Origen of the Romosinuano Cattle

The bovine breed Romosinuano originated on the northern coast of Colombia. Its name indicates that it is a hornless breed (roma) from the plains surrounding the Sinu River in Colombia (Ruiz, 1992).

Hernandez describes the breed by hide color, which varies from bay through chestnut to sorrel. Some animals have black coloring on their heads, near their eyes and around their ears, and on their legs. They lack horns, although some animals have rudimentary horns. Their hides are thick and covered with short, shiny, oily, sparse fur. Their bodies are cylindrical, and they are of medium height. The base of their tale has little flesh and does not stand up significantly.

Composition of the Romosinuano Herd

In 1960, the first CATIE Romosinuano herd was founded when four bulls and seven cows from the herd at North Carolina State University were imported. The North Carolina cattle originated from semen brought into the United States from Colombia by the Secretary of Agriculture before aftosa fever was found there (De Alba, 1984).

The main reason for their being brought to CATIE was to look for, and create, genetic resources adapted to tropical America that could be used in animal husbandry production systems in the region.
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Casas (1990) indicates that during the first few years the Romosinuano were at CATIE, the newly formed beef herd was cross-bred with animals from several different breeds: Brangus, Central American Dairy Criollo cows; and Charolais, Brahman and Santa Gertrudis bulls. Using this variety of breeds it was hoped to create an absorbent cross that would be 7/8 Romosinuano. After 1969, in order to avoid the problems of inbreeding, cows with mostly Romosinuano blood were bred with semen from Charolais and Red Angus. The resulting heifers were re-crossed with Romosinuano. Later, cows were bred with Red Holsteins, Danish Reds and South Devons. Table 1 shows the CATIE Romosinuano herd’s founding animals. At the beginning of the 1990’s, there were animals with Romosinuano blood and crosses with varying degrees of Brahman (Table 2).

Advantages and Disadvantages of Romosinuano Cattle

The Romosinuano breed has been recognized mainly for its high fertility, longevity, docility, and its ability to be crossed with Cebu (Hernandez et.al., 1982). This has been proven in research conducted at, and outside CATIE.

From its introduction at CATIE, the breed was subject to a variety of studies on behavior, growth, fertility, genetic tendency, and meat quality. These were always examined viewing the breed as a specialized genotype or as a crossbreed and always within the specific ecological conditions present in Turrialba. Also, since the herd had been closed since its founding, studies were begun on the effects of inbreeding on growth and fertility in the 1980’s and the beginning of the 1990’s. The vast majority of the studies conducted showed one or another of the benefits and weaknesses of the breed in cattle production systems. CATIE has made a great effort to maintain a complete database on the herd since its inception which, in turn, has served as the basis for both program initiatives and research projects. At the same time, efforts have been made to distribute and evaluate this germplasm.
Table 1. Original members of the CATIE Romosinuano herd

<table>
<thead>
<tr>
<th>Bulls</th>
<th>Breed</th>
<th>Cows</th>
<th>Breed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carolino</td>
<td>Romosinuano</td>
<td>R37</td>
<td>Romosinuano</td>
</tr>
<tr>
<td>Sancón</td>
<td>Romosinuano</td>
<td>R38</td>
<td>Romosinuano</td>
</tr>
<tr>
<td>Jamaica</td>
<td>Romosinuano</td>
<td>1083</td>
<td>Central American Dairy</td>
</tr>
<tr>
<td>Borrego</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C7</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C137</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C118</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C140</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C144</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C188</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C208</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C236</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C237</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C277</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C286</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A85</td>
<td>Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC16</td>
<td>Brangus x Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BA16</td>
<td>Brahman x Brangus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A77</td>
<td>Brangus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A80</td>
<td>Brangus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A81</td>
<td>Brangus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A101</td>
<td>Brangus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A103</td>
<td>Brangus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H19</td>
<td>Brahman x Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H24</td>
<td>Brahman x Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J21</td>
<td>Central American Dairy x Brahman</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>Central American Dairy x Santa Gertrudis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S13</td>
<td>Central American Dairy x Santa Gertrudis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S14</td>
<td>Central American Dairy x Santa Gertrudis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S17</td>
<td>Central American Dairy x Santa Gertrudis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E6</td>
<td>Santa Gertrudis x Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E8</td>
<td>Santa Gertrudis x Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E14</td>
<td>Santa Gertrudis x Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E24</td>
<td>Santa Gertrudis x Central American Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F7</td>
<td>Charolais x (Brahman x Santa Gertrudis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F18</td>
<td>Charolais x (Brahman x Santa Gertrudis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F34</td>
<td>Charolais x (Brahman x Santa Gertrudis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td>Charolais x (Brahman x Santa Gertrudis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NF30</td>
<td>Charolais x (Santa Gertrudis x Brahman)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted by Ruiz, 1992.

Table 2. Breed Composition of the CATIE Romosinuano herd

<table>
<thead>
<tr>
<th>Breed</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55</td>
</tr>
<tr>
<td>More than 50% Romosinuano</td>
<td>=====</td>
</tr>
<tr>
<td>From 25 to 50% Romosinuano</td>
<td>=======</td>
</tr>
<tr>
<td>From 0 to 25% Romosinuano</td>
<td>=======</td>
</tr>
</tbody>
</table>

Modified from Casas (1990)
It has been shown that Romosinuano cattle are characterized by a notable reproductive efficiency compared to other criollo (native) breeds or those introduced into the region, and by a strong resistance to adverse environmental conditions, disease, and parasites common to the tropics. According to the results obtained in Colombia, Costa Rica and other tropical and subtropical countries over the years, the Romosinuano breed constitutes a genetic resource with great potential as an alternative to European breeds which have been used but have limited ability to adapt to tropical conditions.

Research conducted outside CATIE, with pure Romosinuano herds have shown surprising reproduction indexes such as less than 365 day intervals between calvings with an 82% parturition rate, almost 5 points above the Romo x Cebu cows and more than 8 percentage points over the pure Cebu cows (Hernandez, 1979). The same author found a lower growth rate in the Romos even after weaning when they are compared with pure Cebu and the Romo Cebu cross (Table 3).

Other research done by Castro et al. (1971), confirmed that the Romosinuano x Cebu cross had approximately 12% greater preweaning weight gains than the pure Cebu and 37% greater than pure Romosinuano. Results obtained by Vergara et al. (1968) confirmed the weight gain results obtained by Hernandez et al. (1982) which showed preweaning weight gains of approximately 0.52 kg/day.

In general, the studies done outside CATIE corroborate the data showing that the Romosinuano breed has high reproductive indexes and although its growth capacity is relatively low as a pure breed, significant heterosis rates for growth were obtained upon crossing it with other breeds such as the Cebu.
Table 3. Weight evaluation results at weaning for Romosinuanos, Cebus and their crosses.

<table>
<thead>
<tr>
<th>Breed composition</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bull Cow # Animals</td>
<td>Weight at Weaning* (kg)</td>
</tr>
<tr>
<td>Romo Romo 375</td>
<td>170</td>
</tr>
<tr>
<td>Cebu Cebu 245</td>
<td>204</td>
</tr>
<tr>
<td>Romo Cebu 142</td>
<td>214</td>
</tr>
</tbody>
</table>

* Weaning at 9 months

Modified from Hernández (1979)

A chronological analysis of some of the studies done in the CATIE Romosinuano herd confirmed the majority of the results indicated above by the authors. Labbe (1970), determined that Romosinuanos present weights at weaning indicates a slower growth rate. These data were obtained measuring differences in Romosinuano behavior in comparison with other breeds and corroborate the results obtained by Vergara et al. (1968), such as Castro et al. (1971) and Hernandez et al. (1982). Nevertheless, the Romosinuanos were found to have higher birthrates and a higher percentage of weaned calves than the other breeds analyzed (Table 4).

