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M. Cashin, research coordinator, Heifer Project International

H. Veit, Dept. of Pathobiology, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Polytechnic Institute and State University

F. McCarthy, Dept. of Animal Science, College of Agriculture, Virginia Polytechnic Institute and State University

J. Friedericks, Dept. of Agronomy, College of Agriculture, Virginia Polytechnic Institute and State University

R. Angert, project manager, Heifer Project International

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Heifer Project International
Box 13272 Delmas
Port-au-Prince, Haiti

EXECUTIVE SUMMARY

This Operational Program Grant (No. 521.0182-G-00-5044-00, Non-Governmental Support III, Sub-Project No. 11) was provided to assist Heifer Project International in implementing a research program with these purposes: (1) to determine by serum and hair analysis and by associated forage and soil analysis if selected minerals and vitamins are deficient in the cattle and goats in Haiti's Artibonite Valley, and (2) to develop a vitamin-mineral supplement to correct any vitamin-mineral deficiencies found in the cattle and goats.

As a part of the project, the management system of the small farmers responsible for animal care was investigated. An overview of this system is covered in the report.

Several conclusions can be drawn from the results of soil, forage and animal tissue analyses. The most significant for the purposes of this study is that the livestock in this area have extremely low levels of phosphorus (P) and high levels of calcium (Ca)available to them. They suffer from an absolute P deficiency, and the forages available to them have an extremely wide wide Ca/P ratio that interferes with metabolism of other minerals and reduces productivity and reproductive efficiency.

Because of the large amounts of P needed to correct the P deficiency and bring the Ca/P ratio into an acceptable range, it is the conclusion of this research that mere mineral supplements would not address the mineral nutrition problems of these livestock. See the Conclusions and Recommendations sections of the report for further discussion.

There are several other conclusions and associated recommendations concerning the reproductive performance of these animals, such as vitamin E treatment, vitamin A treatment, identification of the reproductive disease indicated in cattle, and development of an internal parasite control strategy.

The authors wish to thank USAID for providing an opportunity to implement this research, and to encourage USAID to continue support of research designed to address the problems of small farmers of limited means.

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This project was designed to be of help to the thousands of men and women who keep ruminants in Haiti. While the grant itself was made to Heifer Project International - Haiti, it was only through the teamwork and encouragement of many members of the international development community that the project was accomplished.

We would specifically like to thank the following:

The administration and staff of Hospital Albert Schweitzer (HAS) made us welcome using the hospital facilities and put up with us. In addition, the presence of HAS in the area was a major factor in making the project possible.

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I. INTRODUCTION

For many years, persons working in livestock development in Haiti have noted poor reproductive performance in the indigenous ruminant livestock. Because of the lack of symptoms of reproductive disease, some workers suspected that a mineral or vitamin deficiency could be the problem. During a meeting of several of those people in Haiti in 1985, it was decided to pursue a study to determine if any such deficiencies or imbalances were present.

Because two of the persons had worked at Hospital Albert Schweitzer (HAS) in the Artibonite Valley, it was decided to make a study of the livestock of that area. The project was a joint venture of Heifer Project International - Haiti (HPI), Christian Veterinary Mission (CVM), and Virginia Polytechnic Institute and State University (VPI) Colleges of Agriculture and Veterinary Medicine, with partial funding provided by USAID/Haiti. The project began in October, 1985. This report is the result of that study.

As was noted by Eriksen and Barrett (1984) in their report to USAID, there is little objective data concerning the livestock practices of Haitian farmers. This project had as its two main purposes to determine if selected minerals and vitamins are deficient in the cattle and goats of the Artibonite Valley, and to develop a suitable vitamin-mineral supplement if deficiencies were found. This supplement would be of value only if it would fit into the economic, social, and management patterns of the animal owners. The ultimate goal of the project was improvement of the reproductive performance of cattle and goats in the region, with possible extension to other areas of Haiti.

This study was conducted within a twelve-mile radius of Deschapelles, location of HAS. Caution is advised in extrapolating the data presented here to other areas of Haiti, since this part of the Artibonite Valley has some unique characteristics:

1) HAS has had community development programs, including veterinary medicine and livestock production training, in this region since the late 1950's. We believe there to be a relatively sophisticated attitude regarding animal husbandry and especially animal health -- in awareness if not always in practice -- that is unlikely to be found in other areas of Haiti. In addition, because of local people's positive attitude toward HAS and their familiarity with the hospital's work in the area, we were able to easily obtain the cooperation of peasant animal owners. Without this ready cooperation, which may not be as easily obtained in other parts of Haiti, this project would have been impossible.

2) The Artibonite Valley is an irrigated area. While we made an effort to select farmers from both lowland (wet) and higher ground, the economic and ecological effects of irrigation cannot be ignored. Large irrigated areas are planted in rice, making the

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land too valuable to plant in permanent pastures. The rice fields, however, are usually fertilized, and the fertilizer which leaches into the irrigation water possibly reaches other growing crops. The effect of leaching, while not measured by this project, is a significant factor in the agricultural system.

3) As noted later in this report, the farmers who participated in this project were not a random representative sample of all Haitian farmers, nor even of all farmers in this area. They were chosen from a group of people who brought their animals to a two-day veterinary clinic for preventative treatment and thus probably had a higher than average interest in their animals.

In order to determine the animals' status regarding minerals and vitamins associated with reproductive efficiency, we looked both at the livestock themselves and at their environment. We analyzed cattle and goat blood serum and hair to measure the animals' levels of selected minerals and vitamins. Since mineral and vitamin deficiencies or imbalances in soils and forages contribute to low production and reproduction in grazing livestock (McDowell et al., 1984), and because the livestock in question only eat feed grown on Haitian soils, it was also necessary to examine soils and the forages that grow on them.

Because very little baseline data existed, it was necessary to find out a great deal about the livestock system and management practices of the farmers of this region. To accomplish this, a series of questionnaires was designed and administered to selected farmers. These surveys covered livestock reproduction, nutrition, disease, and marketing. There are many complex relationships between biological factors and management practices. Only by looking at the two in perspective can we find valid answers to the questions addressed by this project.

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II. METHODOLOGY

A. SELECTION OF PARTICIPANTS

Our initial pool of project participants was made up of farmers who brought their goats for preventative treatment at a local clinic offered by the HAS veterinarian. These farmers were those responsible for day-to-day care of the animals, whether the actual owner or the person keeping the animal in a "share-cropping" type of arrangement. Each was asked two questions to rank them according to relative economic status: 1) Have you ever bought land? and 2) Do you ever sell your daily labor? The assumption was that those who had bought land would be of a higher economic status, those who worked by the day at a lower status, and those who had done neither or both somewhere in between.

From this pool, 121 farmers were chosen as a cross-section of the classes from four communities: Desarmes, Halaire, Marin, and Hatte Bellanger. Each of these farmers was administered a questionnaire to try to determine differences in animal management techniques and the importance of livestock in their lives and to ascertain their willingness to participate in the study.

We found minimal differences in animal management among the farmers. We therefore based our choice of farmers primarily on the number of livestock they had, to arrive at a broad cross section. The average numbers of animals owned by selected farmers were 4 goats, 1.6 cattle, 1.1 horses, 3.1 chickens, guinea fowl and/or turkeys, and 0.1 mules or donkeys, with a range of one farmer who owned only one goat, to another who owned 15 goats, 16 cattle, 10 horses, and 20 chickens. The average number of animals kept for someone else was less than one of any species.

Because our initial pool of participants included only farmers who brought their animals to be treated at a veterinary clinic, it automatically excluded those at the lower end of the economic and managerial spectrum -- those too poor or disinterested to bring their animals. Although this precluded a strictly random sampling of animal owners in the area, it concentrated our study on those farmers whom we feel are most relevant to it: those to whom livestock is of some importance and who are willing to exert extra effort for them.

Forty-three farmers were chosen to participate in the study. None of them were paid for their participation nor promised any particular benefit. From this group, we chose 112 animals -- fifty-six cattle and fifty-six goats -- to represent a cross section of animals by sex, age, and reproductive status (Table 1). We also included in the study four cattle belonging to the HAS beef herd and four goats belonging to the HAS veterinarian -- animals whose management, nutrition and health were expected to be relatively high and easily ascertained. (See appendix A for a complete description of animals.)

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We presumed an attrition rate of 20% and thus hoped to end the project with fifty of each species. The actual attrition rate by the last sampling was 25% for cattle and 43% for goats (Table 1).

Table 1: Sex and Age Distribution Among Animals Studied

	Beginning of Study	End of Study
Cows	24	20
Heifers	13	10
Bulls	9	4
Heifer calves	6	5
Bull calves	8	6
Total cattle	60	45
Does	30	23
Young does	8	3
Bucks	7	3
Female kids	7	5
Male kids	8	0
Total goats	60	34

B. FIELD VISITS

We visited each of these animals four times, at ten-week intervals. The original plan of four sampling points at twelve-week intervals, to represent a full year, had to be modified in order to finish the samplings by October, when many animals are sold to pay for school tuition.

Dates of Samplings (1986)

First sampling: January 27 - February 6
Second sampling: March 31 - April 5
Third sampling: June 9 - June 14
Fourth sampling: August 18 - August 22

We observed as many animals as possible where they stayed during the day. Frequently, animals were loose and owners did not know where they were, or else they were tethered at a prohibitive distance. When this was the case, animals were either brought to us at the road or held in the farmer's yard before being turned loose or tethered in the morning.

The team present at each sampling included three Haitian animal technicians, a Haitian interviewer, an expatriate veterinarian, and an expatriate coordinator.

At each sampling, a physical examination was performed on each animal, and blood and hair samples were taken. For some animals, representative soil and forage samples were collected. In conjunction with the sampling, a questionnaire was administered to the person responsible for day-to-day management of the animal. An effort was made to minimize stress to the animals throughout the procedures -- this was usually possible, as conditions and animal temperament allowed. Stress due to catching and restraining was unavoidable for some animals.

C. PHYSICAL EXAMINATION

Each animal was given an identification number (plastic ear tags for goats, metal ear tags for cattle) at the initial examination. Age was estimated by owners and confirmed by dentition. At each sampling, body weight was determined by heart girth measurement for cattle and scale weight for goats. (Heart girth measurements were also taken on goats for comparison to scale weight. See appendix B.) Respiration rate was taken. The haircoat and skin were examined for parasites, lesions, and general condition. The eyes and conjunctiva were examined, and the latter graded as white, pale pink, or pink. The ears, oral cavity, rectum, legs, and feet were examined, and as applicable, the scrotum, testes, mammary glands, vulva, and vagina were examined. When indicated, a more thorough examination was made by the attending veterinarian.

D. HAIR SAMPLES

The authors acknowledge that hair analysis is not a precise indicator of mineral status. However, it may help to detect severe deficiencies of some minerals which are vital to reproduction (Combs et al., 1982).

Switch hair on cattle has been determined to grow at a relatively constant rate, unlike body hair (Fisher et al., 1985). Accordingly, hair samples were taken from the switch on cattle and corresponding tail area on goats, as such samples were expected to provide a more accurate representation of the animals' nutritional status in the weeks between each sampling. In the first sampling, 5 cc (1 gm) of the most recent growth was collected using battery-powered clippers. All of the regrowth, approximating 1 gm, was collected in each successive sampling.

Each hair sample was identified by animal number, sealed in two plastic bags, and frozen at -2° C within eight hours. Frozen samples were shipped to VPI for analysis for Calcium (Ca), Phosphorus (P), Magnesium (Mg), Iron (Fe), Selenium (Se), and Zinc (Zn). (See appendix C for analytic procedures.)

E. BLOOD SAMPLES

Blood samples were drawn concurrently with the physical examinations. Blood was taken by jugular puncture, the site being shaved prior to puncture to facilitate venipuncture and thus lessen stress on the animals. Two samples per animal were collected in vacutainer tubes: one 5 ml EDTA tube and one 13 ml clotting tube. Blood from the stopper of the EDTA tube was used immediately to make three labeled blood smears per animal. Blood samples were kept cooled and protected from sunlight until further processing at the HAS lab. This was accomplished by use of small, insulated coolers lined with pre-chilled, water-soaked foam tube holders.

We initially attempted centrifuging clotted blood in the field within two hours of collection with a portable, hand-crank centrifuge. We found, however, that it was not possible to obtain or maintain the velocity necessary for complete separation. We therefore kept samples cooled and protected from sunlight until arrival at the laboratory (two to eight hours), where they were centrifuged in a standard laboratory centrifuge (Fick et al., 1979). Two 5 ml vials of serum were decanted per sample. These were wrapped in aluminum foil to prevent light exposure and kept frozen at -2° C awaiting shipment to VPI, where they were analyzed for Ca, P, Mg, Fe, Se, Zn, vitamin A, and vitamin E. (See appendix C for analytic procedures.)

Hematocrits and total white blood cell counts were done on whole blood from the EDTA tubes within ten hours of obtaining them. Standard laboratory procedures were followed.

Blood smears were fixed in 80% methanol in the HAS lab prior to shipment to VPI for differential white blood cell counts.

F. SOIL SAMPLES

A total of thirty-eight soil samples were collected. It often was not possible to correlate a particular soil with a particular animal due to the methods of restraint by tethering, or lack thereof. We therefore chose soils representative of the types of topography, irrigation patterns, and cropping systems that were observed to produce forages eaten by the particular animals.

Standard procedures for collecting composite soil samples were followed. Soil sample boxes were sealed in two plastic bags, frozen at -2° C and shipped to VPI for processing and analysis for P, K, Ca, Mg, Mn, Zn, Fe, Cu, pH and organic matter content. (See appendix C for analytic procedures.)

G. FORAGE SAMPLES

A total of sixty-two forage samples were collected and analyzed. As with soils, it often proved impossible to correlate specific plants with specific animals. In such cases, we chose representative forage samples based on dialogue with the animal owners and our own direct observations of animal consumption.

Stainless steel scissors were used to obtain the eaten portion of growing forages. For those crop byproducts or forages that were carried by animal owners to their animals, we took samples of the portions eaten in the condition in which they were given to the animals. Forage samples were collected in cotton bags and oven-dried at 60° C for twenty-four hours, after which they were labeled and sealed in plastic bags. After shipment to VPI, they were analyzed for Ca, P, Mg, Fe, Se, and Zn. (See appendix C for analytic procedures.)

H. QUESTIONNAIRES

In conjunction with each sampling, a questionnaire was administered to the person responsible for the day-to-day management of each animal. The topics covered at the samplings were, respectively, Reproduction, Feeding and Nutrition, Health and Disease, and Labor and Marketing. The goal was to develop a general picture of the livestock system of Haitian peasants in the area. (The Kreole questionnaires, with English translations, may be found in appendix D. Tabulated responses may be found in appendix E.)

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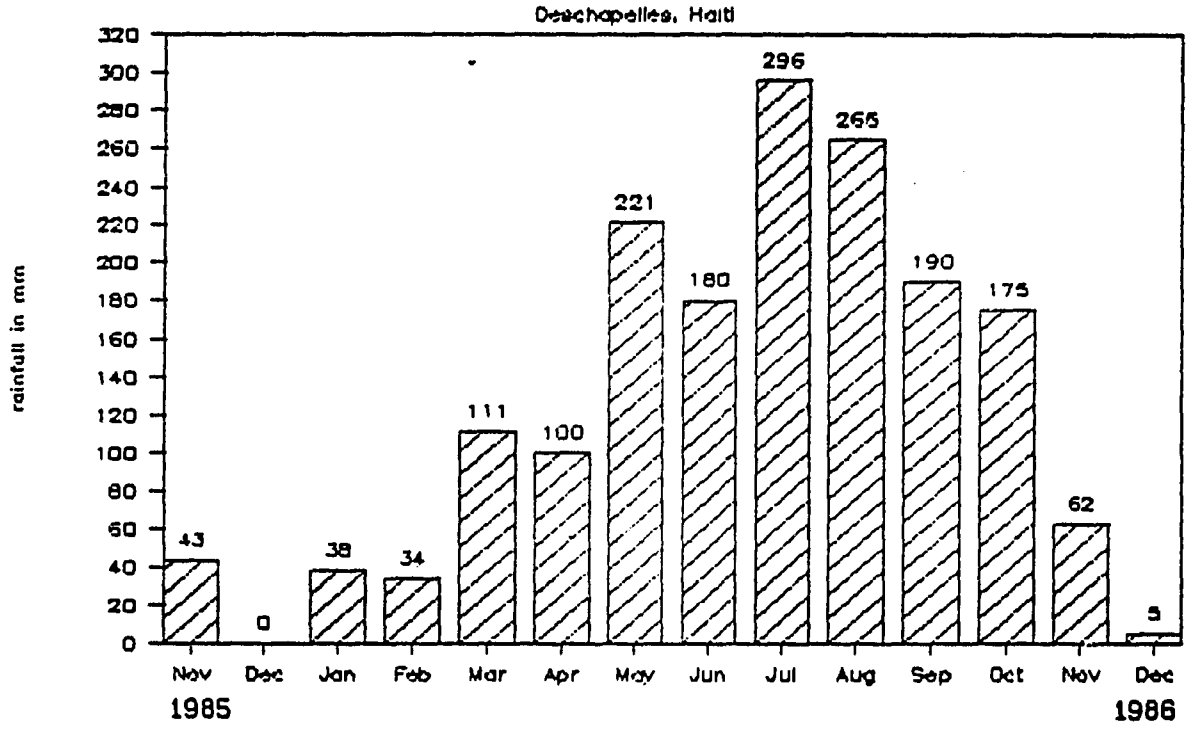
III. RESULTS AND DISCUSSION

A. RAINFALL

It is valuable to note rainfall distribution in relationship to the results of our study. Figure 1 shows rainfall in Deschapelles for the months before and during our study. After four months of negligible rain, light rains fell in March and April, followed by heavy rains in the months of May through August. Our first sampling point therefore fell in the dry season, our second in the very early rainy season, and the third and fourth well into the rainy season.

