/10 years. To make 1 kilometre of fence 2000 nails are used.

Herd

At the time of the interview the farmer had 96 male animals of about 280 kilos and male 40 animals of about 430 kilos. Because he is beginning with cria, he also had 52 female animals between 1.5 and 3.5 years. The female animal are held on about 25 ha, the rest of the farm is used for the males. Although it is suspected that these data are a bit unrealistic at the time of the interview, since he had just sold 15 males (of about 250 kg, because they were to "wild") and bought various females, so probably the areas he mention should be corrected for these new changes in the herd composition. Twice a year the animals are vaccinated with Bacterine Doble. Every three months animal are treated against parasites: Dectomax, against both internal and external parasites, is alternated with Valvacen (only against internal parasites). The animals are sprayed against external parasites a flies, several times a year (depending the abundance of the flies ("mosca paletera")) with a mixture of Neguvon and Nuvan. He puts every 4 months a hormone implant (RALGRO) in the animals older than 18 months, in order to stimulate growth. He expressed his doubts about the effectiveness of these implants. Furthermore, during the last three month before sacrifice, another growth stimulating hormone is used, Anabolin, which has to be injected every month.
The animals are given a mixture of common salt, mineral salt (normally Pecutrin or P-20 + trace elements) and molasses. He mixes one sack of salt (about 60 kg with one sack of mineral salt (about 25 kg), For the whole herd he needs about 26 sacks of each per year. Bringing the salt mixture and melaze to the animals takes about a whole day (I suppose of 5 hours) every two weeks. Per year he buys about 8 to 10 drums of melaze (actual price in Guápiles: 6500 colones per drum, so put at his farm about 8000 colones). Each drum contains 200 l of melaze, or about 300 kg.

He buys the animals at a age of about 10 months at 210-240 kilos and sells them at 26-30 months

at a weight of ±450 kg. Animals are bought everywhere, perhaps about half at nearby farm (so no transportation costs have to be made) and half further away (also at the auction) so these animals have a transportation cost of about 800 colones per animal. He sells mostly to a slaughterhouse. For the transport to the slaughterhouse in the Central Valley he hires a truck for 1500 c.lones per animal. If animal are sold at the auction in Guápiles, transportation cost about 1000 colones per animal.

The animals are crosses of Brahman with other breeds.

The farm count with a corral with roof, a small storehouse, and a caretaker house, in which the permanent worker(s) live.

Socioeconomic aspects

He receives technical assistance from the MAG and CAB (cooperation of beef cattle farmers).

The farm is a cooperation between himself and his brother. They both work on the farm plus 2 children. And there are two permanent workers (1600 colones per day, 6 days per week). However, his brother owns a truck and has two farms himself, so he is probably hardly on the farm. His sons go to school, so the time they work one the farm is rather little.

Interview 21. Manuel Quesada

Just as Marvin Jimenez, the farm of Manuel Quesada is located at Palacios, Cariari, Pococí. Soils of the farm belong to the category fertile, poorly drained.
Total area of the farm is 146 ha, divided in two different parcels of 86 and 60 ha.

Pasture

No exact data on how much of each parcel was Tanner (Brachiaria radicans) and how much Ratana. However, most of the area appear to have about 75% Tanner and 25% Ratana. Ratana grows on the slightly dryer areas. The farm is divided in 12 fields and a system of rotational grazing is applied. The animals are approx. 8 days in one field and it is left ungrazed for approx. 22 days.

When new pasture is, Tanner is 'sown' by putting 'estacas' (stems of the grass) in the ground. This takes 16 hours per hectare. No fertilizers are used. One established, no resowing has taken place. On dryer areas of his farm it was observed that Ratana mixes with Tanner.

Weeds are controlled once a year with chemicals and twice a year with 'chapias' (hand weeding with a machete). Although in the same area, Manuel says that chapias cost between 1000 and 3500 colones per ha, depending on the amount and kind of weeds present, compared to 3000 colones per ha which claims Marvin Jimenez. Chemical weed control: two application per year divided into one against all weeds, using a mixture of one gallon of 2.4D, 1l of Tordon 101 and 1kg of Diuron. It takes one person 5 hours (one "jornal) to spray 2.5 ha. Total for the farm: 292 hours and 58 gallons of the mixture. The second application consists of 2.4D only against "cabezon" taking about 5 hours for 1.25 ha. (for the whole farm: 584 hours and 116 gallons of 2.4D). This seems very much and seems unlikely to be necessary every year.