Table 4. Reproductive behavior of the different breeds at CATIE.

<table>
<thead>
<tr>
<th>Breed</th>
<th>% calves born</th>
<th>% calves weaned</th>
<th>Weight at weaning (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Romo</td>
<td>88</td>
<td>84</td>
<td>165</td>
</tr>
<tr>
<td>Criollo</td>
<td>80</td>
<td>75</td>
<td>202</td>
</tr>
<tr>
<td>Brahman</td>
<td>74</td>
<td>70</td>
<td>186</td>
</tr>
<tr>
<td>Santa Gertrudis</td>
<td>63</td>
<td>60</td>
<td>201</td>
</tr>
</tbody>
</table>

Adapted from Labbé (1970)
At CATIE, Molina (1978) conducted the first study with the goal of evaluating the potential Romosinuano reproductive and growth productivity in different degrees of cross-breeding. Analyzing data from approximately 16 and 14 years (for growth and reproduction respectively), the results showed that as the amount of cross-breeding increases, weight at weaning decreases. Differences in parturition indexes among the varying degrees of cross-breeding were not significant, even though they tended to increase as the amount of Romosinuano blood increased.

The high reproductive yield of the Romosinuano breed is indisputable. Up until 1983, according to De Alba (1984), the total number of calves born in the pure herd was 496. This represents a parturition index above 90%, where the first pregnancy is at 30 months and weight at first breeding is at least 270 kg.

Management of the Romosinuano Herd at CATIE

Feeding of the CATIE Romosinuano herd is based on rotational grazing in grass pastures, especially with a mix of African Star (Cynodon nlemfuensis) and other species from the Axonopus and Paspalum genders (Salgado, 1988).

From the beginning, the genetic management was maintained through a system of natural stationary mounting with a 90 day breeding period, beginning the third week in May, and a calving season beginning at the end of February. The average age at calving was between 30 and 36 months. In the cross-bred herd, the cows with high levels of Romosinuano blood were inseminated with semen from Braham bulls, the rest were mounted naturally by Romosinuano bulls, as were the pure cows (Tewolde, 1988).

In order to avoid consanguinity as much as possible, the mating was of extreme concern from the herd’s founding. After 1982, within the pure herd, four families
were formed and bred among each other. The mating was planned so that a bull produced offspring in the family with which he had the least genetic relationship. This family then incorporated the heifers produced from this pairing, but those bull-calves selected as breeding animals were eventually mated with cows from the next family. This rotational process was carried out with all the families (De Alba, 1984). In the period just before the CATIE herd was eliminated, the pairings within the breed were planned, keeping in mind the kinship coefficient of the potential parents in order to reduce the risk of increased levels of consanguinity in the next generation (Tewolde, 1998; Ruiz, 1992).

From the time the herd was founded, diverse selection criteria were followed. Selection policies were based mainly on behavioral aspects. Replacement selection, as much for cows as for bulls, was done in the CATIE Romosinuano herd using the closed herd for several generations. This provoked an irrevocable, constant increase in the levels of consanguinity, regardless of the care taken to plan the breeding.

Through 1982, the main criteria for selecting bulls, was weight at weaning. After that, the weaned calves were given a pasture test for 150 days after which they were evaluated and pre-selected for physical defects in testicular formation and breed characteristics. Later, the ones with the highest weight gain, and highest productive genetic value on their mother’s side, were selected. The bull-calves selected as potential breeding animals were also tested for fertility and libido. After 1988, a selection criteria was developed based on the weight at weaning calculated against the age of the calf and that of the mother (Tewolde, 1988).

From the beginning, cows were selected based mainly on their fertility and weight of their calves at weaning. According to De Alba (1984), after 1982, in an attempt to perfect the herd, strict selection criteria were imposed on post-weaning weight gain without discarding the importance of maternal fertility. To judge the behavior of the mothers, genetic formulas for the value of the cow’s
age at first calving were used, adding in the first interval between calvings. Later, genetic value formulas were used for calf weight production at weaning. Heifers were selected in the same way as the bull-calves, using only the post-weaning growth as criteria, after 1988.

**Conservation of the Romosinuano Herd at CATIE**

In recent years, the idea of conserving the native Latin American breeds has gained momentum. The reason for this is basically the need to preserve the genetic material which contains the valuable characteristics necessary for production in the area (CATIE, 1992a; CATIE, 1992b). Although the need for conservation is clear, and well documented, there are technical factors which come to bear when deciding if a specific herd of a determined breed can or cannot be conserved. There are also other questions which must be answered before deciding to conserve a single herd:

- What is the real future value of the herd in zootechnical and economic terms?
- What consequences would be felt in the production in the area or country were this herd to be eliminated?
- Is it technically and economically possible to conserve the herd?

Specifically in the case of the Romosinuano breed, the research conducted at and outside CATIE answered the first two questions.

The zootechnical and productive value of the breed is widely shown and justifies the preservation of these genes from that point of view. CATIE's concern was the third question.
To conserve the herd, two methods were considered (Smith, 1984):

1. *In situ* method: Live Offspring Unit
2. *Ex situ* methods: Freezing semen and embryos

In the case of the live units, the main disadvantages (both technical and economic) come from the high cost implied, the increase in consanguinity levels, infectious diseases and other problems of genetic origin which inevitably arise in closed populations like that of the CATIE Romosinuano herd.

CATIE decided not to conserve the Romosinuano herd using the *in situ* method for the following reasons:

1. High levels of consanguinity
2. High incidence of Leucosis infections

In the 1980’s, it was suspected that the technical factors indicated above could cause the Romosinuano herd to become problematic, if proper corrective measures were not taken urgently. It is for this reason that studies were begun to determine the levels at which consanguinity becomes critical to the productive, reproductive and growth characteristics of the herd. In the 1990's serological studies were begun on the animals to determine the level of bovine leucosis present in the Romosinuanos and in general, in the CATIE meat and dairy herds. The results of these studies and tests are documented in this paper.

**Critical Levels of Consanguinity in the CATIE Romosinuano Herd**

Consanguinity occur in the short or long term in genetically closed populations or herds (De Roo, 1980); that is to say, in herds with little or no introduction or exit of germplasm, or that have badly planned matings. For example, if one bull is used for breeding for a long time, he could be mated with his daughters,
granddaughters or mother. Mikami et al (1977), indicates that consanguinity is an inevitable consequence of closed populations, and suggests the need to evaluate its effects when direct and correlated responses are interpreted. Even in genetically open populations, it is important to determine the levels of consanguinity to evaluate the detrimental effects it can have on important economic characteristics (Allaire and Henderson, 1965; Young, 1984).

In 1991, a research study was conducted to seek a response to the detrimental effects of high levels of consanguinity in the Romosinuano herd (Ruiz, 1992). The study determined the effects of consanguinity of the calf, the father, and the mother; their critical levels; economic importance; and how the founding animals contributed to the behavior of the animals in the current CATIE Romosinuano herd.

The results of this study showed that in the first years of the herd, the consanguinity was 0%, as would be expected, with the exception of levels of consanguinity found in some calves in 1965 and 1967. According to De Alba (1984), when the herd was in its first years, the founding breeding bulls (Jamaico, Sancon and Borrego) were mated with their daughters or granddaughters. After 1970, the levels of consanguinity gradually increased year after year. The use of a reduced number of breeding bulls, that already had a high level of consanguinity, from 1976 to 1981 created the need: to change breeding bulls frequently, using more of them where farm conditions permitted; or to use artificial insemination. The total results of consanguinity in calves, fathers and mothers in the Romosinuano herd for 1991 was 6.28, 5.68 and 6.35% respectively, much higher than the levels determined as critical (Ruiz, 1992).