Figure 1: Rainfall in Deschapelles (1985-1986)



[a]Ronald Bluntschli. Mennonite Central Committee, Deschapelles. Personal communication.

B. SUMMARY OF QUESTIONNAIRES: LIVESTOCK SYSTEM

Unless otherwise noted, the source of the material in this section was the set of responses to questionnaires administered to the Haitian farmers at each sampling (appendix E). The reliability of the information therefore depends to a large extent on the knowledge, observations and recall of the respondents. This should be kept in mind in reading and using the information.

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Other sources were the authors' own observations, physical examinations of the animals, and laboratory test results.

In the great majority of cases, the person responsible for day-to-day care of a particular animal was the owner or someone in the owner's family. Although there were some animals which were being kept by someone other than the owner, that person is referred to here as the "owner."

1. Feeding and Nutrition

The feed situation and nutritional status of goats and cattle are affected at the most basic level by the season of the year and the resultant feed and water availability, feed quality, and use of animal restraint.

Figure 2: Months of Reported Feed Availability for Goats

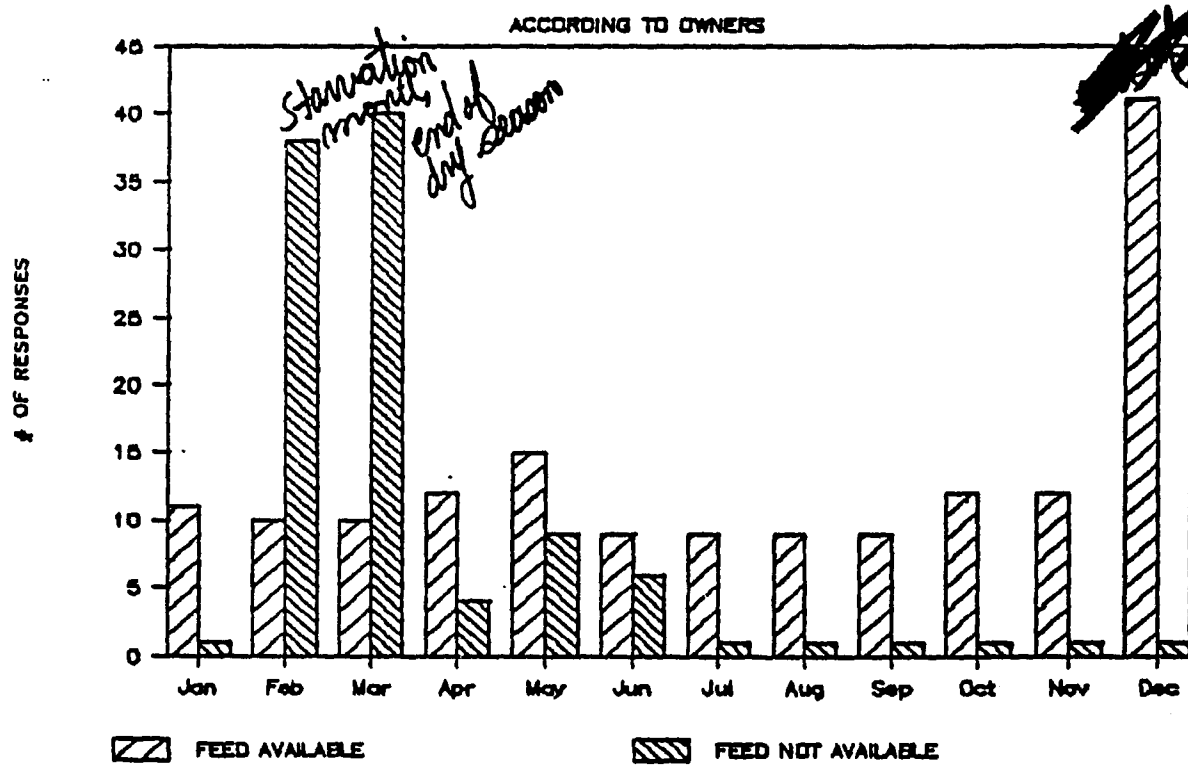

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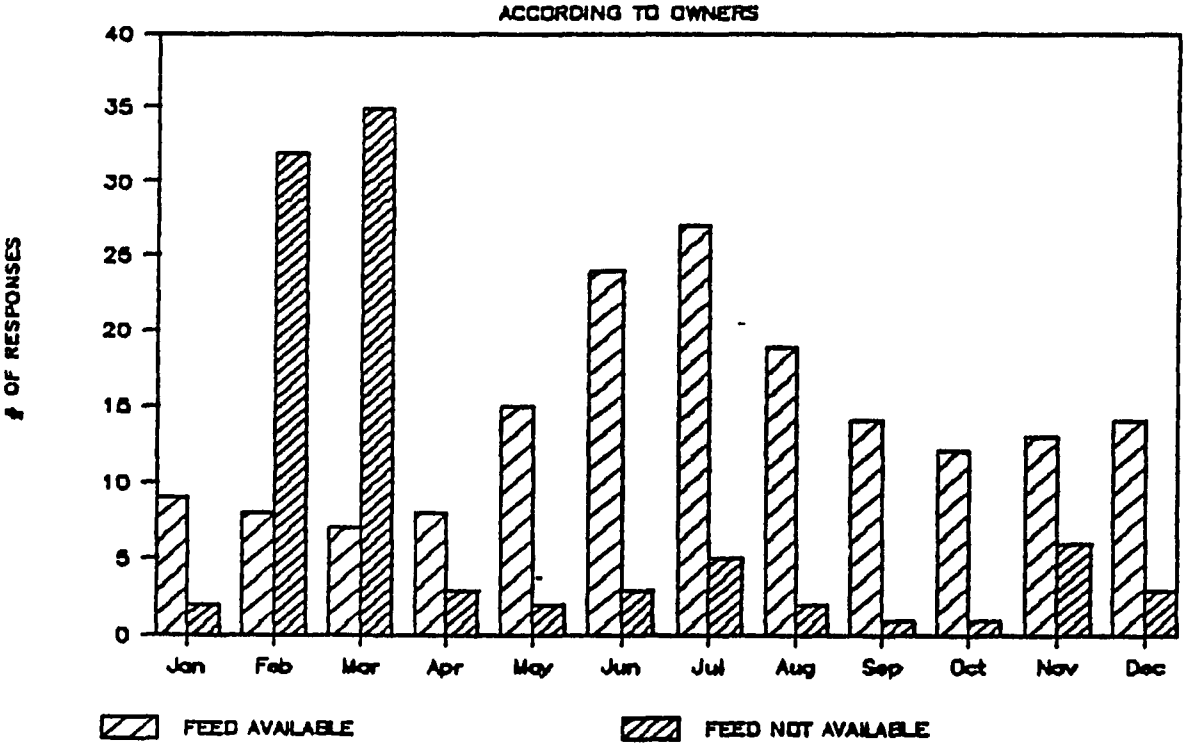
Figure 3: Months of Reported Feed Availability for Cattle



a. General Nutrition

Responses to questions about the availability of sufficient, high-quality animal feed throughout the year were varied (Figures 2 and 3). There was general agreement by most owners of both species that February and March (late dry season) are the months when their animals lack feed. However, 20% of goat owners said that the lack is most severe from April to June (early rainy season), and 30% of cattle owners said the lack is in various other months throughout the year. At the same time, 65% of goat owners and 31% of cattle owners said that the most good feed for their animals is available in December and January, which fall in the middle of the dry season. (The availability of crop residues in those months could explain this.) Many cattle owners (39%) said that the months of food abundance are May to August -- the rainy season.

Examination of animal weight changes between the sampling periods (Table 2) suggests that the rainy season is not immediately beneficial to goats or cattle, and may actually be detrimental to goats. (Sexually mature does had a mean weight loss of 16% in the ten weeks between the second to third sampling periods, corresponding to the start of the rainy season.) There are many possible reasons for this. First, nearly all goats, who have previously been loose to forage, are tethered at this time, thus limiting their feed intake to the forage available within the length of their tether line. Many cattle (57%) are already tethered and thus do not have the reduction in intake associated with the start of tethering. This could explain why the weight

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loss seen in goats at the start of the rainy season was not seen in cattle. Secondly, labor and time are at a premium at this time, as it is the crop-planting season. Animals may not be moved as frequently nor have water provided, thus further limiting forage intake. Thirdly, internal and external parasites are activated at the beginning of the rainy season and populate exponentially throughout the rainy season. Such parasitism could have a major negative effect on growth rate and/or weight gain. Finally, the residues from crops grown for human consumption provide an important part of the diet of cattle and goats. In many cases, availability of such materials is low early in the rainy season, being most available at the end of the rainy and into the dry season, following harvest.

Table 2 Mean Animal Weights (lbs.) by Sampling Period

Point in rainy season:	1 (Dry)	2 (Early Rainy)	3 (Rainy)	4 (Rainy)
Mature Female Goats[a]	73	68	57	57
Mature Female Cattle[a]	612	639	641	663

[a] No animals who kidded or calved during the course of the study were included in these figures.

None of the farmers we surveyed planted any type of forage for their cattle or goats. In listing forages that their cattle eat, a quarter of the cattle owners named guinea grass (*Panicum maximum*). We would speculate that this is volunteer regrowth from plantings done in past years. No concentrates are fed, and the only mineral supplement used consists of salt water sprinkled on dry corn husks so that cattle will eat them. It was not ascertained how widespread this practice is.

b. Goat Nutrition

From December to May, goats are loose during the day, and the feed and water they get is whatever they forage for themselves. Most of them are brought into the owner's yard for the night; about half of those are given some feed and/or water then.

From the time they are a few months old, goats are tethered in the daytime from May to December to prevent them from eating crops growing during those months. Again, most of these animals (82%) are kept in the owner's yard during the night; the rest are left out where they spent the day. Of those animals brought into their owner's yard, about half are given some feed and/or water then.

In the morning the goats are tethered, almost always on the owner's land. The feed they find there varies in type, quantity, and quality, depending on location and season. It consists of various forbs, tree leaves, native grasses, and a very few legumes. Most owners said they move their goats twice during the day, and most (81%) said they cut and carry feed to their goats. The feeds most commonly carried are the leaves of the "gommier"[1] (*Bursera simaruba*, West Indian Birch), "bois d'orme" (*Guazuma ulmifolia*, West Indian Elm), and "mombin" (*Spondias mombin*, Hog-plum) trees, and "pitimi" (*Sorghum vulgare*, Sorghum) crop residue.

Almost all owners (92%) reported carrying water to their goats at some time during the day. (We never directly observed this.) Contrary to the oft-stated belief, all farmers we surveyed are aware that goats drink water. It is apparent that they see the importance of water in that even those who reported not carrying feed to their tethered goats said that they do bring water to them. They all also believe, however, that their goats and cattle get sufficient water throughout the whole year. As there are open irrigation canals in much of the area and they usually have water in them for most of the dry season, it probably is true that they get enough water in the months when they are loose. But during the months they are tethered -- the rainy season and the months following it -- it is questionable whether they do receive the water they need. This is especially so for the months of September through December, as the rainy season has ended, thereby reducing the water content of forages and the amount of surface water available.

c. Cattle Nutrition

Whereas virtually all goats are tethered only from May to December, only 57% of cattle are tethered exclusively during those months, the rest being tethered year-round. Most owners tether their cattle to keep them from eating crops; a smaller percentage do it to keep them from leaving or getting hurt. (One mode of getting hurt is to receive a machete cut when found in someone else's garden during the growing season.) Whether loose or tethered, most cattle spend the night in the same place they spent the day. Very few of them receive feed or water there in the evening. Cattle are usually tethered on the owner's land, where the feed they find consists of various forbs, tree leaves, and native grasses.

Less than a third of the tethered cattle have feed carried to them in the daytime -- this feed is most commonly residues of

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[1]The tree known in Kreole as "gommier" was identified as *Tetrogastris balsamifera* by Ashley (1987) and as *Castilla elastica* by Guthrie (1984).

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corn, plantain, sorghum, or sugar cane, or leaves of the "bois d'orme" tree. All cattle reportedly are led to drink from an irrigation canal or the river at some time or times during the day. As with goats, they are said to be moved an average of twice a day.

2. Reproduction

a. Goat Reproduction

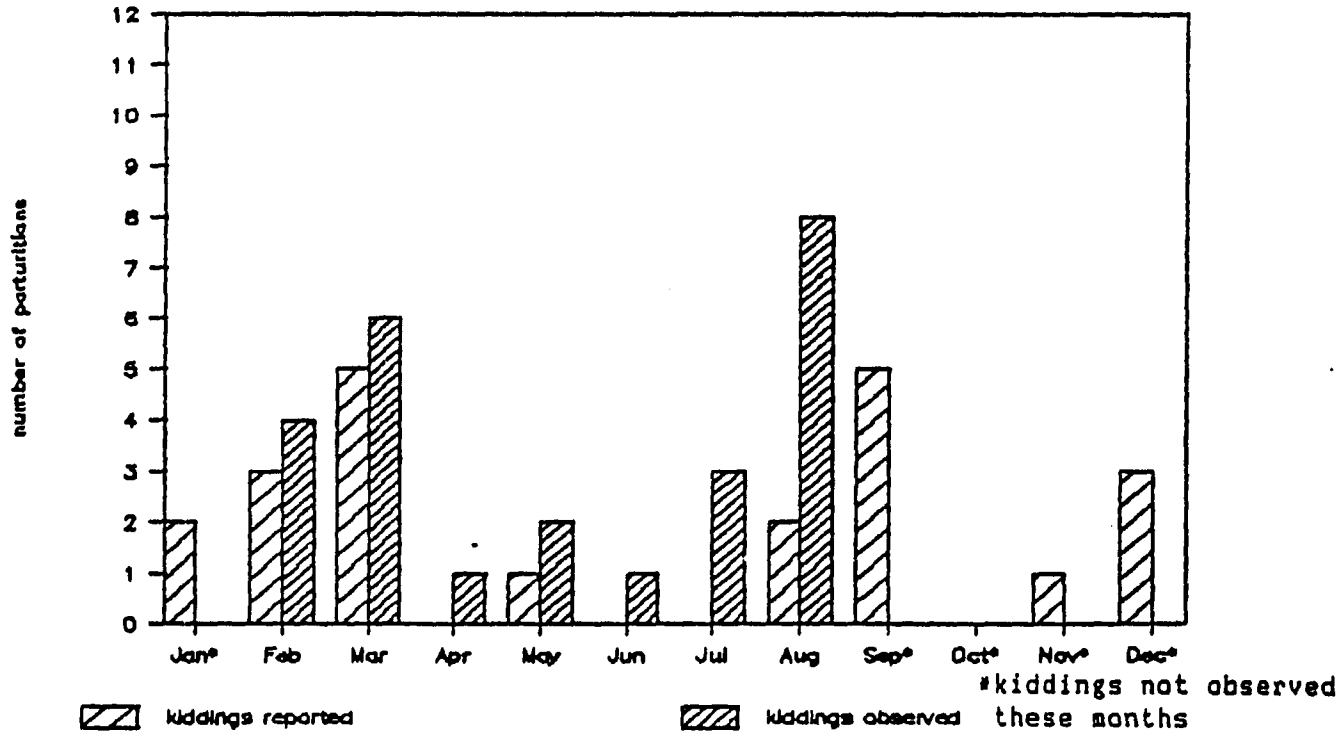
More than half of the owners of sexually mature bucks did not know at what age their buck reached puberty. It seems, from owner response and from observation, that bucks typically begin breeding between three and four months of age, with some as early as two months or as late as six months. Although not directly observed, we suspect that inbreeding from young bucks breeding their sisters and small dams is common. A third of the buck owners indicated some seasonality of breeding, with bucks more sexually active in March and April. There was no knowledge of any condition which could cause infertility. Neither was there knowledge of a limited breeding life. With only one exception, all of the bucks in our study were sold before they were a year old; this general pattern makes the concept of a limited breeding life irrelevant to farmers. There seems to be no sire selection and no control or management of breeding; there is therefore no knowledge of how frequently bucks breed or of conception rate among the does they service.

Most owners of mature female goats (82%) did not know their animal's age at first heat; it appears that the average is around ten to twelve months. Half of the goat owners said they recognize heat in their animals -- the signs recognized by some of them, in order of greatest frequency, included increased vocalization, tail shaking, mounting of other animals, and swollen vulva.

Twenty-four percent of owners of mature females said that female sexual activity (i.e. higher incidence of estrus) is seasonal: 18% said the season is February to April; 6% said the months of January and September. Their perceptions seem to be confirmed by the monthly incidence of observed and reported kiddings. August and September were the months when we observed the highest number of kiddings, indicating conception in March and April. There were also many kiddings in February and March, which indicates conception in September and October (Figure 4).

Almost all doe owners said that the bucks who breed their animal belong to someone else. They were unaware of the number of services per conception. We did not ascertain whether or not they know what particular buck breeds their animal -- we speculate that they rarely do.

Figure 4: Observed and Reported Parturitions in Goats



Very few owners knew the length of gestation for goats; accuracy in determining state and stage of pregnancy was highly variable.

A quarter of the doe owners give extra feed (grass, sorghum or corn residue) and/or water to pregnant does. One third give extra feed and/or water to does when they kid. No special care is given to newborn kids.

Most owners (71%) of does who have kidded at least once did not remember the animal's age at first parturition. For those who remembered, the average age was 14 months. Only two owners claimed to remember their animal's age at second parturition -- the kidding intervals for those two animals were 18 months and 12 months. Based on kiddings observed during the course of the study, we calculated a mean kidding interval of 9 months. This calculated kidding interval is believed to underestimate the actual kidding interval, as there is reportedly a higher rate of kiddings during the portion of the year studied than during the rest of the year. The interval is probably closer to 11 months.