The fences are made out of dead posts (Manu platano) and of living poles of Poro (Erytrina spp.). Each are placed at 1.5 m. To construct 400 metres of fence, 250 dead posts are used and 250 living poles, as well as 6 kg of nails. It takes about 80 hours to construct such a fence. Dead posts of Manu have a lifetime of >20 years. The living poles are cut from other living poles (trees). They are pruned regularly (once a year?) pruning of 800 m takes about 4 jornales (20 hours). Fences are composed of 4 barbed wires (name Caiman). The wires close to the ground are changed every 4/5 years, the two higher wires every 8/10 years. Manuel uses Caiman because it is the cheapest barbed wire available, although he knows that for instance "Moto" last >10 years.

Herd

At the time of the interview the farmer had 135 male animals at the 86 ha farm, and 30 males, 30 novillas, 10 cows for milk production (dual purpose) and 3 horses on the farm of 60 ha.

Every 5 months the animals are vaccinated with Bacterine Doble. At the same time, they are injected with Ivomec or Duotin. Furthermore animal receive vitamins: 5 to 6 cc of Vitacon. This whole treatment takes 2 persons about 20 hours (2 jornales each), including bringing animals to the corral etc.

About 5 to 6 times a year animal are sprayed against flies and torsalos (using Nuvan, 1 "onza" every 15 animals), taking about 6 hours (two persons).

Newly bought animals are injected with vitamins B12 (10 cc each).

The animals are given a mixture of common salt, mineral salt (normally Pecutrin or P-20 + trace elements) and melaze. He mixes one sack of salt (about 65 kg with 0.4 sack of mineral salt (about 25 kg), For the whole herd he needs about 25 sacks of salt and 10 sacks of minerals per year. The salts are mixed with melaze, of which he uses about 3 to 4 drums of 200 l per year. Animal have free access to the salt and melaze mixture. Bringing the salt mixture and melaze to the animals takes 2 to 3 hours per week.

He buys the animals at a age of about 8 to 10 months at about 200 kilos and sells them after a year at about 400 kg. Animals are bought and sold from a middleman, who also takes care of transportation. In the past he has bought and sold animals from and to other places, but he likes the actual system better, although he may not always obtain good prices. At the time of the interview he had bought 30 animals at a price of 34.000 to 36.000 colones and sold 30 older ones estimated at 400 kg each at 64.000 colones each.

The animals are crosses of Cebu cattle with other breeds. About one animal per year is lost due to various reasons.

The farm count with a corral with roof and a storage building. Actually he's building a corral for confinement, in which he thinks to feed the animals with sugarcane and "king grass". He did not know about the need for a protein-rich food, so it may be interesting to check after a year how this works out.

Socioeconomic aspects

He receives technical assistance from the MAG and INA. On the farm Manuel and his son Adrian are employed full time. They contract almost permanently 2 workers for chapias and spraying.

Interview 8. Ricardo Mendez

The farm is located in Rio Hondo, Siquirres and the total area of the farm is 440 hectares. Area under pasture is 400 ha and he has 40 ha of forest. He classified his soils as 'very good for pasture'. Nevertheless, he mentions that he has "tierra roja" which is classified at REPOSA as well drained unfertile soils.

Pasture

The types of grasses and the areas are: 300 ha of Ratana, 40 ha Natural mixed with Ratana, 20 ha Alemán (Echinochloa polystachya), 20 ha Estrella and 20 ha Tanner. The farm is divided in 54 field and they are rotational grazed (2-4 days grazing, 22-30 ungrazed). This year he sowed Estrella and Tanner. Land preparation is done with a tractor and harrow (in April-May). Herbicides are applied after sowing (Combo, 2,4 D and Tordon 101). Land preparation with tractor costs 1500 colones per hour. And he claims that one ha takes about 8 hours. This seems rather unrealistic.

Sowing is done by hand is costs 6,000 colones per ha. No fertilizers are used.

Weed control of existing pastures is done with chemicals (once a year) and chapias (twice a year). In total 20 gallons of 2,4 D, 5 gallons Tordon 101 and 6 litres of Combo are used per year. The herbicides are applied after a chapia. The total cost of applying the herbicides costs 400,000 colones per year. All these data are rather confusing. Compared to the interview with Marvin Jimenez he used only

The fences are made of dead posts (every 5 meters) and living poles (3.5 per meter). The fences have 4 barbed wires (name Moto, 10 rolls in 1 km.). 10 kilos of nails are used to make 1 kilometre of fence. For making 1 kilometre of fence, 18 work days of 8 hours, costing 27.000 colones are needed. Reparation of the fences costs 20 rolls of barbed wire, 50 kilos of nails and 140 working days (8 hours) per year. The living posts are pruned (not specified how often) and the prunings are fed to the animals.