Finally, the studies conducted to determine critical levels and the effects of consanguinity confirmed their detrimental effects on production, reproduction and growth in the CATIE Romosinuano herd. Clear recommendations were
made to introduce new Romosinuano germplasm into the herd that was genetically unrelated to the original CATIE herd animals.

This recommendation could have been carried out through two ways:

1. Importation of new genetic material (Romosinuano animals or semen)
2. Cross-breeding with other breeds

The CATIE Romosinuano herd constituted the only herd of its kind with no aftosa on the continent, which made finding new Romosinuano blood with no kinship to the original CATIE herd members impossible. Legal restrictions prevent any exchange since Central and North America are free of the disease.

Cross-breeding with other breeds would be the easiest way to solve the problem without having to introduce new Romosinuano germplasm, but this path meant the eventual end to the breed at CATIE.

With these extenuating circumstances, the logical conclusion was to maintain the CATIE Romosinuano herd as it was. There was technically no alternative possible that would maintain or reduce the problem of consanguinity and the consequent genetic deterioration of the breed.

**High levels of leucosis infection in the CATIE Romosinuano herd**

Leucosis is a disease endemic to Costa Rica that affects cattle and produces premature death in some animals. The transportation of animals, semen or fertilized embryos from one country to another requires certification that they are free of disease. A high degree of leucosis infection was found among the meat and dairy herds at CATIE which made it impossible for the animals to be distributed in the member countries.
From the moment that the problem of infection was identified in the herd, the required paperwork was begun and in 1992, a protocol was initiated to study the current and future consequences of maintaining the Romosinuano herd at CATIE assuming that a great number of animals were infected with leucosis.

Directives were established with four main actions:

1. Identify the infected animals through laboratory analysis.

Table 5 illustrates the results of the laboratory analyses conducted between 1991 and 1994, where a high percentage of animals were found infected with leucosis.

In laboratory tests in 1994, fully 40.45% (309 samples) of the animals tested positive and another 2% were identified as suspicious. Of all the reproductive age cows (102), 62% (59) were infected.

Table 5. Summary of the laboratory tests conducted for leucosis in the meat herd at CATIE, Turrialba, Costa Rica.

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of tests</td>
<td>309</td>
<td>100</td>
</tr>
<tr>
<td>Positive tests</td>
<td>125</td>
<td>41</td>
</tr>
<tr>
<td>Probable tests</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Infected Cows</td>
<td>59</td>
<td>20</td>
</tr>
<tr>
<td>Infected Bulls</td>
<td>66</td>
<td>21</td>
</tr>
</tbody>
</table>

2. Solicit a panel of experts to analyze and make recommendations

At the CATIE Board of Directors' VI Regular Meeting, held in Turrialba, April 12-15, 1994, the CATIE Administration informed the Board of the high incidence of
bovine leucosis in the Center's cattle herd. The Board's response, resolution 
#21-94VI ROJD (Appendix 1), instructs the CATIE Administration to call in a 
panel of experts to analyze the consequences of the disease in the 
Romosinuano herd, and subsequently make the final decision on this issue.

Later, at its VII Regular meeting held in Turrialba, October 10-11, 1994 
(Appendix 2), the Board considered the detailed report made after the meeting of 
experts held in Guatemala (Appendix 3). Knowing that the conclusions reached 
at this meeting still needed to be analyzed with respect to the actual herd, the 
CATIE Board of Directors resolved that the CATIE Administration and the 
Technical Programs should make a concerted effort to seek international support 
to finance the conservation and use of the Romosinuano herd, given the 
importance of the genetic resource it represented. In their instructions to the 
Director General, the Board also mandated that if concrete actions were not 
established by December 31, 1995 to finance the maintenance of the 
Romosinuano herd, then in the interests of the institution, the program should be 
disbanded.

Spurred by this resolution, CATIE began seeking the economic resources 
necessary to preserve the Romosinuano herd. One proposal was entitled, 
"Conservation and Exploitation/Utilization of the Romosinuano" (Appendix 4). 
This proposal was submitted to the USDA, ARS, Subtropical Agricultural 
Research Station (STAR), and included in its budget a body of high-level 
scientists from such institutions as STAR, the University of Florida, CATIE and 
the Central University of Venezuela. These efforts were fruitless, however.

3. Search for collaboration from other experts to eradicate the disease

Due to the laboratory test results, where a high degree of leucosis infection was 
proven, the Costa Rican Ministry of Agriculture and Livestock sent a letter, 
reference # DCA 309-99, dated July 29, 1993 (Annex 5), indicating that:
"The laboratory test results for the cattle used to collect embryos for exportation to Paraguay have been received. As you can see, (table in the text), the animals do not comply with the health requirements outlined by Paraguay in resolution 349, which states that all animals must test negative for the various diagnostic tests indicated above (table in text). This situation not only makes exportation impossible, but is an indication of the overall health condition of the existing herd and merits a series of actions to control and prevent the distribution of the disease to animals that have not yet been infected. I believe it would be prudent, on the part of the institution, to take the necessary measures to improve the state of health of the CATIE cattle herd, in the shortest term possible and in conjunction with experts in the field, so that it may, in the future, comply with the demands of the international market."

Based on the Ministry of Agriculture and Livestock’s suggestions, CATIE’s Director General wrote to Mr. Cristian Coronas, the OIRSA representative in Costa Rica, reference #D-272, dated February 15, 1994 (Appendix 6) and urgently solicited this organization’s technical assistance in making the correct decisions in this matter.

From this sprung the "Program to treat bovine enzootic leucosis" OIRSA-CATIE-MAG (Appendix 7), which consists of frequent laboratory analyses to separate the infected individuals from the rest of the herd and to eliminate a number of said animals annually. The plan was to have a three-year term with degrees of infection between 30 and 50%. However, the plan was neither economically nor technically feasible to implement.
Conclusions

1. All the information cited indicates that this breed is characterized by a notable reproductive efficiency compared to other breeds native to the region or those that have been introduced. It is resistant to high temperatures, diseases and parasites common to the zone. Given these characteristics, Romosinuanos offer a genetic resource with great potential.

2. Closed management and the impossibility of introducing new blood into the CATIE herd created a very high degree of consanguinity with the consequent loss of productivity and reproductivity in the Romosinuano herd.

3. The fact that 50% of the herd tested positive for bovine leucosis, meant that the germplasm from the CATIE Romosinuano cattle could not be disseminated.

4. The General Administration took all the measures recommended by the CATIE Board of Directors to resolve the matter and made efforts to improve the health and management of the Romosinuano herd in the attempt to preserve this genetic resource.

5. The suggestions made by the Costa Rican Ministry of Agriculture and Livestock, the body which governs issues regarding cattle in the country, were taken into consideration and viable solutions were sought.

6. Keeping in mind the scientific, experimental and economic factors affecting CATIE, the resolution made by the Board of Directors instructing the General Administration to decide whether the program should continue or be terminated was taken under consideration.

7. In 1995, CATIE's General Administration resolved that the Romosinuano herd project should be closed.
Bibliographic references


INFORME SOBRE LEUCOSIS EN EL HATO ROMOSINUANO

La Junta Directiva del CATIE en su VII Reunión Ordinaria, celebrada en Turrialba, los días 10 y 11 de octubre de 1994.

CONSIDERANDO:

1. Que de acuerdo con la Resolución 21-94/VI ROJD de esta Junta Directiva se instruyó a la Administración para convocar a una Reunión de expertos en el tema para analizar las consecuencias de esta enfermedad en el hato romosinuano.

2. Que la Administración ha rendido un informe detallado sobre la Reunión de expertos realizada en Guatemala.

3. Que las conclusiones de esa reunión aún deben analizarse a la luz de la situación real del hato.

RESUELVE:

1. Instruir a la Administración y Programas Técnicos para que, dada la importancia del recurso genético que representa el romosinuano, se hagan ingentes esfuerzos ante la comunidad internacional para financiar su conservación y utilización.