The number of kids born to the does in our study averaged 1.94 per parturition. The number for any given doe varied with successive parturitions, with no discernible consistency or pattern. There were no incidences of dystocia reported.

Abortion and stillbirths were occasionally reported (two abortions and one stillbirth among goats in our study); cause or pre-

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vention is unknown to owners. There is a leguminous vine known as "lian pwa gratè", similar in appearance to Bengal velvet bean[1] (*Styzolobium deeringianum*), which owners claim causes abortion in goats if it is ingested. It is probable that it is *Mucuna pruriens* (Cow Itch) (Pierre-Noel 1971). Interestingly, it has been reported (Uptoff 1959) that *M. pruriens* is sometimes used as an anthelmintic in parts of the West Indies.

The great majority of doe owners did not know the number of weeks after parturition their does begin cycling again; for those who claimed to know, the average was six weeks. Weeks to cycling and weeks to rebreeding were reported to be the same. We cannot speculate as to the accuracy of these figures. It is possible that owners observe estrus and breeding in their female goats at that time, but it is highly unlikely that conception takes place then. Conception at six weeks after parturition is not consistent with reported or calculated kidding intervals; at the calculated mean kidding interval of 9 months, conception would take place 4 months after parturition.

b. Cattle Reproduction

Two-thirds of the owners of sexually mature bulls did not know at what age their bull reached puberty. Of the bulls we observed, those over eighteen months were sexually active. As with goats, many owners (71%) indicated a season of higher sexual activity, usually March and April; a smaller number indicated December to February. Again, the concept of a limited breeding life is not relevant. Only one owner expressed awareness of any cause of infertility: thinness. There was no knowledge of frequency of breeding or of conception rate among females serviced.

A little less than half of the cow owners remembered the animal's age at first heat -- for those, the average age was two years. Of those owners who recognize heat in cows and heifers (59%), most cited increased vocalization as being the observed sign; swollen vulva, the mounting of other animals, and tail shaking were also mentioned.

A third of the owners said that female sexual activity (as evidenced by estrus) is seasonal, being higher from February to April. This seems to be confirmed by the fact that the highest number of calvings observed and reported among the animals in our study was from November to February (Figure 5).

Almost all cow owners said that the bulls who breed their animals belong to someone else. They do not know the number of services per conception.

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[1]Alternative scientific names for Bengal velvet bean are *Styzolobium aterrimum* and *Mucuna deeringiana*.

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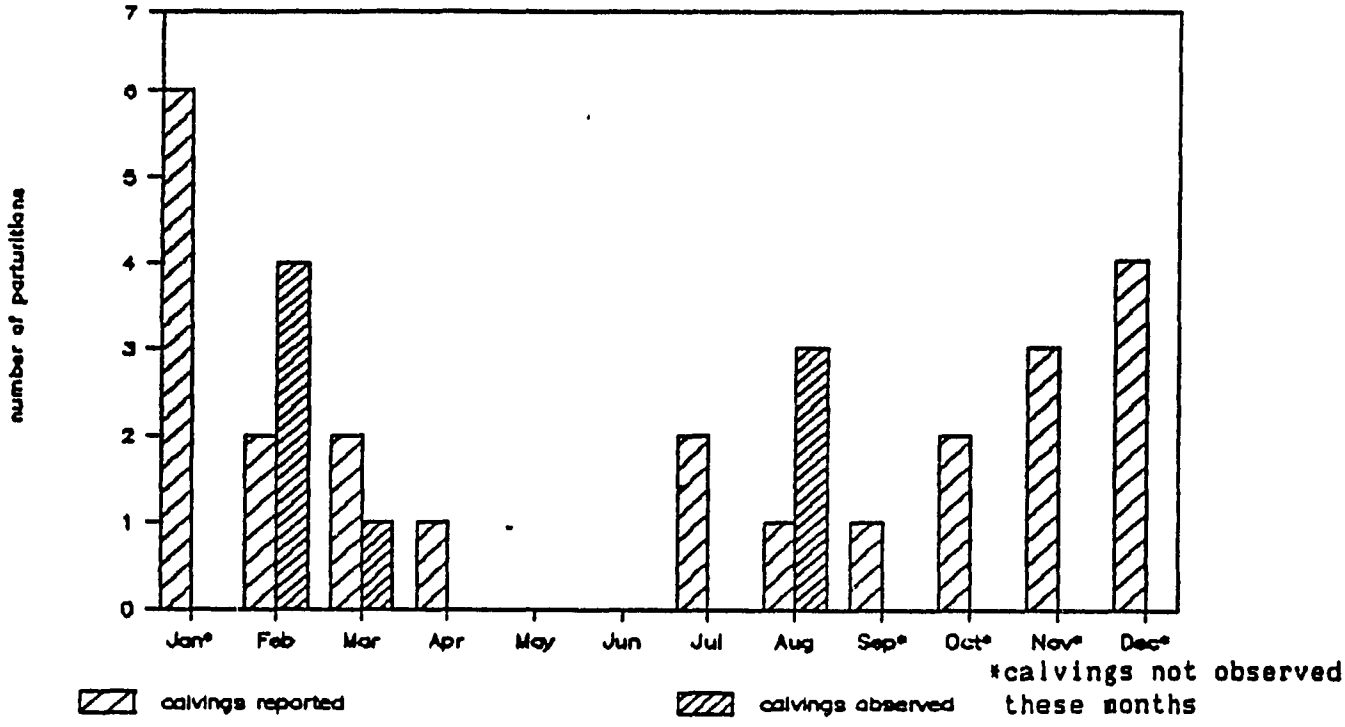
Figure 5: Observed and Reported Parturitions in Cattle



It appears that more people know the gestational length of cattle than of goats. In addition, a majority of owners of pregnant cattle had an accurate idea of when their animal was bred. As stated earlier, we suspect that there is necessarily more deliberate breeding management of cattle than of goats, since many cattle are kept tethered year-round. We did not, however, verify this.

Very few owners (12%) give extra care to their pregnant cows -- the care given consists of extra grass and/or water. As with goats, it is rare for owners to give any assistance or extra care to a cow when she calves. No owners reported giving any care to calves at birth. Dystocia appears to be extremely rare, as does abortion -- neither was reported in any cattle in our study.

Most cow owners (67%) did not remember their animal's age at first parturition; for those who knew (n = 8), the average was 29 months. For those animals for whom calving intervals were remembered (n = 11) the average interval was 22 months. Based on observed calvings, we calculated a mean calving interval of 26 months. This calculation is believed to overestimate the length of the calving interval, as the highest reported incidence of calving occurred outside the time period of this study. The interval is probably closer to 24 months.

Few owners (n = 11) claimed to know the number of weeks after calving that cows begin cycling and breeding again. There was a

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very wide range in the reported number of weeks, from 3 to 104 weeks, with an average of 19 weeks. At the calculated mean calving interval of 26 months, conception would take place 17 months after parturition.

The presence of reproductive abnormalities, as observed in the physical examinations, is covered in section C (p.20): "Results of Physical Examinations."

3. Health and Disease

a. General Health

The reported incidence of actual sickness or disease among the cattle and goats in our study was low: 74% of the goats and 82% of the cattle were reported by their owners to have never been sick. The HAS veterinarian also reports that very few animals at his clinics show symptoms of illness other than problems stemming from internal parasitism. Our observations and physical examinations (see section C: "Results of Physical Examinations") confirm that there is very little catastrophic disease among the animals, but there are, nevertheless, significant health problems.

b. Goat Health

When asked what is the most serious sickness that afflicts their goats, 91% of owners named diarrhea. Fifty-three percent also named it as the most frequently seen sickness in goats. It affects both young and adult goats, and seemed this year to be most prevalent in April and May -- early in the rainy season. Most owners (93%) did not know any cause of diarrhea; a few said that eating sweet potato vines could cause it. The experience of the HAS veterinarians has been that internal parasites are almost always the cause of diarrhea in goats in this area. The seasonal incidence of diarrhea supports this. Specifically, it is during the early rainy season that female internal parasites (nematodes and trematodes) ovulate most prolifically and that shed larvae are most active and able to survive.

A third of the goat owners give their goats salt water when they have diarrhea, and a small percentage (7%) said they take their goats to a veterinarian, which would be local clinics conducted either by the HAS veterinarian or by local veterinary technicians. More than half of the owners (60%) did not know any treatment for diarrhea. Forty percent said that goats die from diarrhea; 47% said they recover. With some exceptions, those owners who said that goats die from diarrhea are those who do not

know any treatment for it, and those who treat diarrhea with salt water or take the goat to a veterinarian said that goats usually recover.

Lice were also reported to afflict both young and adult goats. They were said to be more prevalent this year in April and May -- early in the rainy season. Our samplings fell on either side of these months, and we observed only one case of lice during the whole study, despite the fact that 47% of goat owners named it as the problem most frequently encountered in goats. Most owners (69%) did not know a "cause" or predisposing factor for louse infestation; some of them cited rain as a cause, and a very few said that bad food was a cause. Half of them did not know any treatment for lice, a quarter of them said they take their animal to a veterinarian, and a quarter said they bathe them with leaves of the "ti labé" tree (*Alvaradoa haitiensis*) as a treatment. Most (65%) said that goats recover from lice; 17% said they die. Almost without exception, those who bathe their affected goats with "ti labé" or take them to a veterinarian said that they recover.

c. Cattle Health

The disease named by 58% of cattle owners as being the one <u>most frequently seen</u> was "malcharbon", which is anthrax. It was also named by 71% as being their <u>most serious</u> problem with their cattle. (This disease was never mentioned as occurring in goats.) It is questionable whether the disease they are referring to is really anthrax; a possible alternative named by the HAS veterinarian is babesiosis. The disease is said to affect both young and adult cattle. Only one person named any cause for it: lack of food. Virtually every owner, including those who would take an afflicted animal to the veterinarian, said that cattle die from the disease.

Some owners (16%) said that ticks are the problem seen most frequently in cattle. They affect both young and adult cattle. No treatment was named; all owners said the animals recover.

Internal parasites, and diarrhea and colic attributed to internal parasites, were named by 18% of owners as being the most frequently seen problem in cattle, affecting both young and adult animals. The only treatment named was to take them to a veterinarian. All owners, whether they take them to a vet or not, said that the animals recover.

4. <u>Labor</u>

During the times when an animal is tethered, the same person ties, moves, and carries food and water to him. That person is generally the owner of the animal (50% of goat owners, 59% of

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cattle owners); otherwise, it is the owner's child or other family member. Among adults in our study, it was equally likely for a man or woman to be responsible for goats. There were more men than women responsible for cattle, though it was not uncommon for a woman to have that role. Among children, more boys than girls were responsible for livestock.

When asked who was responsible for caring for sick animals, all cattle owners and three quarters of goat owners responded that it was the veterinarian. This would be either the HAS veterinarian or local veterinary technicians. The goat owner or the owner's child was responsible for care of 15% of sick goats; the remaining 9% received no extra care when sick.

Milking of goats is not practiced by any goat owners in this area. Owners acknowledged that children will often sneak milk from lactating goats -- this practice, however, is not encouraged.

All cattle owners said that they milk their cows -- we did not ascertain how often they do it. The cows are most often milked by the owner (57% of owners); various family members milk the remaining 43%.

There is no use of cattle for animal traction of any kind in this part of the Artibonite Valley. Many cattle owners, however, knew of the use of cattle for plowing either in the village of Lachapelle, 18 miles from Deschapelles, or in Haiti's Central Plateau.

5. Marketing

Our information on the marketing of cattle and goats extends no further than the sale of the animal by its owner. The owners' intention for all the animals in our survey was that they be sold live in a local market. When asked whether the purchaser of the animals would use them for breeding or would eat them, more than half of the goat owners (58%) said for both; 39% said for breeding; and only 3% said strictly for eating. For cattle, slightly more (46%) thought they would be used for breeding; 40% for breeding and eating; 15% for eating.

A third of both cattle and goat owners said that they expected to eat meat from the animal. We are not sure how this would come to pass, since all expected to sell the animal live, and their eventual slaughter point -- local, regional, or Port-au-Prince -- is not known. It could possibly be from local slaughter and sale, with the original owner purchasing some of the meat in the market.

Responses to questions about their preferences when purchasing livestock indicate that buyers of both species look primarily for large animals; some cattle buyers also look specifically for cows who appear to give a lot of milk. The only attribute consistent-

ly discriminated against is small size, for both cattle and goats.

When asked what prices they could ask for animals in the market (the actual sale price probably being slightly less), the responses for goats were as follows:

Mature does	$20	(range $10 - 30)	n = 34
Mature bucks	$19	(range $10 - 35)	n = 34
Female kids	$11	(range $6 - 20)	n = 33
Male kids	$9	(range $5 - 15)	n = 28

Responses were split as to whether a doe or a buck can be sold for more; female kids generally bring more than male kids.

Average asking prices for cattle:

Mature cows	$251	(range $160 - 400)	n = 49
Mature bulls	$262	(range $100 - 600)	n = 48
Heifer calves	$124	(range $80 - 200)	n = 49
Bull calves	$98	(range $50 - 180)	n = 49

More people said bulls can be sold for more than cows, and heifer calves for more than bull calves.

Male animals, especially male goats, are sold more readily than females. (Hence, we had a 92% attrition rate for peasant-owned bucks (12 of 13) and 57% for peasant-owned bulls (4 of 7) which had reached sexual maturity by the end of our study. Attrition was due primarily to sale of the animals.) This is to be expected, as the owner gains no advantage from their use as breeding animals and rarely slaughters them for his own use.

C. RESULTS OF PHYSICAL EXAMINATIONS

1. Goats

a. Integumentary System: No ticks were noted on any goats. One male of the fourteen examined had warts, another a moist lip rash, and two a dry, flaky skin (exfoliative dermatitis).

Sixteen of 51 female goats (31%) had exfoliative dermatitis at some point in the study, and three had skin masses -- possibly fibromas or solitary warts. One female had teat lesions and her kid mouth lesions compatible with sore mouth (contagious ecthyma). Another solitary goat had an oral dermatitis which the owner ascribed to ingestion of the cactus plant, "kandelab" (*Euphorbia lactea*). A single female goat had a heavy louse infestation. Two kids of a female on study had ringworm-like skin lesions.

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b. Reproductive System: The males had no discernible reproductive diseases or lesions. Three females (6%) were noted to have a non-purulent vaginal discharge. Two abortions and one stillbirth were reported. Four neonatal deaths out of 25 kiddings were reported, one associated with maternal mastitis and one with neonatal diarrhea.

Severe mastitis was seen in one mature female and various teat lesions in four others.

c. Digestive System: One male was noted to be eating feces -- depraved appetite is associated with salt or mineral deficiency, usually phosphorus deficiency. Two females were observed to have diarrhea.

d. General & Miscellaneous: The average weight for non-pregnant mature does over the course of the study was 62 pounds.

One male and two females -- one with diarrhea, one lactating and with a chronic cough -- were exceptionally thin. One white-haired, white-skinned female had solar dermatitis.

Mean hematocrits in goats dropped by 11% between the third and fourth sampling points, after remaining relatively stable for the first three. The time lag between the beginning of the rainy season and the drop in hematocrits corresponds with the gradual accumulation of gastrointestinal parasites in the environment and in the goats themselves as the rainy season progresses.

Conjunctival grading was successful in detection of eight of thirteen goats (62%) having a hematocrit of twenty or less (moderate to severe anemia). The most anemic goats were usually detected by conjunctival examination; borderline or minor anemias, and occasionally moderate anemias, were usually missed. There was a significant difference between the hematocrit of the animals graded as having a white conjunctiva and those graded pale pink or pink. Mean goat hematocrits (PCV) for the three color grades were as follows:

	PCV		
White conjunctiva	22%	(range 13% - 33%)	n = 33
Pale pink conjunctiva	27%	(range 17% - 39%)	n = 30
Pink conjunctiva	26%	(range 10% - 38%)	n = 114

2. Cattle

a. Integumentary System: Ticks were present on cattle 55% of the time, being most prevalent between the hind legs, around the anus and udder, and in the ears. The number of ticks was categorized as few (1 - 5 ticks), very light infestation (5 - 12 ticks), or light infestation (over 12 ticks). The incidence of infestation was 10%, 25%, and 20% respectively. In very few cases was the

number of ticks great enough to cause significant blood loss; ticks could, however, play a role in the transmission of blood-borne bovine diseases, such as babesiosis, anaplasmosis, heart-water, and trypanosome infection.

We observed a small assortment of skin lesions on cattle, including seven females with warts, six of them involving the udder. In one case, the udder was rendered non-functional because of the profusion of warts obliterating the teats and precluding milking or nursing. There were also six cases of what are known in Kreole as "gal", which are nodular or plaque-like epithelial thickenings. These lesions may be atypical fibromas, warts, some kind of infectious (fungal or bacterial) dermatitis, sarcoptic or psoroptic mange, or a combination of these conditions. They were generally not troublesome to the affected cattle.

b. Reproductive System: Twelve of the thirty-seven sexually mature females (32%) had vesicular vaginitis at one or more physical examinations. The biological significance of this vaginal lesion in Haiti is unknown. In North America, such lesions are associated with *Ureaplasma species* or infectious bovine rhinotracheitis virus (IBRV) infection, both of which cause significant reductions in fertility of affected females. There were also a few cases of vulvar dermatitis, a few teat lesions and two cases of mastitis.