Herd

At the time of the interview, the farmer had: 246 cows, 84 female animals <1 year, 80 between 1 and 2 years, 90 male animals <1 year, 117 male animals between 1 and 2 years, 269 between 2 and 3 years and 9 bulls. All the animals are vaccinated with Bacterine Doble twice a year, the animals under 3 months not). Levamicol, Dectomax and Ivomec are used against parasites (treatment twice a year). The cows are vaccinated against Brucellosis.

A mixture of common salt (80 quintales (presumably bags of 60 kg?) per year), mineral salt (Pecutrin 40 beg of 25 kg per year) and molasse (12 estañones per year) is given. All "apartos" have salt troughs and it is claimed that animals can freely consume salt and minerals throughout the year.

Only male animals are bought. The animals are between 1 and 2 years old and weigh 250-300 kilos. He buys about 100 animals per year at the cattle auction. The male animals are sold at a weight of ±450 kg to the slaughter house (about 200 animals per year). Per year 40 cows are sold (after 6 births) of about 350-400 kilos. One or two bulls are sold per year (600-700 kilos and at 6 years). There are no data on the sales of other animals.

The breed of the animals is a cross between Brahman, Indobrasil and Gyr. The bulls are Brahman (pure bred). Last year 84 female and 90 males calves were born, resulting in a reproduction of 70% (interval between births is 19 months). The interval between the first birth and the second birth is 20-22 months. Weaning is at 7 months. Ratio cow to bull is 27:1. Last year 6 calves died at birth, and 12 other animals died of other reasons (not specified). He bought (one or all) registered Brahman bulls at EARTH, costing 300.000 colones.

Socioeconomic aspects

The farm is owned by the farmer. He receives technical assistance from MAG Siquirres. Besides himself, 3 (sometimes 4) people work on the farm. The costs for the 3 workers are 66,000 colones per month. The farm has 7 houses for workers, some storage houses, only 1 corral, and he possesses a tractor (MF).

CRIA

Interview no. 20 Fausto Quesada Arias

The farm is located in 4 Esquinas, Cariari, Pococí. The total area of the farm is 77 ha. Total area of pasture for the cria herd is 40 ha. Besides cria he used to have 40-50 male animals for engorde. He uses 20 - 30 ha for crops. Mostly the farm has tierra negra, but also swampy areas and "tierra roja" is present. The farm was bought about 5 years ago.

Pasture

The area under pasture consists of 23 ha of Ratana, 7 ha of Amargo (Axonopus compresses), 8 ha of Tanner and 2 ha of Aleman. In reality, however, most pastures (except Aleman) are mixtures. The pastures are divided in 16 fields (6 in the area of 30 ha). The fields are 3-4 days grazed and are left ungrazed for 22-24 days. He does not sow pasture or uses fertilizers.

Weed control is done by chapias or by pulling out by hand and only one time per year. This takes 3 to 4 persons about 70 to 80 hours for the whole farm (or for 40 ha of pasture?). Once every 2 years herbicides are used for the 'dirty' parts of the pasture. A mixture of
2,4 D and Tordon 101 (4:1) is used. In total 6 gallons of mixture is used. Application takes about 3 hours per ha.

The fences are made of poró banco and 3 barbed wires (Caiman and Moto). Duration of the lifetime of Moto is 15 years. A living post is placed at every two meters. Placing 50 living posts takes 8 hours. This seems too high, although I suspect that it included whether cutting the poles or repairing wires. For reparation of the fences 10 rolls of barbed wire and 8-10 kilos of nails are used per year. This does not appear to happen each year when looking at the fences, which looked rather abandoned. The trees at the outside of the fields are pruned every year. Other trees are pruned less frequently. At the time of the interview, they were pruning an repairing a fence which had not been pruned during the 5 years he owns the farm. This takes 3 persons 45 days of 5 hours for 3 km.