2. Instruir a la Dirección General para que si en un plazo hasta el 31 de diciembre de 1995 no se ha concretado acciones para el financiamiento del mantenimiento de los romosinuano, porceda en la forma que convenga a los intereses institucionales, a cerrar el programa.

Frank Bendaña
Presidente

Rubén Guevara Moncada
Secretario Ex-officio
INFORME SOBRE LA PRESENCIA DE LEUCOSIS EN EL HATO GANADERO

La Junta Directiva del CATIE en su VI Reunión Ordinaria, celebrada en Turrialba, los días 12, 13, 14 y 15 de abril de 1994.

CONSIDERANDO:

1. Que la Administración ha informado a esta Junta sobre la aparición de la enfermedad denominada leucosis bovina en el hato ganadero del Centro a niveles considerablemente elevados.

2. Que por la trascendencia histórica e importancia genética del ganado romosinuano que mantiene el CATIE desde hace más de 35 años este tópico reviste de características especiales.

RESUELVE:

1. Dar por recibido el informe.

2. Instruir a la Administración para convocar a una Reunión de expertos en el tema para analizar las consecuencias de esta enfermedad en el hato romosinuano.

3. Delegar en la Administración la decisión final sobre este asunto.

Frank Bendaña
Presidente

Rubén Guevara Moncada
Secretario Ex-officio
CONCLUSIONES Y RECOMENDACIONES DEL PANEL DE EXPERTOS
CONVOCADOS POR EL CATIE PARA EVALUAR LA SITUACIÓN ACTUAL
Y PERSPECTIVAS DEL HATO ROMOSINUANO EN TURRIALBA

1.- El ganado Romosinuano se caracteriza por una notable eficiencia reproductiva respecto a otras razas criollas o introducidas en la región, por una gran resistencia a condiciones de alta temperatura y enfermedades y parasitos comunes en la zona.

Dadas estas características constituye un recurso genético de gran potencial, según lo demuestran los resultados obtenidos a lo largo de muchos años en Colombia, Turrialba y en los últimos años en Venezuela y en la zona sub-tropical del Estado de Florida, Estados Unidos.

2.- Existe un creciente interés en la región sur de los Estados Unidos por el Germoplasma Tropical no cebuino, que provea características de adaptabilidad por una parte y de calidad de la carne por otra, para su utilización de programas de cruzamientos comerciales, para superar las características de menor productividad que afectan al ganado Cebuino, tanto en los Estados Unidos como en nuestra región.

El ganado romosinuano que posee las características mencionadas, es una alternativa a otras razas europeas que han sido utilizadas pero que tienen limitantes en su adaptación a condiciones tropicales y subtropicales.

3.- El rebaño romosinuano del CATIE, a diferencia de los existentes en otros países de Sur América productores de romosinuano (Colombia y Venezuela) está libre de aftosa, lo cual lo hace un proveedor exclusivo de semen para mercados libres de esta enfermedad, como el de los Estados Unidos, Centro América y México. Debe de tenerse en cuenta que el mejoramiento genético y difusión de éste germoplasma, es mucho más rápido y de menor costo mediante el uso de semen que mediante embriones, únic a vía potencial de exportación de material genético procedente de países con fiebre aftosa.

4.- Los principales limitantes del rebaño romosinuano del CATIE son:

- El grado de consanguinidad existente y su incremento futuro si no se toman medidas en relación al tamaño del rebaño y la introducción de nuevo material genético.
- Incidencia de leucosis viral bobina.

En el momento esta situación no constituye un problema de carácter técnico-productivo, por cuanto los índices zootécnicos no se han afectado negativamente. Constituye un problema dado las restricciones sanitarias impuestas por gobiernos de la región para el movimiento de animales diagnosticados como positivos.

5.- En base a la experiencia de otros países, los Estados Unidos por ejemplo, que no establece restricciones respecto a la leucosis para el ingreso de material genético en su territorio, como lo demuestra la exportación de embriones realizada por el CATIE a Missouri y Florida, y considerando la amplia difusión de esta enfermedad en el continente, se sugiere promover la revisión de las políticas sanitarias relativas a leucosis y otras enfermedades para facilitar el trasiego de material genético entre países.

6.- Para corregir lo señalado en el Punto 4, respecto a la consanguinidad del rebaño, se sugiere:

- Incrementar el tamaño efectivo del rebaño.
- Introducir un material genético de fuentes no emparentadas con el rebaño, mediante la importación de embriones.

Existe un proyecto en ejecución por parte de USDA, Universidad Central de Venezuela, Asociación de Criadores de Ganado Romosinuano de Venezuela y el CATIE, para la obtención de embriones de una amplia diversidad genética proveniente de rebaños sanitariamente controlados para su introducción en los Estados Unidos. Dicha introducción está autorizada por las entidades competentes del Gobierno Estadounidense.

7.- El aprovechamiento de las ventajas de esta raza, dependerá del desarrollo de una estrategia para su difusión y adopción en los sistemas productivos.

El CATIE como organismo regional, está en una situación privilegiada para impulsar, con instituciones nacionales y asociaciones de productores, programas de evaluación y mejoramiento utilizando el romosinuano.
8.- El costo derivado de la conservación, evaluación y difusión del germoplasma romosinquano, debe ser compartido por instituciones y organizaciones de países usuarios actuales y futuros y por agencias internacionales vinculadas a la problemática.

El CATIE debe sensibilizar a potenciales cooperantes para que contribuyan en ese esfuerzo.

9.- Para mayor información se adjuntan los siguientes documentos:

- Romosinuano at The Subtropical Agricultural Research Station (Brooksville-USDA)

  a) Documento de base preparado por CATIE sobre Evolución, Significado y las Perspectivas del Ganado Romosinuano del CATIE.

  b) Información Libre distribución y cooperación actual del hato romosinuano del CATIE e información económica.

  c) Proyecto Conservation and Explotation/Utilization of Romosinuano, preparado por USDA, Universidad Central de Venezuela y CATIE.

  d) El Ganado Criollo Colombiano Romosinuano (ROMO) preparado por Dr. German Martínez.

  e) Animal and Plant Health Inspection Service (USDA-APHIS) Draft protocol to import animal embryos from a country affected with foot and mouth desease (FMD).
DR. JORGE BELTRAN
FACULTAD DE VETERINARIA U.C.V
VENEZUELA

DR. GERMAN MARTINEZ
INSTITUTO COLOMBIANO
AGROPECUARIO ICA
COLOMBIA

DR. ANDREW C. HAMMOND
U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SUBTROPICAL AGRICULTURAL
RESEARCH STATION, FLORIDA

DR. ARNOLDO GONZALEZ REYNA
UNIVERSIDAD AUTONOMA DE
TAMAULIPAS, MEXICO
I. TITLE PAGE

(a) Title:

CONSERVATION AND EXPLOITATION/UTILIZATION OF THE ROMOSINUANO

(b) Submitting Institution:

USDA, ARS, SUBTROPICAL AGRICULTURAL RESEARCH STATION (STARS)

(c) Proposal Identification Number: 14.157

(d) Principal Investigators:

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G. A. ROHRER
Research Geneticist, USDA, ARS, US Meat Animal Research Center
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Clay Center, NE 68933
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II. SIGNATURE PAGE

(a) Investigators' Signatures:

The undersigned affirm that this proposal represents their individual and collective original work, and that they individually and collectively agree to participate in the project as described if it is funded.

__________________________
C. C. Chai

Signed Signature Page will be sent at a later date.