Two of seventeen males had signs of orchitis or epididymitis, the most common causes of which are infections of *Brucella abortus, Tritrichomonas foetus*, or *Vibrium foetus*. The cause in these animals was not determined. It would be useful to ascertain the cause of the problem in Haitian bulls, because such diseases cause considerable infertility, both in the affected bulls and possibly in females bred by them. Three young males (under one year) had abnormally small or undescended testes, which could represent either nutritional deficiencies or developmental anomalies.

c. Digestive System: Three animals had a few oral ulcers, which are typically a non-specific response to trauma of forages or a result of poor nutritional status. (Oral ulcers can also be associated with certain infectious diseases, but in such cases, they are more plentiful, and there are other signs and lesions of the diseases, none of which were observed here.) Three females had either diarrhea or bloody feces, and one had tapeworm segments observed in its feces. No cause for the diarrhea or bloody feces was determined, but given the lack of fever and other signs, internal parasitism was suspected.

d. General & Miscellaneous: The average weight for non-pregnant, mature female cattle over the course of the study was 639 pounds.

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The body condition of the seventeen male cattle was fair or better in all but two animals, which were exceptionally thin. One male from the HAS farm, which was noted throughout our study to be in poor condition, later had a laboratory diagnosis of babesiosis. This tick-transmitted disease can cause anemia, an enlarged spleen, and eventual poor body condition with reduced fertility.

There were five exceptionally thin females, one of which had concurrent diarrhea and one with vesicular vaginitis. In general, the rest of the females were in fair body condition.

Conjunctival color was an unreliable method of determining hematocrit (anemia) in cattle; there were no significant differences in the mean hematocrits of the three grades (white, pale pink, pink). Values in cattle across the whole study averaged 30, with a range of 21 - 40.

3. Summary of Physical Examinations

a. Goats: Goats have a reputation for being physiologically tough in the harsh Haitian environment. Indeed, only three of the sixty-five goats examined were classified as exceptionally thin. The absence of ticks, a solitary case of lice, relatively few obvious skin problems, and the absence of leg, foot or joint disease also support this reputation. In addition, male goats had no discernible reproductive disorders.

Conversely, exfoliative dermatitis (dandruff) was observed in 28% of the goats. While not directly important, this could be a sign of some underlying nutritional deficiency. (We did not observe any differences in serum or hair levels of the evaluated minerals or vitamins in these goats as compared to other goats.) The most severe anemias noted were in goats, and diarrhea was noted in a few goats -- these signs suggest moderate to severe gastroenteric parasitism.

Kid deaths, likely secondary to malnutrition, parasitism, or bacterial enteritis, were reported in 16% of goat parturitions. Abortions and stillbirths, though reported, were not of high enough incidence to be considered catastrophic. Goats appear to have greater late gestational and early neonatal losses than do cattle. Once a goat matures, it seems to fare reasonably well, though it still may suffer from parasitic and/or nutritional disease.

The possibility of ringworm and sore mouth in goats also exists (confirmation is needed). If present, they could be a significant problem in any attempt at large herd management of goats. Mastitis and teat lesions were present, though seemingly not a widespread problem.

b. Cattle: The cattle in this study were generally in fair body condition, given their very limited feed resources. Foot, leg, and joint problems were negligible. On the other hand, ticks, warts, and other poorly-defined skin conditions ("gal") were common to cattle, and the metal ear tags were more irritating than expected.

The presence of orchitis/epididymitis in the males and vesicular vaginitis in the females raised the possibility of infectious reproductive disease in the cattle of this region. Identification of the cause of the reproductive lesions and their effect on reproduction remains to be done. It is noteworthy that we had no reports of abortions or stillbirths in cattle. Hence, if there are infectious diseases causing infertility, they are doing so very early: at coitus, during fertilization or implantation, or early in the embryonic stages of gestation.

The few cases of diarrhea or bloody feces were probably due to internal parasitism. Mastitis and teat lesions were present, though apparently not a widespread problem. Overall, catastrophic disease in cattle was rare, but there was ample evidence of diseases capable of causing serious economic losses. (The diagnosis of babesiosis in one of the HAS animals, while not occurring as part of our study, certainly deserves mention in this context.)

D. WHITE BLOOD CELL COUNTS AND HEMATOCRITS

The blood values found in this study were compared with normal values reported for cattle and goats in the United States (Merck 1985):

Table 3: Normal Values for Hematocrits (PCV) and White Blood Cell Counts

	WBC (10^3/cu mm)	PCV (%)	BASOPHILS (%)	EOSINOPHILS (%)	BAND CELLS (%)	NEUTROPHILS (%)	LYMPHOCYTES (%)	MONOCYTES (%)
GOATS	4-13	22-38	0-2	3-8	rare	30-48	50-70	1-4
CATTLE	4-12	24-46	0-2	2-20	0-2	15-45	45-75	2-7

We presume that certain values could differ in Haitian cattle and goats due to differences in climate, nutrition, and genetics. We therefore have considered only the extreme values (high or low) to be of biological significance. The percentages of animals with low hematocrits and abnormally low or high total WBC counts are summarized in Table 4.

Table 4: Evaluation of Hematology by Sampling Period

	1st Period			2nd Period			3rd Period			4th Period		
	LOW PCV[a]	HIGH WBC[b]	LOW WBC[c]	LOW PCV	HIGH WBC	LOW WBC	LOW PCV	HIGH WBC	LOW WBC	LOW PCV	HIGH WBC	LOW WBC
GOATS	42%	27%	2%	35%	5%	5%	33%	87%	0%	73%	57%	0%
CATTLE	22%	5%	2%	18%	0%	18%	19%	38%	0%	17%	22%	0%

[a] Low PCV = 24% or less for goats, 26% or less for cattle.
[b] High WBC = above 13,000 for goats, above 12,000 for cattle.
[c] Low WBC = below 4,000 for goats, below 4000 for cattle.

These values indicate that goats had low hematocrits about 43% of the time, while cattle had low hematocrits about 19% of the time. Low hematocrits are usually associated with parasitism (internal or external) or blood loss from some other cause. Iron deficiency can cause anemia in young ruminants, but the high Fe levels in soil and forage in this region preclude this in these animals.

Low total WBC counts were rare for goats and uncommon for cattle. Low counts are usually associated with major physiological stress caused by infectious or toxicological agents, severe parasitism, or nutritional deficiencies. High counts were noted an average of 40% of the time in goats and about 15% of the time in cattle, with the highest incidence in the third sampling period. High counts can be caused by parasitic, bacterial, viral, or fungal infection or by excitement. Only 12% of the high goat counts and 29% of the high cattle counts were in the range that could be possibly attributed solely to excitement (within 1000 cells of the upper limit of the normal range).

Differential WBC counts were done on smears chosen randomly from all samplings. Based on comparison with normal values, 19% of the goats and 3% of the cattle had abnormally high eosinophil counts (eosinophilia). Eosinophilia is associated with parasitism or allergic diseases. Given that no clinical signs of allergic disease were noted, it is probable that the eosinophilia was related to parasitism. The only other frequent abnormality was an increased number of monocytes (monocytosis) in 25% of the goats and 10% of the cattle. Monocytosis usually indicates chronic infectious, parasitic, or neoplastic disease. Again, parasitism is suspected as the cause.

In summary, the goats had over twice the incidence of low hematocrits, high total WBC counts, and monocytosis than did cattle, and a much greater incidence of eosinophilia. These hematologic

changes are consistent with parasitism, strongly suggesting that the goats of this area are more severely affected by parasitism than are the cattle.

For complete results of hematocrits and total WBC counts, see appendix F.

E. SELECTED MINERAL AND VITAMIN ANALYSES

1. Serum

Tables 5 and 6 list the mean serum levels of selected minerals and vitamins in goats and cattle in this study, along with the minimal acceptable concentrations (MAC) of each. Because MAC serum values for goats are not available, cattle MAC serum values are used for comparison with values observed in goats in this study. See appendix G for complete results of serum analysis.

Table 5: Mean and Minimal Acceptable Mineral and Vitamin Serum Levels of Goats

Nutrient	Overall Mean Serum Level	Mean Serum Levels by Period 1	2	3	4	MAC For Cattle
Ca (mg/dl)	11.7	13.7	11.8	10.3	10.0	8.0[a]
P (mg/dl)	4.78	6.08	6.42	2.46	2.37	4.50[a]
Mg (mg/dl)	3.90	3.67	3.79	4.18	4.17	1.00[a]
Fe (ug/dl)	261	276	274	249	229	90[a]
Se (ug/ml)	.35	0.36	0.32	0.38	0.34	0.03[a]
Zn (ug/dl)	119	122	112	130	117	60[a]
Vit A (ug/dl)	28.5	26.4	27.3	29.5	33.0	20.0[b]
Vit E (ug/dl)	68	105	94	36	37	70[c]

[a]McDowell et al., 1983. (Nomenclature "Critical Serum Levels" changed to "Minimal Acceptable Concentrations (MAC)".)
[b]Merck Veterinary Manual, 1979.
[c]Norton & McCarthy, 1986.

Table 6: Mean and Minimal Acceptable Mineral and Vitamin Serum Levels of Cattle

Nutrient	Overall Mean Serum Level	Mean Serum Levels by Period 1	2	3	4	MAC For Cattle
Ca (mg/dl)	13.0	15.8	12.0	11.7	11.2	8[a]
P (mg/dl)	4.47	5.04	5.66	2.72	3.08	4.5[a]
Mg (mg/dl)	3.96	3.93	3.81	4.06	4.16	1-2[a]
Fe (ug/dl)	264	245	292	266	258	89[a]
Se (ug/ml)	0.36	0.35	0.36	0.41	0.36	0.03[a]
Zn (ug/dl)	145	147	137	145	152	60-80[a]
Vit A (ug/dl)	27.7	26.0	26.2	31.5	30.7	20.0[b]
Vit E (ug/dl)	132	161	158	84	81	70[c]

[a]McDowell et al., 1983. (Nomenclature "Critical Serum Levels" changed to "Minimal Acceptable Concentrations (MAC)".)
[b]Merck Veterinary Manual, 1979.
[c]Norton & McCarthy, 1986.

a. Phosphorus: Based on the overall mean for all four sampling points, cattle and goat serum P levels were very close to the minimal acceptable serum levels. On the basis of individual sampling points, however, mean levels for both cattle and goats were below critical levels in the third and fourth samplings, and many individual animals (23% of cattle, 21% of goats) were also below critical levels in the first and second samplings. This indicates a generalized phosphorus deficiency, particularly severe in the rainy season (third and fourth samplings).

The following trends in serum P levels were noted:

i) As would be expected (Underwood 1981), mean serum phosphorus levels in young animals were higher than those in mature animals. It is likely that those animals that are still nursing receive sufficient P in milk.

Serum Phosphorus (mg/dl)

Young goats	(<6 mo.)	7.70
Adult goats	(>6 mo.)	4.22
Young cattle	(<12 mo.)	5.67
Adult cattle	(>12 mo.)	4.22

ii) Overall serum P levels were lower in goats that kidded during the study than in goats that did not kid (4.27 vs. 5.20 mg/dl). This could be due to the depletion during gestation of P stored in body tissues. There was only a slight difference between cattle that did and did not calve (4.26 and 4.50 mg/dl, respectively), possibly indicating greater stored P in cattle.

iii) In 68% of the goats that kidded (n = 19), levels rose after parturition. Although the mean P rise was only from 4.35 to 4.53 mg/dl, it included five animals with a very large mean P decrease (6.24 to 2.52 mg/dl). Physical examination and laboratory analyses revealed nothing else noteworthy about those five animals. If those animals, and an additional one whose P level did not change, are excluded, the mean P rise was from 3.67 to 5.24 mg/dl. The tendency for serum P to rise after parturition was also noted in cattle, though there were not enough calvings during the course of the project to adequately evaluate this (a P rise in 5 out of 6 parturitions).

b. Vitamin E: Mean serum vitamin E levels in cattle were adequate at all sampling points, yet 27% of the cattle showed inadequate levels in at least one sampling. For goats, levels were adequate in the first two samplings, but fell to only half of the critical level in the third and fourth samplings. Overall, 76% of the goats had a low serum E level at some point.

c. Vitamin A: Mean serum vitamin A levels were adequate for both species at all samplings, but some animals (23% of goats; 31% of cattle) showed low levels in at least one sampling. Levels did not appear to be correlated with reproductive performance, reproductive status, or sampling period. Low A levels in goats are comparatively more serious than the identical levels in cattle, because goats have very little beta-carotene in their blood to convert to A (Bondi and Sklan, 1984).

d. Iron: Mean Fe levels were well above the critical level, and bordered on the upper end of the normal range of 89 - 270 µg/dl (McDowell, L.R., personal communication). Many animals (59% of goats and 44% of cattle) had abnormally high levels at some point during the year.

e. Other Minerals: Mean and individual serum levels of Ca, Mg, Zn, and Se were well above critical levels.

2. Hair

Hair mineral values have varied widely in past studies, both within and between the different studies. Hair mineral levels are reported to be affected not only by an animal's dietary intake, but also by season, breed, age, hair color, body location,

gender, and genetic background (Combs et al., 1982). In our study, no statistically significant differences in hair mineral values due to hair color were noted. Given the variables, hair analyses are not precise indicators of an animal's overall mineral status. They may, however, be of value in evaluating zinc and selenium intake (Combs et al., 1982).

Comparison of values found in this study with the range of values found in other studies may be useful. Mean values are listed in Tables 7 and 8. (See appendix G for complete results of hair analysis.)

a. Zinc: Zn hair levels were much higher in cattle than in goats (219 ppm vs. 82 ppm). This could be due to the positive correlation between hair stiffness and hair zinc concentrations (Miller et al. 1965), as bovine switch hair is stiffer and coarser than goat tail hair. The mean hair zinc level in cattle in this study was within the range reported in other studies; mean level in goats was much lower than the only other reported value.

b. Selenium: Se levels were much lower in cattle hair than in goat hair (.31 ppm and 1.18 ppm respectively). Hidiroglou et al. (1968) reported that cows with hair Se concentrations between .06 and .23 ppm produced cows with white muscle disease, while calves with concentrations greater than .25 ppm were free of white muscle disease. Hair selenium concentrations in both cattle and goats in this study were above the .25 ppm level. They were both also well below the concentration of 5 to 10 ppm reported by Olson (1969) to indicate Se toxicity.

Table 7: Hair Mineral Concentrations in Haitian Goats and Concentrations Reported in Other Studies

Mineral	Mean Haitian Goat Values (ppm)	Previously Reported Values[a] (ppm)
Ca	2395	1605
P	343	279
Mg	205	264
Fe	36	20
Se	1.18	--
Zn	82	128

[a]Combs, D.K. Dept. of Dairy Sci. University of Wisc., Madison. Personal communication.

Table 8: Hair Mineral Concentrations in Haitian Cattle and Concentrations Reported in Other Studies

Mineral	Mean Haitian Cattle Values (ppm)	Previously Reported Values[a] (ppm)
Ca	590	265 -- 3,208
P	38	190 -- 516
Mg	60	114 -- 270
Fe	11	29 -- 70
Se	0.31	0.06 -- 10.00
Zn	219	122 -- 342

[a]Combs, D.K. Dept. of Dairy Sci. University of Wisc., Madison. Personal communication.

3. Forage

Forage samples were analyzed for mineral content and classified on the basis of accessibility to goats and cattle at the different sampling points. (See appendix H.) Table 10 compares mean mineral concentrations of cattle forages of high and medium accessibility at each sampling period with recommended dietary mineral requirements for cattle. Table 9 makes the same comparison for goats. Sheep mineral requirements, which are similar to goat requirements (Haenlein 1980), are used due to the unavailability of such figures for goats. Forage levels listed in these tables do not represent the actual daily nutrient intake of the livestock, but rather the nutrient levels in the feeds which make up the majority of their diet.

Table 9: Comparison of High- and Medium-Access Haitian Goat Forages with Recommended Sheep Mineral Requirements

Mineral	Mean Forage Levels by Period 1	2	3	4	Dietary Requirements[a]
Ca (%)	1.00	1.11	0.54	0.50	.21 - .52
P (%)	0.07	0.09	0.06	0.06	.16 - .37
Mg (%)	0.15	0.15	0.21	0.14	.04 - .08
Fe (ppm)	252	383	252	262	30 - 50
Se (ppm)	0.15	0.11	0.20	0.25	0.1
Zn (ppm)	79	61	49	49	35 - 50

[a]NRC (1975). All values are expressed as concentrations in dry matter.

Table 10: Comparison of High- and Medium-Access Haitian Cattle Forages with Recommended Cattle Mineral Requirements

Mineral	Mean Forage Levels by Period 1	2	3	4	Dietary Requirements[a]
Ca (%)	0.81	.85	0.53	0.56	.22
P (%)	0.07	0.07	0.06	0.08	.20
Mg (%)	0.13	0.14	0.20	0.17	.10
Fe (ppm)	271	427	215	311	20
Se (ppm)	0.19	0.13	0.27	0.20	0.1
Zn (ppm)	87	58	34	71	40

[a]Requirements for Ca and P from NRC (1976). Requirements for other minerals from NRC (1983). All values are expressed as concentrations in dry matter.

a. Calcium & Phosphorus:- The data clearly demonstrate very high forage calcium levels and persistently low forage phosphorus levels.

There is an absolute phosphorus deficiency in the available forages (only 30-40% of requirements for cattle and 16-56% for goats). Overt symptoms of P deficiency, such as poor growth,

impaired reproductive performance, pica, and bone abnormalities are generally noted in ruminants when the P concentration in forages declines to 0.10 - 0.15% in the dry matter (Reid and Horvath, 1980). All but two individual forage samples in this study had P levels below that -- the exceptions were okra leaves at 0.2% P and "balé" (*Sida spp.*) at 0.13% P.