At the time of the interview the herd consisted of 40 cows for only cria, 10 cows that are being milked, 20 female calves, 15 female animals between 1 and 2 years, 10 between 2 and 3 years and 13 male calves. The animals are injected with Bacterine Doble every year (sometimes twice a year). Dectomax is only given to the calves under 3 months. For the other animals Bayverm, Panacur and Verminum is used against internal parasites (twice a year). The animals are sprayed every 22 days with Butox or Torsagan. For the bull Neguvon oral is used. All these jobs take 2-3 hours for 2 persons. The animals receive 15 kilos of common salt, 1 kilo of mineral salt (Pecutrin) and 1 gallon of melaze per week, taken one person about 2 hours. No roofed salt troughs are present, instead, old tires cut in half are used.

Animals are not bought. Per year about 12 male calves of 190 kilos are sold at the subasta. About 6 cows per year are sold. They weight about 400 kilos and are sold to Coope Montecillos. slaughterhouse. Of the other female animals 3 are sold per year (about 300 kilos per animal). Every two years a bull is sold (650-700 kilos) to Coope Montecillos. The costs of transportation are 12,000-20,000 colones per 10 animals (to Coope Montecillos). The transport to the subasta costs 10,000 colones per 10 animals.

The breed of the animals is a cross between Brahman, Indobrasil and Gyr. The bull is a cross between Brahman and Indobrasil (not pure bred). Last year he noted one abortion, two calves died at or shortly after birth and 6 other animals died of snake bites. This had never happened before and he considered it as something unusual.

Last year 30 calves were born, cows have their first calve at an age of 2.5 years and calves are weaned at 7 to 8 months.

Socioeconomic aspects

The farmer owns the farm. He receives technical assistance from INA (?), and uses credit for buying animals and a steelyard (romana). He works on the farm with 2 of his children (adults). The corral is roofed.

Interview 5. Marvin Quesada Ramirez

The farm is located in Freeman, Matina. Total area of the farm is 132 ha and 120 ha is pasture. He classified his soils as 'dark brown soils' and as 'good'. The presence of Tanner and the location of the farm make clear that considerable areas have drainage problems.

Pasture

The pasture consists of 60 ha of Ratana and Estrella, and 60 ha Tanner. The area is divided in 10 fields. The fields are grazed for 8 days and are left ungrazed for 30 days. He plans to sow 5 ha of Br. brizantha (? TANNER??) per year, a process which he has just started (?). The preparation of the land and the sowing costs 15 days per ha (1,000-1,500 colones per day). No fertilizers are used. Seeds are obtained on the farm.

The weeds are controlled with chapias (3 times a year, not the total area) and herbicides (2 times a year, the whole area). Every time the weeds are controlled with herbicides, 10 gallons of 2,4 D and 1 gallon Tordon 101 is used. Small quantities of Combo and Gramoxone are used for the 'difficult' weeds. Application of herbicides takes 3 days of 8 hours for 10 ha (family labour). For the chapias 2 days of 8 hours are needed to clean 10 ha. Not clear how many persons are involved.

The fences are made of dead posts (Cacha) and living poles (madero negro and poró). The fences have 4 barbed wires. The dead posts are put at every 3 metros. Between two dead posts two living posts are put (333 dead posts and 666 living posts per kilometer). For reparation 1 roll of wire and 1-2 kilos of nails are used per year (very little for the whole farm!). No further data on maintenance were obtained.

At the time of the interview herd consisted of 142 cows, 40 female calves <1 year old, 30 female animals between 1-2 years, 40 male calves, 8 month old, 27 male calves >8 and <12 months old, 15 male animals between 1-2 years and 4 bulls. The animals (older then 3 months) are given Bacterine Doble twice a year. Dectomax is given twice a year to all the animals. Also Vitacon (vitamins) are given. Each year some antibiotics like Emicina and Penicilina are used.

Per year 50 bags of 60 kg of common salt and 6 estañones of melaze are used. Only small quantities of mineral salt are given. Animals cannot access salt freely .

About 40 female calves (150-170 kg) and 40 male calves (180-200 kg) were sold at the subasta Guápiles. Old (>8 births) cows (15-20 animals of 450 kg) were sold and 10 cows of 3-4 years were bought. Every 3 years two bulls are sold and two new bulls are bought at other farms.

The breed of the animals is a cross Brahman and Indobrasil. The bulls are Brahman (pure bred) and cost about 200.000 colones each. In 1995 106 calves were born. 6 calves died at birth. No older animals died. The age at first birth of the cows is 32-34 months. Calves are weaned at 7 months.

Socioeconomic aspects

The farm is his property. The farm has a corral and a storage building. He receives techical assistance of the MAG. Credit is used for buying animals and land. Labour is family (2 persons) and 3 persons who each work for 90 days at the farm.