__________________________
T. A. Ols
das

__________________________
A. Tewolde

das

__________________________
J. J. Beltran

G. A. Rohrer

(b) Authorizing Signatures:

Each of the undersigned affirms that this proposal represents an authorized submission of the institution that the undersigned represents, that it has been prepared using the appropriate accounting and other practices of that institution, and that the institution intends to devote the specified staff, facilities and financial resources to the project if funded.

__________________________
M. E. Carter

__________________________
J. Troconiz

__________________________
T. E. Walsh

__________________________
D. B. Laster

__________________________
R. G. Moncada
C. INNOVATIVE ASPECTS

The use of sequence tagged genetic markers, specifically microsatellites, to estimate genetic population parameters and assist selection of cattle in a breed conservation program is innovative and would make use of the most recently available technologies. Embryo transfer and cryopreservation techniques are sophisticated technologies and the application of embryo washing procedures that will allow importation of cattle embryos from Venezuela to the U.S. (and subsequently to Costa Rica) is new. Use of biological efficiency as a criterion for further conservation and utilization of animal genetic resources is also new.

D. STRENGTHENING INNOVATIVE RESEARCH CAPACITY OF DEVELOPING COUNTRY INSTITUTIONS

A graduate assistant from CATIE will receive an M.S. degree in animal breeding and genetics at the University of Florida and conduct thesis research at the USDA, ARS, Subtropical Agricultural Research Station (STARS) in Brooksville, FL and USDA, ARS, Roman L. Hruska US Meat Animal Research Center (MARC) in Clay Center, NE. Furthermore, a technician from CATIE will receive training in embryo transfer procedures at STARS. Application of the embryo transfer training will be necessary for successful project completion at CATIE. It is envisioned that this training will result in the maintenance of a long-term program in these areas in Costa Rica. Research capacity also will be enhanced by the purchase of cryopreservation, storage and embryo transfer equipment at CATIE.
V. TECHNICAL ANALYSIS

A. OVERALL AIM AND SPECIFIC OBJECTIVES

The overall aim of the research project is the conservation, exploitation and utilization of the Romosinuano breed.

The specific research objectives are to:

1. Conserve the Romosinuano as a distinct, tropically-adapted Bos taurus breed by expanding the population and to preserve genetic diversity within the breed by utilizing genetic markers to guide selection.

2. Reduce inbreeding of the Romosinuano in Costa Rica by introduction of unrelated Romosinuano germplasm from South America.

3. Increase the exploitation and utilization of the Romosinuano breed as a valuable genetic resource for high reproductive efficiency under harsh tropical conditions by evaluating performance under differing environmental conditions, namely Costa Rica, Florida and Venezuela.

B. BACKGROUND AND RATIONALE

Conservation and preservation of animal genetic resources is of global importance (FAO, 1987). There is a need to maintain and manage biodiversity to sustain agricultural production systems throughout diverse agroecological zones. This is particularly important in developing countries as in Latin America where beef and dairy production systems play significant economic, social, ecological and biological roles (CATIE, 1992).

The Criollo cattle of Latin America have been recognized as possessing unique attributes worthy of conservation (FAO, 1987; CATIE, 1992). Criollo cattle types or breeds evolved in tropical regions of Latin America through natural and artificial selection of Bos taurus cattle brought to South America in the 16th century by early settlers. Over three centuries these cattle adapted to tropical conditions by developing tolerance to heat and resistance to disease including parasitic infection. In the 20th century, however, these native cattle have nearly been eliminated because of successive generations of crossbreeding with zebu (Bos indicus) bulls. The benefits of heterosis resulting from the initial generation of such crossbreeding improved growth, unfortunately, this was attributed solely to the zebu bulls and thus cattle producers thought that increasing the percentage of zebu in their cattle would result in increased performance. The heterotic advantage of the F1 generation is halved with each additional generation of upgrading with zebu bulls which today is probably in its fourth or a higher generation. As a result, almost all heterosis has been lost and production efficiency, particularly reproductive performance is now very low, with calving percentages under 50% per year. Crossbreeding of the now nearly pure zebu cows with Bos taurus bulls could restore heterozygosity and increase productivity. However, the most popular Bos taurus breeds (Angus, Hereford, Simmental, Charolais, etc.) do not survive well under the harsh tropical conditions of Latin America. The advantage of a superior Criollo breed such
17 calves (9 heifers and 7 bulls) that are 6 months of age. All of these animals were derived from embryos imported from CATIE and transferred into recipients at STARS (Chase et al., 1992). Data collected from the bulls of the first of two importations indicated puberty (50 million sperm cells/ejaculate) in the Romosinuano was reached at a similar age as Angus and that both were earlier than Brahman (Chase et al., 1993). At the University of Missouri, 4 Romosinuano calves were born following embryo transfer, 3 were slaughtered and 1 heifer was transferred to the STARS herd in Florida. A larger number of Romosinuano X Angus crossbred cattle were produced in Missouri by artificial insemination. In that study, carcass characteristics were evaluated in 18 Angus and 16 Romosinuano X Angus (Clarke et al., 1993). Carcass quality and cutability traits of the two breed groups were similar.

The potential of the Romosinuano to contribute toward increasing beef cattle production efficiency in the tropical regions of South and Central America and in the warm regions of the U.S. is great. However, successful exploitation of this potential is obviously threatened due to the dwindling numbers of the breed.

There is no current legal mechanism for importation of beef cattle germplasm to Costa Rica directly from Venezuela or Colombia due to the existence of foot and mouth disease in countries south of Panama. Recent regulations by the USDA Animal and Plant Health Inspection Service (APHIS, 1991) allow the importation of washed embryos into the U.S. from countries where foot and mouth disease is endemic. Due to the current political situation in Colombia, however, U.S. government officials, including USDA scientists and APHIS veterinarians, have not been permitted travel to Colombia. Thus, embryos need to be collected and imported from Venezuela. Semen or embryos obtained from progeny born in the U.S. can be exported to Costa Rica. Use of artificial insemination and embryo transfer technologies are used in the cattle industry to accelerate the production and utilization of genetically superior animals. At the present time, these technologies still provide the most practical means of conserving germplasm (Polge, 1990).

Because of its historical interest in the Romosinuano and its education and development mission, CATIE is well suited to be the lead institution for breed conservation efforts, evaluation, and introduction of the Romosinuano throughout Latin America. Recently, CATIE has taken the initiative to bring together scientists in Latin America to develop a regional plan with short and long term goals for genetic conservation efforts (CATIE, 1992; Tewolde and van Dijk, 1993). Venezuela is in a unique position to assure the continuance of the Romosinuano outside of Colombia, particularly if available biotechnologies are applied to preserve genetic diversity within the breed.

Most of the U.S. investigators (Chase, Olson and Hammond) had the opportunity to meet with the Venezuelan investigators and Romosinuano cattle breeders, and to observe most of the Romosinuano cattle in Venezuela. The breeders in Venezuela are willing to cooperate. Recently we obtained over 300 pedigrees of Romosinuano cattle in Venezuela. Romosinuano from a Colombian government herd (Instituto Colombiano Agropecuario; ICA), that was instrumental in promoting the breed in Colombia, were well represented in the cattle now in Venezuela. The pedigrees we obtained included Colombian registration numbers.
in Venezuela with Ministry of Agriculture Officials (Venezuelan government
official veterinarians), Venezuelan investigators (Beltran, Bastidas and
Barrios) and Romosinuano breeders to: 1) inspect the proposed ET facility,
2) outline the final recommendations for testing and monitoring the donor
herds of origin, 3) discuss the proposed scheduling of events when animals
arrive at the ET facility, and 4) discuss arrangements for the purchase of
flushes and semen. The objectives of this meeting could be accomplished in a
three-day visit. Following this meeting, the Venezuelan investigators and a
Venezuelan official veterinarian would begin the one-year monitoring and
testing of the donor herds of origin and make any necessary modifications to
the ET facility.