Forages had an abnormally high calcium/ phosphorus ratio:

Mean Ca/P Ratios by Period

	1	2	3	4
Cattle	11.6:1	12.1:1	8.8:1	7.0:1
Goats	14.3:1	12.3:1	9.0:1	8.3:1

A Ca/P ratio of 1:1 to 2:1 is recommended, with a close ratio most critical if P intake is marginal or low (McDowell et al., 1984), as is the case here. Ratios above 7:1 can affect growth rate, reproductive efficiency, and lactation in both cattle and goats (Scott 1986). All individual forages tested here (appendix J) also had adequate to high calcium levels and marginal to low phosphorus levels.

b. Selenium: Mean forage Se levels were adequate for both species in all sampling periods. There were a few forage species which were deficient at one sampling and not at others; there were no discernible trends by location or time of year. Even though mean forage selenium levels were adequate, and serum Se levels reflect this, serum vitamin E levels indicate that E intake may frequently be marginal or deficient. The nutritional interrelationship between Se and vitamin E is complex and not fully understood, but dietary alterations of one may change the requirement for the other (Ammerman et al., 1978). Since both E and Se are necessary to avoid clinical diseases associated with deficiencies of both elements, it is possible that an animal whose vitamin E intake is low could show a Se deficiency even when Se intake is adequate.

c. Zinc: Forage zinc levels were usually adequate, but bioavailability of zinc is reduced by high dietary levels of calcium, chromium, copper, iron and cadmium (Underwood 1977). Our analyses showed high forage levels of calcium and iron; hence, there is a possibility that functional zinc deficiency may occur in some animals even though forage zinc levels appear adequate. (This was not apparent in serum levels.)

d. Iron: Forage iron levels were extremely high: eleven to twenty-one times the dietary requirement for cattle, and eight to thirteen times the requirement for goats. The Fe levels, though high, were well below the maximum tolerable level of 1000 ppm

(McDowell et al., 1983). Nevertheless, excess Fe may interfere with metabolism of Zn (Underwood 1977) and P (McDowell et al., 1978).

e. Magnesium: Forage magnesium levels were adequate for cattle, and for goats were over twice the dietary requirement.

For complete results of forage analysis and for translations of forage names, see appendix H.

4. Soils

The soils of the lower Artibonite Valley are classified as Eutric Fluvisols by the FAO/UNESCO Soil Map of the World (1972). This is equivalent to Eutric Fluvents by the USDA Soil Taxonomy system (Dent 1980) and indicates that they are potentially productive alluvial soils, occasionally limited by seasonal flooding. Only two of the soils sampled in our study were subject to periodic flooding from the Artibonite River.

Analysis of these soils indicates that they are relatively fertile, have a basic reaction, contain free carbonates, and are relatively high in organic matter (Table 11). The extraction procedure used provides an index of the availability of elements to crops such as corn, sorghum, grasses and beans. The mean values for all elements evaluated were in the medium, or marginal to high categories. Crops grown on soils whose element levels are in the marginal and medium ranges will generally show response to inputs of those elements. (For complete soil test results and descriptions of soil samples, see appendix I.)

Note that a two-part calibration table is required for phosphorus because the ICP-OES technique measures organically bound P as well as inorganic forms (Soltanpour et al., 1979). The organically bound P is not as readily available to plants as the inorganic; therefore, as the organic matter content increases, the upper limit of each calibration category is increased as well.

When the range of values for each element is observed, P and Zn are found to be low in 26% and 34% of the soils, respectively (Table 12). In addition, 45% of the soils fall in the medium range for P, and 21% fall in the marginal range for Zn. This indicates that a total of 71% of the soils can be expected to respond to P fertilizer and 55% of the soils will likely respond to applied Zn when cropped to corn, sorghum, grasses, or beans.

When the soils are sorted by sampling period, the mean and median values for P (Table 13) and Zn (Table 14) are both lower in the second period and higher in the third period. Accordingly, there is a trend for both P and Zn to have a larger percentage test low to medium, or marginal, during the second period and to have a larger percentage test high to very high during the third period.

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Table 11: Average values of soil analyses

SAMPLING PERIOD	P	K	Ca	Mg	Mn	Zn	Fe	Cu	pH	O.M.
	ppm									-%-
1	19.0	273.8	426.6	47.4	19.9	2.4	24.6	10.3	7.6	4.1
2	6.6	209.3	421.3	50.0	19.4	1.3	21.4	14.4	7.8	3.6
3	30.9	373.5	401.3	67.0	9.1	5.8	33.4	16.1	8.2	4.3
4	16.6	267.2	400.3	53.2	7.9	2.7	21.2	13.6	8.4	3.6
OVERALL	18.1	278.1	414.5	53.3	15.0	2.9	25.0	13.2	7.9	3.9

CALIBRATION VALUES [a]

	K		Mn	Zn	Fe	Cu
LOW	0-60	LOW	0.0-1.8	0.0-0.9	0.0-2.0	0.0-0.5
MEDIUM	60-120	MARGINAL	---	1.0-1.5	2.1-4.0	---
HIGH	>120	HIGH	>1.8	>1.5	>4.0	>0.5

P CALIBRATION VALUES

Organic matter 0-2.5%		Organic matter >2.5%	
LOW	0-5	LOW	0-6
MEDIUM	6-9	MEDIUM	7-14
HIGH	10-13	HIGH	15-22
VERY HIGH	>13	VERY HIGH	>22

[a] Soltanpour and Schwab (1977)

Table 12: Percentage of samples in P and Zn calibration categories

P				Zn		
LOW	MEDIUM	HIGH	VERY HIGH	LOW	MARGINAL	HIGH
%				%		
26	45	8	21	34	21	45

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Table 13: Soil phosphorus values by sampling period

SAMPLING PERIOD	MEAN	MEDIAN	RANGE	LOW	MEDIUM	HIGH	VERY HIGH
	ppm			%			
1	19.0	9.0	5.4-89.7	39	31	15	15
2	6.6	6.5	0.7-11.5	33	67	--	--
3	30.9	23.4	2.5-86.8	12.5	25	12.5	50
4	16.6	9.6	2.5-54.7	13	62	--	25

Table 14: Soil zinc values by sampling period

PERIOD	MEAN	MEDIAN	RANGE	LOW	MARGINAL	HIGH
	ppm			%		
1	2.4	1.3	0.4- 8.5	31	23	46
2	1.3	1.0	0.5- 3.3	45	33	22
3	5.8	3.5	0.9-14.8	13	25	62
4	2.7	1.4	0.3-12.3	50	--	50

When the soils are sorted by cropping practice into cropped, pasture, and fallow/scrub land categories, there are differences in the mean values for P, Zn, and organic matter (Tables 15, 16, and 17), with the fallow/scrub samples having the highest values in each test. The cropped and fallow/scrub samples both exhibit a very wide range in values for each test, although the medians are not so dissimilar. This indicates a great deal of variability in either the soil or the soil management techniques within each category. Nevertheless, in these two management categories, 71-74% of the soils would be expected to respond to added P, and 58% to added Zn.

The pasture category is unique in that it is represented by only five samples, and four of these are from the HAS pastures that are fertilized regularly. The differences in the calibration categories for this group should be viewed with this in mind.

Table 15: Soil phosphorus values by cropping practice

PRACTICE	MEAN	MEDIAN	RANGE	LOW	MEDIUM	HIGH	VERY HIGH
	ppm			%			
CROPPED	17.4	9.2	1.4-86.8	32	42	10	16
FALLOW/SCRUB	20.2	9.8	2.4-89.7	21	50	8	21
PASTURE	14.4	9.9	0.7-30.1	20	40	--	40

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Table 16: Soil zinc values by cropping practice

PRACTICE	MEAN	MEDIAN	RANGE	LOW	MARGINAL	HIGH
	ppm			%		
CROPPED	2.2	1.1	0.5-10.2	32	26	42
FALLOW/SCRUB	4.3	1.8	0.3-14.8	43	15	42
PASTURE	2.0	1.6	0.6- 3.8	20	20	60

Table 17: Soil organic matter content by cropping practice

PRACTICE	MEAN	MEDIAN	RANGE
	%		
CROPPED	3.8	3.8	1.7- 5.8
FALLOW/SCRUB	4.2	4.2	0.6-10.5
PASTURE	3.6	4.3	1.7- 5.1

Of the other elements analyzed, all tested high with the following exceptions:

a. Three soils tested medium in K: one pasture sample in the first sampling and two scrub land samples in the fourth sampling.

b. The mean value for Mg was 53.3 ppm, but the range was 8.9 to 151.6 ppm. Since no calibration table is available for this element, it is not possible to determine how many of the soils would respond to Mg, but it is to be expected that a crop might benefit from added Mg when the test level is in the lower end of the range. This is especially true in soils that are high in Ca, as these soils are.

As soil pH rises, availability and plant uptake of Fe, Mn, Zn, Cu, and Co decrease, and Mo and Se concentrations increase (McDowell et al., 1983). High pH also decreases P availability in soil, because of the formation of basic calcium phosphates. A low availability of soil P may be due more to this factor than to actual soil P levels (Reid and Horvath, 1980).

Soil pH shows a trend to higher values during the third and fourth samplings, probably due to active dissolution of the carbonates during the rainy season. This increase in pH would be expected to further reduce the availability of P and Zn to growing plants to levels below those indicated by the extraction procedure.

5. The Relationship of Mineral/Vitamin Nutrition to Reproduction

a. Calcium and phosphorus: There was a clear and consistent phosphorus deficiency in forages, and a P deficiency in serum that was especially severe in the third and fourth samplings (corresponding with the rainy season). Absolute phosphorus deficiency can cause bone and joint disease, anorexia and weight loss, pica, and lack of ovulation and estrus (McDowell et al., 1983; Church and Pond, 1982). We calculated a 26 month calving interval, which suggests that cattle could be going through long periods (post-parturition and post-lactational) of phosphorus deficiency anestrus. This hypothesis is supported by similar circumstances noted in other tropical areas (McDowell et al., 1984).

High dietary calcium levels accentuate the phosphorus deficiency by creating large Ca/P ratios. Ratios over 7:1 in ruminant diet cause decreased feed efficiency, milk production, and fertility, especially in the face of an absolute P deficiency. In this study, there were no mean forage ratios below 7:1.

b. Vitamin E and selenium: On the basis of serum vitamin E levels, three quarters of the goats and a quarter of the cattle appeared to be deficient in vitamin E for part of the year. The deficiency was more widespread and more severe for both species in the rainy season (third and fourth sampling points); almost all goats showed deficient serum levels then.

Vitamin E deficiency, though not itself responsible for reproductive failure in ruminants (Merck 1973), is very closely linked with selenium, a deficiency of which can cause nutritional muscular dystrophy, reduced growth, embryonic mortality, and retained placenta (McDowell 1983). It has often been presumed by livestock workers in Haiti that animals here suffer from Se deficiency. It has been the experience of some workers that dairy cows that had not previously responded to Estramate (prostaglandin analog) given for estrus synchronization, did respond after being given injectable Se/vitamin E. Since Se levels appear adequate, it is likely that the response was due to the increase in vitamin E.

c. Vitamin A: On the basis of serum vitamin A levels, approximately a quarter of the goats and a third of the cattle appeared to be deficient in vitamin A for at least one part of the year. Vitamin A deficiencies can be caused by heavy infestation of internal parasites, even in the presence of adequate forage carotene levels (JLA 1983). Vitamin A deficiency can cause reproductive problems including male infertility, abortions, and birth of weak or abnormal offspring (Church and Pond, 1982).

d. Zinc: The possibility of zinc deficiency was suggested by borderline forage zinc levels and goat hair zinc levels well below the previously reported levels. Marginal or low-normal

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forage zinc concentrations may represent a true physiological deficiency of zinc in the presence of the high forage and serum Ca and Fe concentrations found here, as high levels of Ca and Fe impair Zn absorption, transport, and use (Underwood, 1977). We observed retarded development of male gonads in bull calves and skin dryness in goats -- these signs suggest, but are not definitive for, a possible zinc deficiency. This study neither established nor ruled out a functional or absolute zinc deficiency.
e. Iron: The high iron levels in forage and serum, though not toxic, could be antagonistic to other minerals (e.g. P and Zn), deficiencies of which can adversely affect reproduction.

f. Other minerals: This study did not examine other minerals, such as iodine, manganese, or copper, that are known to have impaired absorption due to high dietary calcium.

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IV. Conclusions

Prior observations and reports suggested that mineral and/or vitamin deficiencies might be a major cause of the poor reproductive performance in the cattle and goats of Haiti's Artibonite Valley. The goal of this project was to provide a way to improve the reproductive performance by ascertaining if selected minerals or vitamins are deficient, and then proposing an appropriate supplement to correct identified deficiencies or imbalances. The study resulted in the following conclusions:

1. The soils and forages of this area are deficient in phosphorus, resulting in a general P deficiency in animals. The deficiency is severe enough to cause major impairment of reproductive performance.

2. The soils of this area have a high calcium content, resulting in very high forage calcium levels. The high Ca levels in conjunction with the low P levels result in an extremely wide Ca/P ratio in animal forages, which itself reduces productivity and reproductive efficiency.

3. Although mean serum levels of vitamin E were adequate in cattle in all four samplings and in goats in the first two samplings, levels in individual animals indicate that 27% of the cattle and 76% of the goats were deficient in E for at least part of the year. Deficiencies occurred at all sampling points, but were more widespread and severe in the rainy season.

4. Selenium levels are adequate in forages and serum for both cattle and goats.

5. Mean serum vitamin A levels of goats and cattle were adequate. Nevertheless, a significant number of animals (31% of cattle, 23% of goats) had serum A levels below the critical level at one or more sampling points, indicating a periodic A deficiency.

6. Half of the soils had low or marginal zinc levels, and forage levels were occasionally marginal, but there were no low serum zinc levels in cattle or goats. This study neither established nor ruled out a functional or absolute zinc deficiency.

7. Forage iron levels, though not toxic, are high enough that they could be antagonistic to other minerals, specifically Zn and P.

8. Magnesium levels are sufficient in soil, forage, and serum.

9. There is evidence of vaginal and testicular disease in cattle, but not in goats.

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10. We did not find evidence of catastrophic disease in the cattle or goats. Nevertheless, they have a myriad of health problems. Cattle in this study suffered from internal and external parasitism, malnutrition, mastitis, various skin conditions, and possibly reproductive disease. Goats in this study suffered from internal and external parasitism, diarrhea, malnutrition, anemia, mastitis, abortions, stillbirths, neonatal deaths, and possibly sore mouth and ringworm. Although farmers may perceive their animals as generally healthy, the problems are of sufficient incidence and seriousness to have a definite adverse effect on animal performance.

11. The management practices of animal owners do little to enhance production and reproduction in cattle and goats. This factor cannot be ignored in any attempt to improve livestock performance.

V. RECOMMENDATIONS

One of the major goals of this project was to develop a mineral supplement that would address the mineral needs of the livestock of the Artibonite Valley. It was also thought that some "accumulator" plants high in the deficient minerals would be identified, and that these native plants could be promoted as a viable mineral supplement.

Our findings make it clear that the biggest problem in ruminant mineral nutrition in this area is phosphorus deficiency. This deficiency and the accompanying excess in forage calcium result in a very high Ca/P ratio that further affects production and reproduction.

Most commercially available trace mineral supplements are higher in calcium than in phosphorus, making them unsuitable for the animals of this area. Only two individual forage samples, okra leaves and "balé" (*Sida spp.*), were found to be moderate P sources with a low Ca content. Yet neither of these plants, even if they were suitable for expanded use, offer enough phosphorus to be a solution to the deficiency in these animals.

To raise P to a sufficient level without concurrently raising Ca is not likely to be accomplished by the use of any readily-available, low-cost mineral supplement. Therefore, no specific mineral supplement can be recommended at this time. The solution to the problem is more likely to lie in the P and Ca content of the feeds themselves.

One possibility that is both available and of very low cost in this part of Haiti is rice bran with germ and hulls, a byproduct of rice milling. This feedstuff contains .30% Ca and 1.08% P, a Ca/P ratio of 0.28:1 (McDowell et al., 1974). If it were processed and used appropriately, it would contribute to correcting the P deficiency and balancing the wide Ca/P ratio in forages.

The authors recognize several problems with the use of this product and recommend more research be done to assess the value of rice byproducts as feed for ruminants in Haiti. One problem is the abrasiveness of the rice hulls, which can irritate the lining of the rumen if ingested in large quantities or over an extended period of time. Although there are processes which can be used to lessen the severity of this problem, the simplest solution is to remove the hulls from the bran and germ. Hulls do not contribute greatly to the P content, and removal of hulls when the rice is milled is a relatively simple procedure. Another problem with rice bran is its high moisture content, which causes it to become rancid if not used fairly quickly. The problem is accentuated by the current storage method of leaving the bran outside in piles unprotected from the environment. Another problem at the present time is scarcity. In the face of the shortage of wheat shorts in

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Haiti, rice bran is being used as an alternative feed for pigs. As the number of pigs in Haiti continues to rise, this competition will be an increasingly significant factor.

Vitamin A deficiency is usually not expected in animals whose diet consists almost exclusively of green plants. Yet many livestock workers in Haiti have observed a response when unthrifty animals were given injectable vitamins A & D, possibly because heavy parasite loads were causing A deficiency. We did find vitamin A deficiency in a significant number of animals, and suggest the continued use of vitamins A & D in treating animals. Increased efforts to control internal parasites are also strongly recommended.

Low serum vitamin E levels make it probable that animals, especially sexually mature animals, will respond to therapeutic treatment with vitamin E. Its continued use is recommended.

Continued training in appropriate livestock management, especially in nutrition, parasite control, and breeding, would increase the benefit of livestock ownership to the farmer.

Research into the cause of the vesicular vaginitis observed in cattle is strongly recommended. While disease identification was outside the scope of this project, it is highly probable that the reproductive disease indicated is a significant constraint to reproductive efficiency.