Annex 4 Prices, quantities and units

Prices of the cattle auction*, Guápiles

	Price ¢/kg	Price $/kg
-male calves <200 kg	185,86	0,89
-male animals 200-400 kg	172,11	0,82
-male animals 400-500 kg	175,62	0,84
-bull >500 kg	185,34	0,89
-female calves <200 kg	156,09	0,74
-female animals <350 kg	151,50	0,72
-cow >350 kg	146,52	0,70

*Prices are from 20-8-1996 and 2-8-1996. The prices are representative for the period May-August 1996. Exchange rate: 1$=210 colones (August 1996).

Prices, quantities and units of various products

Herbicides

	Price ¢/unit	Price $
-2,4 D	2960/galon	14,10
-Tordon 101	2720/galon	12,95
-Combo	2545/frasco	12,12
-Gramoxone	3950/galon	32,95
-Diuron	1095/0,5 liter	5,95
-Round-up	2100/liter	10,00
-Karmex	1040/0,5 liter	4,95
-Ranger	1700/liter	8,10

Vaccines

	Price ¢/unit	Price $
-Bacterine Doble	1280/50 doses	6,10
-Bacterine Triple	1325/50 doses	6,31
-Anthrax	445/10 doses	2,12
-Brucellosis	605/5 doses	2,88

Products against parasites

	Price ¢/unit	Price $
-Ivomec	17500/200ml (1cc/50kg)	18,19
-Dectomax	18900/200ml (1cc/50kg)	90,00
-Panacur	9865/liter (5cc/50kg)	46,98
-Albendazol	3775/liter (6cc/60kg)	17,98
-Ripercol	3850/500ml (1cc/40kg)	18,33
-Bayverm	305/doses (animal of 440 kg)	1,45
-Levamicol	2155/500cc (1cc/20kg)	10,26
-Duotin	3500/50cc (1cc/50kg)	16,46
-Butox		
-Neguvon	4660/kilo	22,19
-Nuvan	975/100cc	4,46
Others		
-Vitacon	7850/500cc	37,38
-B12-complex	375/100cc	1,79
-Implant "Ralgro"	6500/24 doses	30,95
-Common salt	180/10 kilo	0,86
-Pecutrin	5100/25 kilo	24,29
-P-20	4100/23 kilo	19,52
-MG	1350/11,5 kilo	6,43
Barbed wire		
-Caiman	4050/335 m	19,29
-Moto	4680/335 m	22,29

Annex 5 APST for engorde

Annex 6 APST for cria

Annex 7 Construction of corral

Costs of a corral of 150 m^2 for about 50 animals, without a roof.

69 posts of manu negro of second class quality, having some irregularities (e.g. only two straight sides). Each post costs 120 colones (which is 90 colones per 'pulgada tica'). 155250 colones

125 pieces of 3 m wide, 12,5 cm high and 3,34 m long, known as 'regla corral'. Made of manu negro, they cost 120 colones every 'pulgada tica' or 900 colones each. 112500 colones

The smaller pieces for the doors cost 675 colones each. 18225 colones

Hinges: 1250 colones. 3750 colones

Nails: 155 colones per kilo. 1550 colones

Time needed for construction:
- 2 persons need about 30 minutes to put one post in its place: 69 hours
- 2 persons need one hour to put 15 pieces in its place: 17 hours
- one person needs 4 hours to make one door and put it in its place: 12 hours

Total (200 colones per hour). 19600 colones

TOTAL COSTS: 310875 colones = (beginning of August 1996) $ 1480 US.

Construction of a roof.

-hardwood of 5 by 10 cm, total lenght 146 m (¢100 per pulgada)	35000 colones
-hardwood of 5 by 7.5 cm, total length 84 m (¢100 per pulgada)	15100 colones
-hardwood of 2.5 by 7.5 cm, total length 210 m (¢100 per pulgada)	18900 colones
-4 posts of manu negro of 10 by 10 cm by 4.20 m (¢2000 each)	8000 colones
-zinc laminas	160800 colones
-nails for roof (2 kg, ¢200 per kilo) and woodwork (4 kg, ¢155 per kilo)	1020 colones
-labor about 4 days for 2 persons = 64 hours	12800 colones
-products to preserve wood which is not manu negro (1 galon 'penta' and 5 galon of diesel)	3000 colones
-painting of wood (2 persons for one day)	3200 colones
-painting of roof (labor and paint)	25000 colones
TOTAL COSTS OF ROOF:	282820 colones
	1347 US$