About one year later (mid-August 1995) U.S. investigators (Olson and Chase)
would make a second trip to Venezuela and with all interested parties to: 1)
select the specific candidate ET donor dams and sires to enter the ET
facility, 2) do a final inspection of the ET facility, 3) set a final schedule of events in the ET facility and 4) deliver supplies for
synchronization, superovulation and insemination. As indicated in the
Background and Rationale, potential ET donor dams and sires will have been
selected by pedigree analysis prior to the trip. Investigators from the U.S.
(Olson and Chase), Costa Rica (Tewolde) and Venezuela (Beltran, Bastidas and
Barrios) would then travel to each Romosinuano herd that contained potential
ET donor dams and sires. The information to be collected on each potential
ET donor would include: rectal palpation of reproductive organs, ultrasonic
examination of the ovaries, passage of a catheter through the cervix, visual
observation of conformation, and a photograph of the animal. Bulls will also
be observed and, depending upon the facilities, breeding soundness
examinations may be performed. After all potential ET donor dams and sires
have been evaluated, all interested parties will meet in Maracay, Venezuela
to select 25 candidate donor cows and 5 sires. Following this meeting, the
Official Veterinarian of Venezuela, Chase, Beltran, Bastidas and Barrios will
meet at the ET facility to accomplish objectives 2 through 4 of this visit.
The objectives of these meetings can be accomplished in 7 to 10 days
depending on how many herds are involved. Three to five herds are expected
to participate. Candidate ET donor cows and sires will then be transported
from the ranches to the ET facility by September 1, 1995.

Once the ET donor dams and sires have been accustomed to the ET facility
(October 1, 1995), estrous cycles will be synchronized in donor dams. Five
dams on each of five days will be administered a progestogen ear implant (6
mg norgestomet) and injection (3 mg norgestomet and 5 mg estradiol
valerate). This synchronization package is commonly known as Syncro-Mate-B
(Sanoﬁ Animal Health, Overland Park, KS). Nine days after implant
insertion, the implant will be removed and prostaglandin-F2a (PGF2a;
Lutalyse; The Upjohn Co., Kalamazoo, MI) will be administered (25 mg).
Treated animals should display estrus 36 to 48 hours after implant removal.
Nine days after synchronized estrus, follicle stimulating hormone (FSH;
Schering-Plough Animal Health Corp., Kenilworth, NJ) will be administered
twice-daily for ﬁve days (superovulation, total dose of 40 mg; Staigmiller
et. al, 1979). Additionally on d 4 two injections of PGF2a will be given
(25 and 15 mg, respectively) to induce luteolysis and estrus. Fresh semen
will be collected (primarily by artiﬁcial vagina but also by
electroejaculation
into groups of 25 cows. Estrous cycles of recipient cows in each group will be synchronized using progestogen (Syncro-Mate-B) as previously described for donor cows in Venezuela. Sterile marker bulls fitted with chin ball markers will be run with the cows as an aid to estrus detection. Around the expected time of synchronized estrus, visual observations for estrus activity will be conducted three times each day to determine day and approximate time of standing estrus. Seven days after the time of observed estrus, cows that developed a palpable corpus luteum will be utilized as recipients. Romosinuano embryos imported from Venezuela will be thawed, classified (stage and quality determined), and transferred into recipient cows (one embryo/recipient). The same reputable U.S. embryo transfer specialist that flushed cows in Venezuela will also transfer the embryos. It is customary to contract collection and transfer with the same individual for accountability and quality assurance. After the embryos have been transferred into all groups of recipient cows, recipient cows will be managed as one herd. At 60 to 90 days after embryo transfer, pregnancy will be determined by rectal palpation and only pregnant cows will remain in the herd through calving.

We anticipate about 40 calves from the transfer of 80 embryos (we have achieved a range of 45 to 55% calving at Brooksville in the past). At birth (spring, 1997), all Romosinuano calves will be weighed, and tattooed and ear tagged for identification. In September 1997, Romosinuano calves will be weaned. At weaning, calves will be weighed, body condition scored, and hip height will be measured. Romosinuano heifer and bull calves will be managed seperately and fed a weaning diet for about one month in drylot. Romosinuano heifers will then be placed in a heifer development program that will involve comparison to other breeds of heifers at similar ages. Likewise, Romosinuano bulls will be developed along with other breeds of bulls. The main emphasis of this research will be to determine breed (tropical vs temperate) and nutritional effects on postweaning growth, reproductive development and puberty. Age and weight at puberty will be determined in both Romosinuano heifers and bulls.

During this same time period (1996-1997) a graduate assistant from Costa Rica, identified by CATIE, will be conducting course work for an M.S. degree at the University of Florida, Gainesville. This graduate student will conduct the animal phase of his or her research at Brooksville, FL and will conduct laboratory analyses at Clay Center, Nebraska. Blood samples will be collected at weaning from the Venezuelan Romosinuano calves born at Brooksville (September 1997). Blood samples will be centrifuged and lymphocytes (buffy coat) collected and frozen. Also at this time, blood samples will be collected and lymphocytes harvested in a similar fashion from CATIE Romosinuano cows and bulls previously born in Brooksville in 1991 and 1993. These lymphocytes will be transported on dry ice to the collaborating genetics laboratory in Clay Center, Nebraska. Under the supervision of Dr. Rohrer, the graduate assistant will learn the molecular biological techniques required to genotype animals using polymerase chain reaction (PCR) based sequence tagged genetic markers. The student will learn procedures to purify DNA from lymphocytes, amplify specified regions of genomic DNA in vitro via PCR, and size fractionate DNA with agarose and polyacrylamide gel electrophoresis. From the data generated, the relative level of inbreeding in the Costa Rican population can be assessed, as well as the genetic
season. Therefore, estrus synchronization may need to be utilized. This should not present any technical problems because the technician will be familiar with these procedures as performed during embryo transfer. Beginning in the breeding season of 2002, artificial insemination could be continued or sires from the ET line could be used in natural service.

Embryo transfer in the ET line at CATIE will be conducted for two consecutive years; during the breeding season in 1999 and 2000. About 50 embryos will be transferred each year. The preparation of recipient cows will be similar to that discussed at Brooksville. Maintenance of this ET line will be from replacing the recipient CATIE Romosinuano cows with their ET calves. The ET females would be bred to unrelated ET males.

The three lines of cattle would need to be maintained for at least 5 years. Biological efficiency will be compared between the three herds at CATIE as previously described (Tewolde and van Dijk, 1993). Performance of the three herds at CATIE will be compared with performance of Romosinuano cattle in Venezuela and Florida.

Time Chart

<table>
<thead>
<tr>
<th>Month</th>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct</td>
<td>1994</td>
<td>APHIS veterinarian, Hammond and Chase visit ET facility in Venezuela (3 days).</td>
</tr>
<tr>
<td>Aug</td>
<td>1995</td>
<td>Tewolde, Olson and Chase and all investigators in Venezuela select donor cows and sires (10 days).</td>
</tr>
<tr>
<td>Sep</td>
<td>1995</td>
<td>All donor cows and sires in ET facility.</td>
</tr>
<tr>
<td>Nov</td>
<td>1995</td>
<td>APHIS veterinarian and Chase go to ET facility in Venezuela for semen and embryo collections (14 days). ET specialist and CATIE technician to Venezuela for embryo collections (6 days).</td>
</tr>
<tr>
<td>Dec</td>
<td>1995</td>
<td>APHIS veterinarian to ET facility for final sample collection.</td>
</tr>
<tr>
<td>Jan</td>
<td>1996</td>
<td>Embryos imported to STARS.</td>
</tr>
<tr>
<td>Mar</td>
<td>1996</td>
<td>Begin transfer of embryos into recipient cows at STARS.</td>
</tr>
<tr>
<td>Dec</td>
<td>1996</td>
<td>Romosinuano calves born at STARS.</td>
</tr>
<tr>
<td>Sep</td>
<td>1997</td>
<td>Romosinuano calves weaned, lymphocytes collected.</td>
</tr>
<tr>
<td>Aug</td>
<td>1998</td>
<td>Genetic analyses completed.</td>
</tr>
<tr>
<td>Oct</td>
<td>1998</td>
<td>Semen collected and frozen for export to CATIE.</td>
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### Estimated Budget
#### Year 2