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APPENDIX A: DESCRIPTION OF ANIMALS — CATTLE

FARMER'S NAME	LOCATION	ID	AGE JAN '86 (ALL AGES IN MONTHS)	AGE CON-FIRMED?*	AGE EST.	SEX	COLOR & MARKINGS	REMARKS
H.A.S. BEEF FARM	DROUIN	49	2	YES		M	LT BROWN W/ WHITE UNDERNEATH	BULL CALF; CASTRATED
H.A.S. BEEF FARM	DROUIN	76		NO	120	F	CREAM - CHAROLAIS/ZEBU	COW
H.A.S. BEEF FARM	DROUIN	185	18	YES		F	BROWN	HEIFER
H.A.S. BEEF FARM	DROUIN	245		NO	48	M	CREAM - CHAROLAIS	BULL
VENANCE DORMEUS	DROUIN	552		NO	78	F	DARK BROWN	COW; CALF IS #699
HORIUS GENEUS	DROUIN	553		NO	72	F	WHITE WITH GREY SPECKS	COW
HORIUS GENEUS	DROUIN	554	0	NO	60	F	BLACK & WHITE	COW; MOTHER OF #556
HORIUS GENEUS	DROUIN	555	36	NO	12	M	BLACK & WHITE	BULL CALF
HORIUS GENEUS	DROUIN	556	12	YES		M	BLACK & WHITE	BULL CALF; CALF OF #554
GUILENE PHILISTIN	DESARMES	557	96			F	WHITE W/ RED SPOTS	COW
CONSERVE PHILISTIN	DESARMES	558		NO	54	F	DARK BROWN & WHITE	COW
RAYMOND ISAAC	DESARMES	559	24	YES		F	RED & WHITE	HEIFER
LAPOMBRE LOUIS	HATTE BELLANGER	560		NO	42	F	DK BROWN - WH SCARS REAR RIGHT	COW
RAYMOND ISAAC	DESARMES	562		NO	84	F	RED; SWAY BACK (DEFORMITY)	COW; MOTHER OF #563
RAYMOND ISAAC	DESARMES	563	4	YES		M	RED & WHITE	BULL CALF; CALF OF #562
RAYMOND ISAAC	DESARMES	564		NO	60	F	SOLID BROWN	COW
NACCIUS NACCI	MARIN	565		NO	60	F	REDDISH BEIGE	COW
NACCIUS NACCI	MARIN	566		NO	60	F	BROWN	COW
NACCIUS NACCI	MARIN	567	2	YES		M	RED; WHITE SPOT ON FOREHEAD	BULL CALF; BORN JAN. 29, 1986
OGESTE BERNARD	MARIN	568		NO	48	F	RED; WHITE UNDER	HEIFER
MERONE ST FLEURAND	MARIN	569		NO	36	F	DARK BROWN SOLID	HEIFER
NELIO NEIL	MARIN	570		NO	18	F	REDDISH; SCAR BACKBONE	HEIFER
ESPERANTA DORCE	MARIN	571		NO	10	F	WHITE; RED SPOTS	HEIFER CALF
VERSEDIEU DOMINIQUE	HATTE BELLANGER	601	6	YES		F	SOLID REDDISH	HEIFER CALF
VERSEDIEU DOMINIQUE	HATTE BELLANGER	603	6	YES		F	BROWN; BLACK POINTS	HEIFER CALF
HINNOSAINT JOSEPH	HATTE BELLANGER	604	5	YES		F	BROWNISH/RED SOLID	HEIFER CALF
VERSEDIEU DOMINIQUE	HATTE BELLANGER	605	6	YES		M	SOLID RED	BULL CALF
SEVERT DOMINIQUE	HATTE BELLANGER	606	144	NO	108	F	SOLID DK BROWN;WH ON REAR LEG	COW; MOTHER OF #607
SEVERT DOMINIQUE	HATTE BELLANGER	607	1	YES		M	SOLID DARK BROWN	BULL CALF; CALF OF #606; BORN DEC. 31, 1985
SEVERT DOMINIQUE	HATTE BELLANGER	608		NO	96	F	SOLID BROWN; HORNS CURVE UP	COW
SEVERT DOMINIQUE	HATTE BELLANGER	609	24	YES		M	SOLID BLACK	BULL
SEVERT DOMINIQUE	HATTE BELLANGER	610	18	YES		M	SMALL; REDDISH; SHORT HORNS	BULL
NOTHEL LOUIS	HATTE BELLANGER	611	72	YES		F	DK BROWN; 2 WHITE REAR FEET	COW
NOTHEL LOUIS	HATTE BELLANGER	612	60	YES		F	DARK BROWN	COW
NOTHEL LOUIS	HATTE BELLANGER	614	12			M	DARK BROWN	BULL CALF
MATHIEU NOEL	HATTE BELLANGER	615	36	NO	24	F	SOLID REDDISH; SHORT HORNS	HEIFER
DIEULIMENE PAUL	MARIN	616		NO	72	F	WHITE; BROWN SPOTS	COW
MME. SAINVIL	MARIN	617		NO	18	M	CREAM	BULL

APPENDIX A: DESCRIPTION OF ANIMALS — CATTLE

FARMER'S NAME	LOCATION	ID	AGE JAN '86 (ALL AGES IN MONTHS)	AGE CONFIRMED?*	AGE EST	SEX	COLOR & MARKINGS	REMARKS
MARIE ROSETTE PAUL	LAMONI	618	18	YES		M	BROWN & WHITE	BULL
DECESSE ALTIDORT	MARIN	619		NO	84	F	DARK BROWN; WHITE UDDER	COW; MOTHER OF #620 AND #621
DECESSE ALTIDORT	MARIN	620	30	NO	12	F	DARK BROWN	HEIFER; OFFSPRING OF #619
DECESSE ALTIDORT	MARIN	621	12	NO	10	F	DK BROWN; "YD" LEFT RUMP	HEIFER CALF; CALF OF #619
DIEULIMENE PAUL	MARIN	622	24	NO	36	F	DK BROWN/WHITE UNDERNEATH	COW
ERILIA PIERRE	MARIN	623	30	YES		F	LIGHT RED	HEIFER; VERY SMALL
NOELSIUS NOELYSTE	MARIN	624	48	YES		F	B/W SPOTS	COW
NOELSIUS NOELYSTE	MARIN	625	72	YES		F	BROWN; FACE GREYING	COW; MOTHER OF #676
NOELSIUS NOELYSTE	MARIN	676	1	YES		M	BROWN; WHITE TAIL & SHEATH	BULL CALF; CALF OF #625
SAINT JULES CAMILL	MARIN	677	48	YES		F	BROWN & WHITE	COW
SAINT JULES CAMILL	MARIN	678	12	YES		F	RED	HEIFER
WILFRID EDOUARD	MARIN	679	24	YES		M	GREYISH BEIGE SOLID	BULL
NAZAIR DELICE	MARIN	680	72	YES		F	LT RED WITH WHITE SPOTS	COW
ERILIA PIERRE	MARIN	681	4	YES	0	F	DARK BROWN	HEIFER
LAHENS PIERRE LOUIS	HALAIRE	682			60	F	CREAM; "SJR" LEFT RUMP	COW; 2 RIGHT TEATS FUSED AT BASE
SUZANE BELVIUS	HALAIRE	683		NO	78	F	BROWN	COW
FRANCKLIN DECIUS	HALAIRE	684	18	NO	30	M	BROWN & WHITE	BULL
ODIJE NOEL	MARIN	685	24	YES		F	BROWN & WHITE	HEIFER
WILTENE LORISSAINT	MARIN	686		NO	48	F	DARK BROWN	COW; OUTER 2 TEETH BACKWARDS
WILTENE LORISSAINT	MARIN	687	1	YES		M	DARK BROWN	BULL CALF; CALF OF #686
NOELSIUS NOELYSTE	MARIN	688	12	YES		M	DARK BROWN	BULL.
EDNER JEROME	MARIN	689	12			F	BROWN & WHITE	HEIFER; SMALL
EDNER JEROME	MARIN	690	24	YES		F	DARK BROWN	HEIFER; SMALL
ELTINE SEJOUR	MARIN	691		NO	84	F	BROWN	COW
ELTINE SEJOUR	MARIN	692	24	YES		F	DK BROWN; WHITE INSIDE LEGS	HEIFER
GLADISSE LETOIR	HALAIRE	693	18	YES		F	RED & WHITE	HEIFER
MERCIDIEU ARELIEN	HALAIRE	694	26	YES		F	DK BROWN, WHITE SPOTS	HEIFER
REGILISTE PRECIUS	HALAIRE	695		NO	72	F	WHITE, BROWN SPOTS	COW; MOTHER OF #696
REGILISTE PRECIUS	HALAIRE	696	3	YES		M	DARK BROWN	BULL CALF; CALF OF #695
VENANCE DORMEUS	DROUIN	697	120	NO	72	F	BROWN & WHITE; LONG HORNS	COW; MOTHER OF #698; ALL TEETH GOOD, NOT AGE 10
VENANCE DORMEUS	DROUIN	698	2	YES		F	RED & WHITE	HEIFER CALF; CALF OF #697
VENANCE DORMEUS	DROUIN	699	4	YES		F	BROWN	HEIFER CALF; CALF OF #552

* Age as reported by owners was checked against dentition. If there was a significant discrepancy, estimated age is shown.

APPENDIX A: DESCRIPTION OF ANIMALS — GOATS

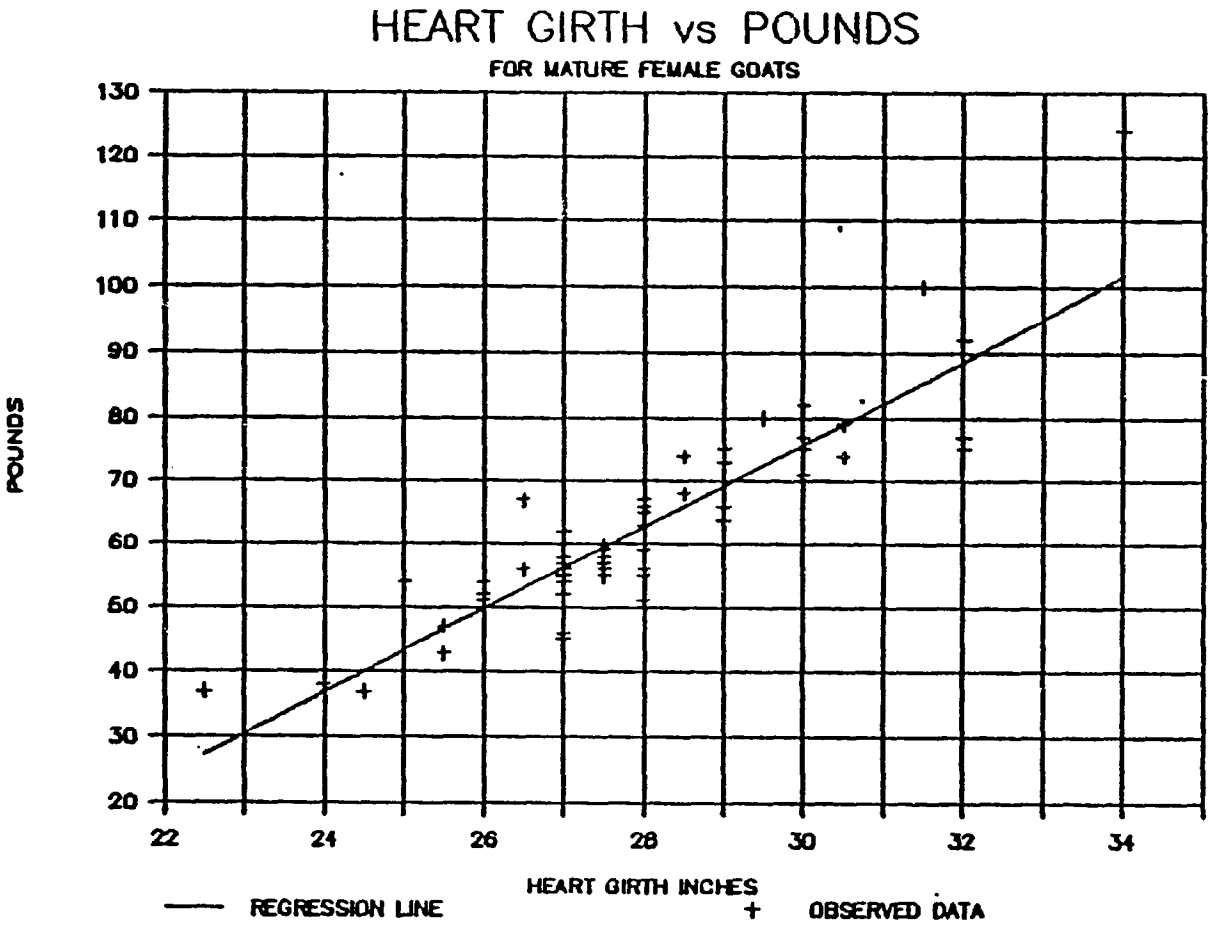
FARMER'S NAME	LOCATION	ID	AGE JAN '86 (ALL AGES IN MONTHS)	AGE CON-FIRMED?*	AGE EST	SEX	COLOR & MARKINGS	REMARKS
ROD FRANK	H.A.S.	15	42	YES		F	BLACK W/ LITTLE WHITE	DOE
ROD FRANK	H.A.S.	901	30	YES		F	BROWN NUBIAN "JILL"	DOE
ROD FRANK	H.A.S.	902	12	YES		M	BLACK NUBIAN BUCK "BUCKY"	BUCK
ROD FRANK	H.A.S.	903	18	YES		M	BR SPOTTED HALF NUBIAN "BOZO"	BUCK
HITEPSSIE JOSEPH	HATTE BELLANGER	904		NO	76	F	WHITE; BR SPOTS RT REAR LEG	DOE
SEVERT DOMINIQUE	HATTE BELLANGER	905	48	YES		F	DK BROWN, WHITE MARKINGS	DOE
SEVERT DOMINIQUE	HATTE BELLANGER	906	42	YES		F	DK BROWN;WH SPOT ON FOREHEAD	DOE
MME. OVILUS FRANCOIS	HATTE BELLANGER	907	36	YES		F	SANDY WITH WHITE	DOE
MME. OVILUS FRANCOIS	HATTE BELLANGER	908	11	YES		F		YOUNG FEMALE
MME. OVILUS FRANCOIS	HATTE BELLANGER	909	60	YES		F	LIGHT SANDY;BLACK STRIPE BACK	DOE
MME. OVILUS FRANCOIS	HATTE BELLANGER	910	4	YES		F	BROWN; BL & WH POINTS	FEMALE KID
NOTHEL LOUIS	HATTE BELLANGER	911	36	NO	48	F	BROWN;BL POINTS;RT EAR OFF	DOE
NOTHEL LOUIS	HATTE BELLANGER	912	10	YES		F	WHITE/ SANDY BEHIND HORNS	YOUNG FEMALE
SILVAINT SEFFRIN	HATTE BELLANGER	913	12	NO	24	F	ALL COLOR:DK BR, SANDY, WHITE	DOE
VENET SUFFRAIN	HATTE BELLANGER	914	2	YES		M	SOLID SANDY	MALE KID
VENET SUFFRAIN	HATTE BELLANGER	915		NO	18	F	WHITE W/FEW BROWN SPOTS	DOE
FRANCK JOSEPH	HATTE BELLANGER	916	4	YES		F	WHITE	YOUNG FEMALE
DOSTERNE DORMILUS	MARIN	917		NO	8	F	SOLID BLACK	FEMALE KID
ITEPCIE PIERRE	MARIN	918		NO	30	F	BLACK/BEIGE/WHITE	DOE
MME. VILSAINT SAINVIL	MARIN	919		NO	48	F	BLACK WITH WHITE	DOE
PHILOSCAR CHALESCA	MARIN	920		NO	9	F	WHITE/DK BROWN	FEMALE KID
PHILOSCAR CHALESCA	MARIN	921		NO	24	F	BROWN, BLACK HAIRS;WH ON FACE	DOE
PATRICK CHARLESCAR	MARIN	922	120	NO	90	F	MOTTLED LIGHT BR. & WHITE	DOE
PATRICK CHARLESCAR	MARIN	923	24	YES		F	BLACK, WHITE NOSE	DOE
PATRICK CHARLESCAR	MARIN	924	5	YES		F	DK BROWN; WHITE SPOT HORNS	FEMALE KID
THEODULE SIRIUS	MARIN	925	12	YES		F	DK BROWN; SMALL WH B/W HORNS	YOUNG FEMALE
THEODULE SIRIUS	MARIN	926	10	YES		M	DK BROWN; SMALL WH B/W HORNS	BUCK
VENANCE DORMEUS	MARIN	927	24	YES		F	BROWN WITH BLACK HAIRS	DOE
VENANCE DORMEUS	MARIN	928	18	NO	24	F	BLACK & WHITE	YOUNG FEMALE
VENANCE DORMEUS	MARIN	929	36	YES		F	SANDY	DOE
NOELSIUS NOELYSTE	MARIN	930		NO	48	F	DUN WITH BLACK POINTS	DOE
NOELSIUS NOELYSTE	MARIN	931		NO	48	F	DARK BROWN & WHITE	DOE
GEORGES DORMILUS	MARIN	932		NO	36	F	WHITE	DOE
SUZANE BELVIUS	HALAIRE	933		NO	36	F	BROWN & WHITE SPOTS	DOE
SUZANE BELVIUS	HALAIRE	934		NO	24	F	DARK BROWN	
FRANCKLIN DECIUS	HALAIRE	935		NO	48	F	BROWN; WHITE ON FACE & T AIL	DOE
LAHENS PIERRE-LOUIS	HALAIRE	936	4	YES		F	WHITE	YOUNG FEMALE
ODIJE NOEL	MARIN	937		NO	96	F	DK BROWN; WHITE BETWEEN HORNS	DOE
ODIJE NOEL	MARIN	938	4	YES		M	WHITE	MALE KID
ODIJE NOEL	MARIN	939	4	YES		M	LIGHT RED; SOME WHITE	MALE KID

APPENDIX A: DESCRIPTION OF ANIMALS — GOATS

FARMER'S NAME	LOCATION	ID	AGE JAN '86 (ALL AGES IN MONTHS)	AGE CON-FIRMED?*	AGE EST	SEX	COLOR & MARKINGS	REMARKS
JOEL NOEL	MARIN	940	36	YES		F	SANDY	DOE
JOEL NOEL	MARIN	941		NO	36	F	BROWN; BLACK POINTS	DOE
JOEL NOEL	MARIN	942	4	YES		M	WHITE	MALE KID
MERCIDIEU ARELIEN	HALAIRE	943	12	YES		F	BLACK; WHITE SADDLE	YOUNG FEMALE
MERCIDIEU ARELIEN	HALAIRE	944	YES	YES		M	BLACK & WHITE	MALE KID
VILSINE PITESSE	DESARMES	945		NO	30	F	WHITE	DOE; MOTHER OF #946
VILSINE PITESSE	DESARMES	946		NO	7	F	WHITE	KID OF #945
VILSINE PITESSE	DESARMES	947	5	YES		M	BROWN; BLACK HAIRS	MALE KID
MERONA VILCENA	DESARMES	948		NO	54	F	BLACK & WHITE	DOE
MERONA VILCENA	DESARMES	949		NO	12	F	LIGHT BROWN	DOE
GUILENE PHILISTIN	DESARMES	950	2	YES		F	BEIGE	FEMALE KID; TWIN TO #951
GUILENE PHILISTIN	DESARMES	951	2	YES		F	BROWN; BLACK POINTS	FEMALE KID; TWIN OF #950
GUILENE PHILISTIN	DESARMES	952	6	YES		M	WHITE	BUCK
CONSERVE PHILISTIN	DESARMES	953		NO	10	F	WHITE & BROWN	YOUNG FEMALE
CONSERVE PHILISTIN	DESARMES	954	5	YES		M	BROWN/BLACK/WHITE	BUCK
CONSERVE PHILISTIN	DESARMES	955	5	YES		M	BROWN/BLACK/WHITE	BUCK
JACQUELIN AUGUSTIN	DESARMES	956	3	YES		M	GREY	MALE KID
MECENE DOSTERNE	DESARMES	957	6	YES		M		MALE KID
MECENE DOSTERNE	DESARMES	958	6	YES		M	BEIGE	MALE KID
MECENE DOSTERNE	DESARMES	959	48	YES		F	WHITE	DOE
RAYMOND ISAAC	DESARMES	960		NO	18	F	BROWN; BL & WH POINTS	DOE
RAYMOND ISAAC	DESARMES	961	8	YES		F	BROWN & WHITE	YOUNG FEMALE
WILFRID LOUIS JEUNE	MARIN	962		NO	48	F		DOE
FAVEUR JEAN BAPTISTE	MARIN	963		NO	7	M	WHITE	MALE KID
VENANCE DORMEUS	DROUIN	964		NO	108	F	BLACK	DOE; REPLACED #928; OLD — TEETH WORN

* Age as reported by owners was checked against dentition. If there was a significant discrepancy, estimated age is shown.

Appendix B: Heart Girth and Weight Correlation for Mature Haitian Goats



Appendix C: Analytic Procedures

Serum Analysis

Upon receipt at VPI, serum was stored frozen at -80° C until analyzed for P, Ca, Mg, Zn, Fe, Se, vitamin A, and vitamin E.

Ca, Mg, Zn, and Fe were determined using a Perkin-Elmer atomic absorption spectrophotometer (Model 403), following the procedures described in the operations manual (Perkin-Elmer 1976). A lanthanium oxide diluent (0.1% W/V LaO_3) was used for Ca and Mg samples. Zinc samples were diluted with deionized water. Iron samples were deproteinized with trichloroacetic acid.

Serum selenium was determined by wet digesting samples (Heckman 1967 & 1968), using nitric acid followed by perchloric acid. Digesta was analyzed with a Perkin-Elmer atomic absorption spectrophotometer (Model 460) at 196 nm, utilizing an electrodeless discharge lamp (Perkin-Elmer 1976).

Serum P was determined by a colorimetric procedure, based on measurement of the blue color formed when inorganic phosphate reacts with molybdate in an acid medium and is reduced with para-aminonaphthol sulfonic acid (Fiske and Subbarow, 1925). Absorbance was read on a spectrophotometer at 660 nm.

Serum vitamin E (tocopherol) was measured by a microprocedure previously described: tocopherol was oxidized by ferric chloride and the pink complex of ferrous ions with bathophenanthroline. Absorbance of this solution was read on a spectrophotometer at 536 nm (Fabranek et al., 1968).

Serum vitamin A was extracted by the Kimble procedure (Kimble 1939). The color development phase was performed according to the procedure described by Dugan et al. (1964).

Hair Analysis

Upon receipt at VPI, hair samples were stored frozen at -80° C until further processing.

Washing procedures were a modification of those reported by Dorea et al. (1982). Hair was cut into small pieces, washed in sodium lauryl sulfate (0.1% W/V) under mechanical agitation for 30 minutes, and rinsed on filter paper with distilled, deionized water. Samples were then washed in acetone and diethyl ether consecutively for 10 minutes, and then oven-dried at 100° C for 12 hours or more.

The washed and dried hair samples were then wet-ashed, using a modification of procedures previously described by Heckman (1967 & 1968). Samples (0.5 gm) of hair were weighed out and mixed with 5.0 ml of concentrated nitric acid (HNO_3) and allowed to sit overnight. Then 2.0 ml of 70% perchloric acid ($HClO_4$) was added to digest the hair until a clear solution was obtained, and 1.0 ml of this solution was diluted with 12.5 ml of distilled, de-

ionized water. The resulting solution was analyzed for Ca, P, Mg, Zn, Fe, and Se, using the procedures described for serum analysis.

Feed Analysis

Upon receipt at VPI, forage samples were kept stored in plastic bags at room temperature until analysis. Wet-ashing procedure was the same as that described for hair samples. Forage analysis procedures for P, Ca, Mg, Zn, Fe, and Se were the same as those used for serum and hair analysis.

Soil Analysis

Upon receipt at VPI, soil samples were air-dried at room temperature and ground to pass through a stainless steel sieve with 2 mm size openings. The well-mixed samples were returned to the sample boxes and stored for subsequent analyses.

Determination of pH was performed using a 1:1 (v/v) ratio of soil to distilled water. Thirty minutes after adding water to the soil, the soil was stirred into suspension and the pH determined using a paired glass electrode assembly.

The soils were extracted with 1 M NH_4HCO_3 - 0.005 M DTPA solution (Soultanpour and Schwab, 1977). The extracts were analyzed for P, K, Ca, Mg, Zn, Mn, Fe, and Cu by inductively-coupled plasma optical emission spectrometry (ICP-OES) as described by Soultanpour et al. (1979). The ICP-OES system used was a Jarrell-Ash ICAP 9000. The instrument parameters were: sample flow rate 1.9 cm^3/min; height of observation above work coil 17 mm; forward power 1.25 W; reflected power <3 W.

Organic matter determinations were performed by chromic acid oxidation of a 1 g sample and colorimetric determination of the amount of unreduced chromate (Allison 1965).

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Appendix D: Questionnaires in English and Kreole

QUESTIONNAIRE #1

MALES (Mal -- toro ou bouk):

1. Do you think this animal is good, average or poor?
   Kijan ou wè bèt-la? Sé you bon mal, pa pi mal, ou pa bon?

2. How old is he?
   Ki laj li yé?

3a. Has he arrived at breeding age?
   Eské li rivé nan laj lè-l konmansé chofé pou kwazman? oui/non

b. If yes, at what age did he begin breeding?
   (Si oui) A ki laj li té konmansé chofé?

4a. Do you know any conditions which can make a bull/buck unable to breed?
   Eské ou konnin you kondition ki fè toro/bouk pa kapab kwazé?

b. What?
   Ki kondition?

5. Do you know how many times he breeds per year?
   Eské ou konnin konbyen kwazman li fè pa ané? oui/non

   If yes, how many?
   (Si oui) Konbyen?

6. Do you know how many of the females he breeds have offspring by him?
   Eské ou konnin konbyen fémèl li kwazé ki fè pitit pa li? oui/non

   If yes, how many?
   (Si oui) Konbyen?

7a. Is there a certain time of the year when he's more sexually active?
   Eské gin you épok nan ané-a lè mal-la pi chofé? oui/non

bc. When?
   Ki lè?

8. For how many years is he good for breeding?
   Pou konbyen ané li bon pou kwazman?

9a. Have you ever seen a veterinarian with him?
   Eské ou té wè you veterinè avek li?

b. If yes, how many times?
   (Si oui) Konbyen fwa?

Appendix D: Questionnaires in English and Kreole

FEMALES (Fémèl):

1. Do you think this animal is good, average, or poor?
   Ki jan ou wè bèt-la? Sé you bon fémèl, pa pi mal, ou pa bon?

2. How old is she?
   Ki laj li yé?

3a. Has she reached sexual maturity? (first heat)
   Eské li gin tan mandé parey primyé fwa-a? oui/non

b. (If yes) At what age did she have her first heat?
   A ki laj li té mandé parey primyé fwa-a?

c. Do you know when she's in heat?
   Eské ou konnin lè li mandé parey? oui/non

d. How do you recognize that?
   Ki jan ou rékonèt sa?

4a. Do you know if there's a certain time of year when she comes into heat more?
   Eské ou konnin si gingnin you épok espésiyal nan ané-an lè li konn mandé parey?

bc. If yes, when?
   (Si oui) Ki lè?

5.[a] At the time a female is bred, do you know whether her offspring will be male or female?
   Eské ou konnin si pitit-yo ap mal ou fémèl lè manman-an kwazé? oui/non

   How do you know that?
   Ki jan ou konnin sa?

6. Do you know any condition which can prevent a female from becoming pregnant?
   Eské ou konnin youn kondition ki fè fémèl pa kapab vin plenn?

7a. Is she pregnant now?
   Eské li plenn kounyéa? oui/non

b. When was she bred?
   Dépi ki dat li té kwazé?

c. Do you know when she will calve/kid?
   Eské ou konnin kilè lap fè pitit?

d. Was she bred by a bull/buck that belongs to you?
   Eské li kwazé avek toro/bouk pou ou? oui/non

e. Do you know how many times she was serviced before she became pregnant?

Eské ou konnin konbyen fwa li té kwazé anvan li vin plenn?
oui/non

f. (If yes) How many times?
(Si oui) Konbyen fwa?

8a. Do you give any special care to pregnant females?
Eské ou bay swèn espésiyal pou vach/kabrit ki plenn?

b. What?
Ki swèn?

9a. Has she already calved/kidded?
Eské li gin tan fè pitit? oui/non

b. How many times has she calved/kidded?
Sé konbyen poté li gin tan fè?

10a. At what age did she calve/kid the first time?
A ki laj li té fè pitit primyé fwa-a?

b. How many offspring did she have the first time?
Nan primyé poté-a, konbyen pitit li té fè?

11a. At what age did she calve/kid the second time?
A ki laj li té fè dezyèm poté pitit-la?

b. How many offspring did she have the second time?
Sé konbyen pitit li té fè nan dezyèm poté-a?

12a. At what age did she calve/kid the third time?
A ki laj li té fè twazyem poté pitit-la?

b. How many offspring did she have the third time?
Sé konbyen pitit li té fè nan twazyem poté-a?

(If she had calved/kidded more than three times, write the age and how many offspring on the back of this page.)
(Si li té fè plis pasé twa poté, ékri laj-li é konbyen pitit sou dèyè paj-sa-a.)

13a. Does she ever have any problems in calving/kidding?
Eské li konn gingin pwoblèm nan fè pitit? oui/non

b. What problems?
Ki pwoblèm?

14. Do you give her any special care when she calves/kids?
Eské ou konn bay manman swèn espésiyal lè li fè pitit?

15. Do you give newborns any special care?
Eské ou konn bay pitit-yo swèn espésiyal lè yo fèk fèt? oui/non

What care?
Ki swèn?

16a. Has she ever aborted?
Eské li té avoté you poté? oui/non

b. Do you know why she aborted?
Eské ou konnin poukisa li té avoté?

c. Do you know how you can prevent abortion?
Eské ou konnin ki jan ou kab anpeché sa?

17. How many weeks after calving/kidding does she go into heat again?
Sé konbyen semenn aprè fè pitit li mandé parey anko?

18. How many weeks after calving/kidding do you breed her?
Sé konbyen semenn aprè fè pitit mal-la konn kwazé-l?

19a. Have you ever seen a veterinarian with her?
Eské ou té wè you veterinè avèk li?

b. How many times?
Konbyen fwa?

Appendix D: Questionnaires in English and Kreole

QUESTIONNAIRE #2

1ab. Since the last time we examined this animal, has he been sick?
Depi dènyé fwa ké nou té examiné bèt-la, èské li té tonbé malad?
oui/non

2ab. Since the last time we examined this animal, have you seen a veterinarian with him?
Depi dènyé fwa ké nou té examiné bèt-la, èské ou té wè veterinè avèk li? oui/non

3ab. Since the last time we examined this animal, have you given him any medication?
Depi dènyé fwa ké nou té examiné bèt-la, èské ou té ba li ninpot rémèd? oui/non

4a. (For females) Since the last time we examined this animal, has she calved/kidded?
(Pou fémèl-yo) Depi dènyé fwa ké nou té examiné bèt-la, èské li té fè pitit? oui/non

bc. (If yes) When, and how many offspring?
(Si oui) Kilè li té fè pitit epi konbyen pitit?

5a. (For females) In what month did she calve/kid the last time?
(Pou fémèl-yo) Nan ki mwa li té fè pitit dènyé fwa?

b. (If she has never calved/kidded) In what month was she herself born?
(Si li pajanm fè pitit) Nan ki mwa, li-menm, li té fèt?

6. Where does this animal sleep?
Ki koté bèt-la domi?

7. Do you bring food or water to him where he sleeps?
Eské ou poté manjé oubyen dlo pou li koté li domi-an?

8ab. During what months is he tethered?
Pandan ki mwa nan ané-a li nan kod?

9. Why do you tether him in those months?
Poukisa ou maré li nan kòd nan mwa-sa-yo?

10. When he's tethered, what kind of food does he find to eat?
Lè li nan kòd, ki kalité manjé li jwenn pou li manjé koté li maré-a?

11a. When he's tethered, do you bring food to him?
Lè li nan kòd, èské ou poté manjé pou li? oui/non

b. (If yes) What kind of food?
(Si oui) Ki kalité manjé?

12. When he's tethered, how does he get water to drink?
Lè li nan kòd, kijan li jwenn dlo pou bwè?

x

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13ab. During what months is he loose (i.e. untethered)?
Pandan ki mwa nan ané-a ké li lagé?

14ab. During what months does he get the most good food?
Pandan ki mwa nan ané-a ké li jwenn plis bon manjé?

15ab. During what months can he not get enough food to eat?
Pandan ki mwa nan ané-a li pa kab jwenn kont manjé?

16. What do you think is the most important thing to do for your animal to ensure a benefit to you yourself?
Ki sa ou kwè ki pi nésèsè pou fè pou bèt-la pou li kab ba ou youn bon randman?

Appendix D: Questionnaires in English and Kreole

QUESTIONNAIRE #3

1ab. Since the last time we examined this animal, has he been sick?
Depi dènyé fwa ké nou té examiné kabrit/bèf-la, èské li té tonbé malad? oui/non

2ab. Since the last time we examined this animal, have you seen a veterinarian with him?
Depi dènyé fwa ké nou té examiné kabrit/bèf-la, èské ou té wè veterinè avèk li? oui/non

3ab. Since the last time we examined this animal, have you given him any medication?
Depi dènyé fwa ké nou té examiné kabrit/bèf-la, èské ou té ba li ninpot rémèd? oui/non

4a. (For females) Since the last time we examined this animal, has she calved/kidded?
(Pou fémèl-yo) Depi dènyé fwa ké nou té examiné kabrit/bèf-la, èské li té fè pitit? oui/non

b. (If yes) When did she calve/kid, and how many offspring did she have?
(Si oui) Kilè li té fè pitit epi konbyen pitit?

5. (For females) Is she pregnant now?
(Pou fémèl-yo) Eské li plenn kounyéa? oui/non

6. What was the last sickness this animal had?
Ki dènyé maladi kabrit/bèf-la té genyen?

7. When did he have that sickness?
Kilè li té genyen maladi-sa-a?

8a. Did you do anything for him?
Eské ou té fè anyen pou li? oui/non

b. (If yes) What?
(Si oui) Kisa?

9. What other sickness has this animal had?
Ki lot maladi kabrit/bèf-sa-a té genyen?

10. What sickness do you see most often in your goats/cattle?
Ki maladi ou wè pi souvan nan kabrit/bèf-ou-yo?

11ab. What causes that sickness?
Sak bay maladi-sa-a?

12. Does it affect young or adult goats/cattle?
Eské sé ti kabrit/bèf oubyen gwo kabrit/bèf ki konn genyen li?

13a. Do you know any treatment for it?
Eské ou konnin ninpot trètman pou yo? oui/non

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b. (If yes) Explain.
(Si oui) Espliké.

14. (If yes) Do you do the treatment?
(Si oui) Eské ou konn fè-l pou yo? oui/non

(If no) Why not?
(Si non) Poki pa?