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<th>Line Items</th>
<th>CATIE AID/Matching</th>
<th>UCV AID/Matching</th>
<th>UF AID/Matching</th>
<th>STARS AID/Matching</th>
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<td><strong>SALARIES</strong></td>
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<td>Tewolde 10%</td>
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<td>Beltran 20%</td>
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<td>Bastidas 15%</td>
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<td>Barrios 15%</td>
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<td>Olson 10%</td>
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<td>Chase 20%</td>
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<td>Hammond 10%</td>
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<tr>
<td><strong>Graduate</strong></td>
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<td>assistant 100%</td>
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<td>Technician 10%</td>
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<td>25,000/0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET specialist</td>
<td>0/18,500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td></td>
<td></td>
<td></td>
<td>0/13,800</td>
</tr>
<tr>
<td>and supplies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Purchase embryos</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and semen</td>
<td>30,000/0</td>
<td></td>
<td>0/0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15,000/8,300</td>
<td>30,000/8,000</td>
<td>0/0</td>
<td>25,000C/35,700</td>
</tr>
</tbody>
</table>
### Estimated Budget
**Year 4**

<table>
<thead>
<tr>
<th>Line Items</th>
<th>CATIE AID/Matching</th>
<th>UF AID/Matching</th>
<th>STARS AID/Matching</th>
<th>MARC AID/Matching</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SALARIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tewolde 10%</td>
<td>0/5,800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olson 10%</td>
<td>0/0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chase 15%</td>
<td></td>
<td>0/9,400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hammond 10%</td>
<td></td>
<td>0/8,600</td>
<td></td>
<td>0/5,500</td>
</tr>
<tr>
<td>Rohrer 10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate assistant 100%</td>
<td>5,000/0</td>
<td></td>
<td>0/7,500</td>
<td></td>
</tr>
<tr>
<td><strong>Travel</strong></td>
<td></td>
<td>3,750/0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Materials and supplies</strong></td>
<td>0/14,000</td>
<td>0/2,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>8,750/5,800</td>
<td>0/0</td>
<td>0/39,500</td>
<td>0/7,500</td>
</tr>
</tbody>
</table>
B. BUDGET JUSTIFICATION

In year 1, $2,500 for Tewolde to travel to Venezuela to select donor animals (August 1995, 12 days, per diem $130/day and $940 transportation); $1,720 for Beltran (UCV) to accompany the Venezuelan government veterinarian to monitor disease in donor herds (San Cristobal and San Fernando) in October 1994 and February 1995 (4 days per diem $130/day and $340 transportation each trip); $3,360 for all investigators in Venezuela to select donor cattle (August 1995, 6 days per diem $130/day and $340 transportation per person); $3,000 for Olson to travel to Venezuela to select donor animals (August 1995, 12 days per diem $130/day, $1,340 for transportation, and $100 for SOS insurance); $7,000 for salary and travel for a required APHIS precollection orientation to be held at Hyattsville, MD to prepare for embryo collections (October 1995, 3 days salary, per diem and transportation for 3 APHIS veterinarians; APHIS costs were estimated from figures provided by AHIS for actual costs in recent collections); $6,000 to repair and maintain the ET facility to APHIS specifications; $9,000 for animal care and feed at the ET facility ($9,000; $2.50/day x 30 animals x 120 days); $7,500 for supplies needed for synchronization, superovulation and semen and embryo collection ($250/animal); and $7,500 for a portable embryo freezer with battery back up to remain in Venezuela due to possible disease transmission.

In year 2, $1,750 for a technician from CATIE to assist with embryo collections in Venezuela (8 days per diem $130/day and $710 transportation); $750 for a graduate assistant from CATIE to travel to Florida to begin graduate studies; $12,500 for a graduate assistantship from CATIE to conduct graduate research on this project in Florida; $12,500 for an APHIS veterinarian in Venezuela during semen and embryo collections (November 1995, 16 days, includes salary, per diem, transportation, supplies, communication and shipping); $3,500 for an APHIS veterinarian to monitor disease in donor animals post-embryo collection (December 1995; 3 days, includes salary, per diem, transportation, supplies, communication and shipping); $10,000 for diagnostic analysis of all samples for disease by APHIS laboratory ($300/animal and $1,000 shipping; APHIS costs were estimated from figures provided by AHIS for actual costs in recent collections); and $30,000 for the purchase of embryos and use of bulls for semen ($1,000/animal) because these animals are owned by private breeders.

In year 4, $750 for graduate assistant to travel to Clay Center, NE to perform genetic analyses (October 1997; $750 round trip); $750 for graduate assistant to return to CATIE upon degree completion (September 1998); and $2,250 for Tewolde to travel to Brooksville to evaluate bulls and heifers for future semen and embryo collection.

In year 5, $1,250 for a technician from CATIE to travel to Brooksville for embryo collections; $1,750 for supplies for AI and embryo transfer; $7,500 for the purchase of a embryo freezer for CATIE and $750 for a cryogenic storage tank for embryos and semen at CATIE.
their country. Thus, frequent communication between PI's and STARS will be necessary for proper timing of procurements. Also, this necessitates frequent communication between co-PI's and other investigators. PI's within a country are responsible for the publication of results conducted within their country. If a PI should change institutions then a co-PI from that country would pick up the responsibilities of that country's PI. If there was not a co-PI in that country then a new investigator at that institution would be sought.

B. STAFF AND SCIENTIFIC COLLABORATION

Dr. Beltran, a specialist in beef cattle breeding and genetics will coordinate work with private breeders in Venezuela. Selection of donor cattle in Venezuela will be a collaborative effort with input from all institutions. Dr. Bastidas a reproductive physiologist with specialization in AI will coordinate semen collections and AI in concert with Dr. Barrios another reproductive physiologist trained in embryo transfer. These physiologists will prepare the donor cows for embryo collections and assist with embryo collections. Significant collaboration between these physiologists, Dr. Chase and a technician from CATIE will occur during this period. Drs. Tewolde, Olson and Rohrer and a graduate assistant from CATIE will work together in the genetic analyses and selection of germplasm for exportation to CATIE. Dr. Chase and a technician from CATIE will collect embryos for export to CATIE and collaborate on the transfer of embryos and AI at CATIE. Drs. Hammond and Olson will work with Dr. Tewolde to assess biological efficiency between herds in Costa Rica.

C. TRAINING

A research assistant from CATIE will receive an M.S. degree (3 years) in animal breeding and genetics at the University of Florida and will conduct the animal portion of his or her research at STARS and laboratory analyses at MARC. Research and training will focus on utilizing gene markers to assess genetic diversity in the Romosinuano. A technician from CATIE will receive training in estrous synchronization, superovulation, embryo collection and embryo cryopreservation in Venezuela (6 days) and at Brooksville (3 months). It is envisioned that these trainings will result in the maintenance of a long-term program in these areas in Costa Rica.

D. FACILITIES

STARS is a federal facility with program jointly supported and administered by the U.S. Department of Agriculture, Agriculture Research Service and the University of Florida, Institute of Food and Agricultural Sciences (IFAS). Location headquarters is about 7 miles north of Brooksville, FL. Located at the Main Station of STARS are an office building, a laboratory building, a historical office building used for meetings, and five buildings used for maintenance and storage. Cattle working pens with hydraulic squeeze chute and scale are located near a barn with individual hand-feeding facilities for 24 animals, 3 metabolism crates, large forage dryer, feed grinding room, small wet lab, and hay and equipment storage. An additional set of pens, squeeze chute and electronic scale are located near a 16-pen feedlot with a
MINISTERIO DE AGRICULTURA Y GANADERIA
DEPARTAMENTO CUARENTENA ANIMAL
DIRECCION DE SALUD ANIMAL

29 julio de 1993
DCA = 309-93

Señor
Ph. D. Arnoldo Ruiz V.
Coordinador Producción Animal
CATIE
-Presençe

Estimado señor:

Se han recibido los resultados de laboratorio de los bovinos utilizados para la recolecta de embriones para exportar a Paraguay, obteniéndose los siguientes datos:

<table>
<thead>
<tr>
<th>IDENTIFICACION DEL ANIMAL</th>
<th>LEUCOSIS</th>
<th>IBR</th>
<th>BRUCELLA</th>
<th>CAMPYLOBACTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 9-I</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R 103 H</td>
<td>N</td>
<td>P</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R 17 H</td>
<td>P</td>
<td>P</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R 50 E</td>
<td>P</td>
<td>P</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R 9-6</td>
<td>P</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R 46-D</td>
<td>P</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R 8-20</td>
<td>P</td>
<td>P</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R 40 E</td>
<td>P</td>
<td>P</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R 4 A</td>
<td>P</td>
<td>P</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R 30 E</td>
<td>P</td>
<td>P</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

P: animal positivo.
N: animal negativo.

Como puede ver, los animales no cumplen los requisitos sanitarios solicitados por Paraguay en la resolución 349, en la que indica que sean animales negativos a las diferentes pruebas diagnósticas anteriormente citadas.

Esta situación sanitaria no solo les imposibilita para la exportación, sino además es un indicativo de la condición sanitaria general del hato existente y que amerita una serie de acciones para controlar y prevenir la distribución de estas enfermedades a animales que podrían encontrarse negativos.
Creo conveniente que la institución, en el menor plazo posible y en conjunto con especialistas en la materia, tome las medidas necesarias para mejorar el estado sanitario de su hato ganadero y pueda en un futuro cumplir con las exigencias del mercado internacional.

En espera de su comprensión a esta.

Dra. Myriam Jiménez Mata
Jefe Departamento Cuarentena Animal

CC: Ing. Sergio Abarca M. Director General Ganadería.
    Dr. Víctor Hugo Sancho V. Sub-director Salud Animal.
    Dr. Erasmo Ugalde. Centro Inseminación Artificial.
    Ph. D. Assefaw Tewolde. Genetista Animal CATIE.
    Sr. Arnoldo Barrantes. Administrador General Fincas CATIE
    Archivo.
15 de febrero, 1994
D-272

Ingeniero
Cristián Coronas
Representante del OIRSA en Costa Rica
SAN JOSE

Estimado Ingeniero Coronas:

Dentro de sus actividades de investigación, el CATIE cuenta con un hato de ganado Romosíniano, el cual constituye el único de esta raza libre de aftosa en el continente y por ende representa un recurso genético muy valioso que ha mostrado un gran potencial para el mejoramiento de la ganadería de carne en la región. El mismo cuenta con un historial de más de 35 años de evaluación y para sus cruces con razas cebuinas ha tenido gran demanda en los últimos años a nivel de la sub-región centroamericana y en algunos casos fuera de ella.

En días anteriores se realizó el sangrado de una muestra del hato para establecer un programa de transferencia de embriones, encontrándonos con la desagradable situación que el mismo presenta un nivel de alrededor del 50%, portador de la Leucosis bovina.

En vista de que la información que hemos recopilado sobre esta enfermedad, que aparentemente es endémica en algunos países y por este medio deseamos solicitar, con carácter de urgencia, al Organismo que usted representa, una asesoría técnica que nos permita tomar las decisiones correctas con especial énfasis en los casos en que dichos animales sean destinados a la exportación (en pie, semen o embriones) a otros países de la región, con fines de investigación o comerciales.

Al agradecer anticipadamente las gestiones que realice para canalizar nuestra solicitud de apoyo, hago propicia la oportunidad para hacerle llegar un atento y cordial saludo.

Atentamente,

Rubén Guevara Moncada
Director General

fov

fc: Rómulo Olivo Filipe, Subdirector General
Dr. Julio Jiménez, Especialista en Salud Animal para Costa Rica
PROGRAMA PARA EL SANEAMIENTO DE LUCOSIS ENZOOTICA BOVINA

OIRSA–CATIE–MAG

Para implementar un Programa de Saneamiento de un Hato infectado con LEUCOSIS ENZOOTICA BOVINA es necesario desarrollar un cronograma de actividades y la adopción de normas de manejo sanitario que incidan directamente en el desarrollo del programa de Control y Erradicación de esta enfermedad.

Dentro de las actividades primarias están:

1. DIAGNOSTICO INICIAL

Se debe de efectuar un diagnóstico inicial a la totalidad del hato, mediante un sangrado y prueba de inmunodifusión en agar gel, en el laboratorio del Ministerio de Agricultura y Ganadería.

2. PLAN DE SANEAMIENTO PARA UN HATO CON UNA ENFECCION DE UN 30% A UN 50%.

DURACION DEL PLAN TRES AÑOS.

Se hará una prueba global al hato por año, por un período de tres años

- Separación de animales positivos del resto del hato.
- Eliminación de un tercio de las hembras en reproducción positivas cada año.
- Eliminación del 100% de los bovinos infectados de los restantes estratos con excepción de los bovinos menores de 8 meses de edad.
- Estos bovinos serán sometidos a una nueva prueba al cumplir los 10 meses de edad eliminando los que persistan positivos.
- Los animales positivos que no se eliminen a la primera prueba deberán ser identificados de la forma más clara posible.
PRACTICAS DE MANEJO

- Uso de inseminación artificial con pipetas y guantes descartables por animal, o cubrir con toros negativos en forma exclusiva para las vacas y vaquillas negativas.

- Las prácticas de ordeño y palpación debe de hacerse primero a los animales negativos.

- No usar vacas positivas como nodrizas.

- Utilizar agujas desechables para las prácticas de aplicación de medicamentos.

- Esterilizar el instrumental quirúrgico cada vez que se va a utilizar.

- Controlar los insectos en lugares de alta concentración de animales como son corrales, salas de ordeño.

- No permitir el ingreso de animales que no hayan sido probados por dos veces con un intervalo de tres meses entre cada prueba.

- Posterior a la tercera prueba anual será eliminado el último tercio de los bovinos positivos como los positivos de otros estratos.

- Los bovinos serán sometidos a dos pruebas con intervalo de tres meses, declarando el hato libre de la enfermedad en caso de ser negativas ambas pruebas.

3. PLAN DE SANEAMIENTO PARA UN HATO CON UN 50% DE PREVALENCIA DE LEUCOSIS ENZOOTICA BOVINA.

DURACION DEL PROGRAMA DE SANEAMIENTO 4 AÑOS.

- Efectuar pruebas anuales eliminando el 25% de las hembras infectadas cada año.

- Los bovinos infectados de los que se encuentran en los diferentes estratos serán eliminados en un 100% con
excepción de los menores de 8 meses de edad.

- Estos bovinos serán nuevamente probados cuando cumplan los 10 meses de edad, eliminando los que persistan positivos.

- Identificación clara de los bovinos positivos que no sean eliminados.

- Después de la cuarta prueba, se elimina el último 25% de las hembras infectadas más los infectados en los otros estratos.

- Después de eliminar todos los positivos se efectuarán dos pruebas con un intervalo de tres meses entre ellas, declarando el hato libre si éstas resultan negativas.