15. Does an animal with that sickness usually recover or die?
Eské kabrit/bèf avèk maladi-sa-a konn refè oubyen mouri?

16a. What is the second most common sickness you see in your goats/cattle?
Ki dèzyem maladi ou konn wè pi souvan nan kabrit/bèf-ou-yo?

bc. What causes it?
Sak bay maladi-sa-a?

d. Does it affect young or adult goats/cattle?
Eské sé ti kabrit/bèf oubyen gwo kabrit/bèf ki konn genyen?

e. Do you know any treatment for it?
Eské ou konnin ninpot trètman pou yo? oui/non

f. (If yes) Explain.
(Si oui) Espliké.

g. (If yes) Do you do the treatment?
(Si oui) Eské ou konn fè-l pou yo? oui/non

(If no) Why not?
(Si non) Poki pa?

h. Does an animal with that sickness usually recover or die?
Eské kabrit/bèf avèk maladi-sa-a konn refè oubyen mouri?

17a. What is the third most common sickness you see in your goats/cattle?
Ki twazyem maladi ou konn wè pi souvan nan kabrit/bèf-ou-yo?

bc. What causes it?
Sak bay maladi-sa-a?

d. Does it affect young or adult goats/cattle?
Eské sé ti kabrit/bèf oubyen gwo kabrit/bèf ki konn genyen?

e. Do you know any treatment for it?
Eské ou konnin ninpot trètman pou yo? oui/non

f. (If yes) Explain.
(Si oui) Espliké.

g. (If yes) Do you do the treatment?
(Si oui) Eské ou konn fè-l pou yo? oui/non

(If no) Why not?
(Si non) Poki pa?

18.[b] Of all the sicknesses that affect your goats/cattle, which gives you the most trouble?
Nan tout maladi kabrit/bèf-ou-yo konn genyen, kilès bay ou plis pwoblem?

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Appendix D: Questionnaires in English and Kreole

QUESTIONNAIRE #4

1ab. Since the last time we examined this animal, has he been sick?
Depi dènyé fwa ké nou té examiné kabrit/bèf-la, èské li té tonbé malad?

2ab. Since the last time we examined this animal, have you seen a veterinarian with him?
Depi dènyé fwa ké nou té examiné kabrit/bèf-la, éskè ou té wè veterinè avèk li? oui/non

3ab. Since the last time we examined this animal, have you given him any medication?
Depi dènyé fwa ké nou té examiné kabrit/bèf-la, èské ou té ba li ninpot rémèd? oui/non

4a. (For females) Since the last time we examined this animal, has she kidded/calved?
(Pou fémèl-yo) Depi dènyé fwa.ké nou té examiné kabrit/bèf-la, èské li té fè pitit? .oui/non

bc. (If yes) When did she kid/calve, and how many offspring did she have?
(Si oui) Kilè li té fè pitit epi konbyen pitit?

5. (For females) Is she pregnant now?
(Pou fémèl-yo) Eské li plenn kounyéa? oui/non

6. When you sell this animal, will he be bought for eating or breeding?
Lè ou vann kabrit/bèf-sa-a, èské yo achté li pou manjé oubyen pou gadé?

7. Will you sell him live, or will you slaughter him before selling?
Eské ou ap vann-ni vivant oubyen èské ou ap touyé-l pou vann-ni?

8.[c] Will you eat any meat from this animal?
Eské ou ap manjé nan viann kabrit/bèf-sa-a? oui/non

9. Will you sell him in a local rural market or in the city market?
Eské ou ap vann-ni nan maché an dèyo oubyen nan maché lavil?

10. Who tethers the animal and moves him?
Ki moun ki konn maré kabrit/bèf-ou nan kòd epi chanjé li?

11. Who brings food and water to him?
Ki moun ki konn poté manjé oubyen dlo pou li?

12. Who takes care of the animal when he's sick?
Ki moun ki konn fè rémèd pou kabrit/bèf-ou lè li malad?

13.[d] Who in your family buys and sells your goats/cattle?
Kilès moun nan famil-ou ki konn achté kabrit/bèf-yo epi ki vann kabrit/bèf-yo?

14.[e] How much can you ask for an adult doe/cow when you sell her?
Konbyen ou kab mandé pou youn manman kabrit/gwo vach?

15.[e] How much can you ask for an adult buck/bull when you sell him?
Konbyen ou kab mandé pou youn gwo bouk/gwo toro?

16.e How much can you ask for a female kid/heifer calf when you sell her?
Konbyen ou kab mandé pou youn ti fémèl kabrit/ti gazel?

17.e How much can you ask for a buck kid/bull calf when you sell him?
Konbyen ou kab mandé pou youn ti bouk/ti toro?

18. Is there a kind of goat/cow that people prefer and for which they'll pay more money? (color, size, amount of milk, other -- not to be suggested)
Eské genyen youn kalité kabrit/bèf ké moun pi pito é ké yo ap péyé plis pou li? (koulè, gwosè, anpil lèt, lot bagay)

19. Is there a kind of goat/cow that people don't like and for which they'll pay less money?
Eské genyen youn kalité kabrit/bèf ké moun pa renmen é ké yo ap péyé mwens pou li?

20a. Does some one milk your goat/cow?
Eské genyen youn moun ki tiré lèt kabrit/bèf-ou-yo? oui/non

b. (If yes) Who?
(Si oui) Ki moun?

21.[f] (If yes) Does some one in your family drink that milk, or do you sell it?
(Si oui) Eské genyen moun nan famil-ou ki bwè lèt-sa-a, oubyen èské ou vann-ni?

22. (OMIT FOR GOATS) Do you use your cattle to pull a plow?
Eské ou sèvi avèk bèf-ou pou ralé chari? oui/non

23a. (OMIT FOR GOATS) Do you know any one who does that?
Eské ou konnin lot moun ki konn fè sa? oui/non

b. (If yes) Where?
(Si oui) Ki koté?

NOTES ON QUESTIONNAIRES

[a] #1.5 (Females) This question was included because of reports of the belief among peasants that the sex of offspring could be determined at the time of breeding.

[b] #3.18 Because of incorrect Kreole, this question was possibly misinterpreted to mean "Which sickness that affects your goats/cattle is the most serious?"

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[c] #4.8 This question should have been followed up in order to ascertain how they expected to eat meat from animals that they sold live.

[d] #4.13 Because of incorrect Kreole, this question was possibly misinterpreted to mean, "Who in your family buys and sells goats/cattle as a profession?"

[e] #4.14 - 4.17 These questions should have been phrased "How much do you receive?" rather than "How much do you ask?"

[f] #4.21 Because of incorrect Kreole, this question was not understood to mean selling milk versus drinking milk.

Even though this was not intended as an in-depth inquiry into the Haitian livestock system in this area, but rather as a broad overview, there are some additional questions which should have been included:

--Do you ever deliberately try to breed your females to a particular male? On what basis do you choose a male?

--(For cattle who are always tethered) How do female cattle get bred?

--Do you separate calves/kids from their mothers to wean them, or does the mother animal wean her offspring herself?

--At what age are calves/kids weaned?

--At what age are animals first tethered?

--Do you ever see buck kids breed their mothers?

--How often do you milk your cattle?

--Do you ever provide salt for any of your animals?

--What are the symptoms of "malcharbon"?

Appendix D: KEYS TO QUESTIONNAIRES

The following "keys" to the questionnaire response tables are included for those who may wish to use the raw data found in in Appendix E.

QUESTIONNAIRE #1

***ALL AGES ARE GIVEN IN MONTHS ***
***ALL MONTHS ARE NUMBERED 1 - 12 ***
***ALL "YES" RESPONSES ARE STATED AS "1," AND ALL "NO" RESPONSES AS "0." ***
***ALL RESPONSES OF "DON'T KNOW" ARE STATED AS 99, 999, OR 9999 ***

MALES:

1) 1-good 2-average 3-poor
7b) month starts
7c) month ends
8) 1-don't know 2-always .

FEMALES:

1) 1-good 2-average 3-poor
3c) checked all applicable: know heat?
cries
shakes/raises tail
swollen vulva
mounts others
4b) month starts
4c) month ends
6) 1-don't know 2-too fat 3-too fat or too skinny
12c,d) age and number for fourth parturition
14) 1-no care 2-feed 3-feed and water 4-HAS vet
15) 1-no care 2-HAS vet

QUESTIONNAIRE #2

***ALL AGES ARE GIVEN IN MONTHS ***
***ALL MONTHS ARE NUMBERED 1 - 12 ***
***ALL "YES" RESPONSES ARE STATED AS "1," AND ALL "NO" RESPONSES AS "0." ***
***ALL RESPONSES OF "DON'T KNOW" ARE STATED AS 99, 999, OR 9999 ***

6) 1-yard 2-tethered in scrub 3-loose in scrub 4-scrub 5-pasture
8a) month starts
8b) month ends
9) 1-not eat garden 2-not leave 3-not hurt 4-good grass
10 & 11) A-sorghum stalks, leaves B-corn stalks, leaves, husks C-rice straw D-plantain leaves E-plantain stalks F-sweet potato stalks G-sugar cane leaves H-sugar cane stalks I-bwadomm J-gommier K-mombin L-tia tia M-benzolive N-tipalto O-guinea grass P-kodagrinn (grass) Q-dékos (grass) R-napier

grass S-guatemala grass T- absint U-balé V-lalo W-siwel
12) 1-lead to water/river 2-carry water 3-doesn't get
13a,b) month starts and ends
14a,b) month starts and ends
15a,b) month starts and ends
16) 1-much/good food 2-food and water 3-food and vaccine 4-food and vitamins 5-food and see vet 6-food and parasite control

QUESTIONNAIRE #3

***ALL AGES ARE GIVEN IN MONTHS ***
***ALL MONTHS ARE NUMBERED 1 - 12 ***
***ALL "YES" RESPONSES ARE STATED AS "1," AND ALL "NO" RESPONSES AS "0." ***
***ALL RESPONSES OF "DON'T KNOW" ARE STATED AS 99, 999, OR 9999 ***

6) 0-never/none 1-"malcharbon" = anthrax 2-diarrhea 3-ticks 4-lice 5-skinniness 6-fever 7-worms 8-warts 9-can't/won't eat 10-stomach ache 11-tetanus 99-always

7) what month
9) see #6 above
10) see #6 above
12) 1-young and adult 2-young 3-adult
15) 1-recover 2-die 3-either
16a) see #6 above
16d) 1-young and adult 2-young 3-adult
16h) 1-recover 2-die 3-either
17a) see #6 above
17d) 1-young and adult 2-young 3-adult
17h) 1-recover 2-die 3-either
18) see #6 above

QUESTIONNAIRE #4

***ALL AGES ARE GIVEN IN MONTHS ***
***ALL MONTHS ARE NUMBERED 1 - 12 ***
***ALL "YES" RESPONSES ARE STATED AS "1," AND ALL "NO" RESPONSES AS "0." ***
***ALL RESPONSES OF "DON'T KNOW" ARE STATED AS 99, 999, OR 9999 ***

6) 1-eating 2-breeding 3-both
9) sold in rural market? y/n
10,11) 1-owner 2-child of owner 3-others
12) (FOR GOATS) vet gives medicine? y/n
(FOR CATTLE) 1-owner 2-child of owner 3-others 4-vet 5-not done
13) 1-no one 2-person in family
18) 1-big 2-a lot of milk 3-both
19) 1-little
20b) 1-owner 2-other
21) 1-drink 2-sell 3-both
23b) 1-Lachapelle 2-Central Plateau

Appendix E: Responses to questionnaire 1 for female animals
(See appendix D for questions and key to responses)

ID	1	2	3a	3b	3c	3d	3e	3f	3g	4a	4b	4c	5	6	7a	7b	7c	7d	7e	7f	8a	8b
GOATS																						
15	1	42	1	999	1	1	0	0	0	1	9	10	0	4	1	9	2	1	1	1	1	good food: concentr.
901	2	30	1	18	1	1	1	1	0	1	9	10	0	4	1	9	2	1	1	1	1	good food: concentr.
904	1	78	1	999	0	0	0	0	0	0	0	0	0	1	1	99	99	0	0	0	0	
905	1	48	1	5	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
906	1	42	1	999	1	0	1	0	0	1	4	4	0	0	0	0	0	0	0	0	0	
907	1	36	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	
908	1	11	1	999	0	0	0	0	0	0	0	0	0	1	1	99	99	0	0	0	0	
909	1	60	1	999	0	0	0	0	0	0	0	0	0	0	1	11	3	0	0	0	0	
910	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
911	1	48	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
912	1	10	1	999	0	0	0	0	0	0	0	0	0	0	1	11	4	0	0	0	0	
913	1	24	1	999	1	0	1	0	0	1	2	2	0	0	1	99	4	0	0	0	0	
915	2	18	1	999	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
916	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
917	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
918	0	30	1	999	0	0	0	0	0	1	3	3	0	0	0	0	0	0	0	0	0	
919	1	54	1	999	1	0	1	0	0	0	0	0	0	1	1	8	99	0	0	0	0	
920	2	10	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
921	2	24	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
922	1	96	1	999	1	1	0	0	0	1	3	4	0	1	1	99	2	0	0	99	1	GIVE PAY PITIMI, H20
923	2	24	1	18	1	1	0	0	0	1	3	4	0	1	0	0	0	0	0	0	0	
924	2	5	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
925	1	12	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
927	1	24	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
928	1	18	1	12	0	0	0	0	0	0	0	0	0	1	1	99	99	0	0	0	0	
929	2	42	1	999	0	0	0	0	0	1	4	4	0	1	0	0	0	0	0	0	0	
930	2	48	1	999	1	0	0	1	0	1	1	9	0	1	0	0	0	0	0	0	0	
931	2	48	1	999	1	0	0	1	0	1	1	9	0	1	0	0	0	0	0	0	0	
932	2	36	1	999	0	0	0	0	0	0	0	0	0	1	1	99	99	0	0	0	1	GRASS, WATER
933	1	36	1	999	1	1	0	0	0	0	0	0	0	1	1	99	99	0	0	0	0	
934	2	20	1	999	1	0	0	0	0	0	0	0	0	1	1	99	99	0	0	0	1	TOUT KALITE ZEB
935	0	48	1	999	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
936	2	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
937	2	102	1	999	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
940	2	36	1	12	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
941	2	36	1	999	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
943	2	8	1	6	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
945	1	30	1	999	1	0	0	0	1	0	0	0	0	1	1	99	2	0	0	0	1	PAY PITIMI, PAY MAI
946	1	5	1	5	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	
948	1	54	1	999	1	0	0	0	1	0	0	0	0	1	1	99	99	0	0	0	0	
949	1	12	1	999	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	
950	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
951	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
953	2	10	1	999	0	0	0	0	0	0	0	0	0	1	1	99	99	1	0	0	1	PAY:MAI MOULIN&PITIM
959	1	48	1	999	0	0	0	0	0	0	0	0	0	2	1	99	99	1	0	0	0	

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Appendix E: Responses to questionnaire 1 for female animals
(See appendix D for questions and key to responses)

ID	9a	9b	10a	10b	11a	11b	12a	12b	12c	12d	13a	13b	14	15	16a	16b	16c	17	18	19a	19b
GOATS																					
15	1	2	24	1	36	1	0	0	0	0	1	kids died 1-2 weeks	4	2	0	0	0	32	32	1	99
901	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	99
904	1	999	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
905	1	4	10	2	999	2	999	1	999	2	0		1	1	0	0	0	9999	9999	0	0
906	1	3	11	1	999	2	999	2	0	0	0		1	1	0	0	0	9999	9999	0	0
907	1	1	10	2	0	0	0	0	0	0	0		1	1	0	0	0	9999	9999	0	0
908	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
909	1	3	10	2	999	3	999	2	0	0	0		1	1	0	0	0	9999	9999	0	0
910	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
911	1	4	10	2	999	2	999	1	999	2	0		1	1	0	0	0	8	8	0	0
912	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
913	1	2	999	1	999	1	0	0	0	0	0		1	1	0	0	0	3	3	0	0
915	1	1	999	1	0	0	0	0	0	-0	0		1	1	0	0	0	9999	9999	0	0
916	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
917	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1
918	1	1	999	2	0	0	0	0	0	0	0		1	1	0	0	0	9999	9999	1	2
919	1	3	999	2	999	2	999	2	0	0	0		2	1	0	0	0	4	4	1	1
920	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1
921	1	1	999	1	0	0	0	0	0	0	0		1	1	0	0	0	9999	9999	1	1
922	1	8	999	2	999	2	999	1	999	2	0		2	1	0	0	0	8	8	1	3
923	1	1	18	2	0	0	0	0	0	0	0		3	1	0	0	0	9999	9999	1	3
924	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	3
925	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1
927	1	1	999	1	0	0	0	0	0	0	0		1	1	0	0	0	9999	9999	1	2
928	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	9999	9999	1	2
929	1	2	18	1	36	2	0	0	0	0	0		1	2	0	0	0	9999	9999	1	2
930	1	4	999	1	999	2	999	2	999	3	0		2	1	0	0	0	9999	9999	1	1
931	1	1	999	2	0	0	0	0	0	0	0		2	1	0	0	0	9999	9999	1	1
932	1	2	999	1	999	1	0	0	0	0	1	LEAF MED STOPPED DEV	2	1	1	0	0	9999	9999	1	1
933	1	2	999	2	999	2	0	0	0	0	0		3	1	0	0	0	9999	9999	1	1
934	1	1	999	1	0	0	0	0	0	0	0		2	1	0	0	0	9999	9999	0	0
935	1	4	999	2	999	2	999	1	999	1	0		1	1	0	0	0	9999	9999	1	1
936	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
937	1	4	999	2	999	3	999	3	999	4	0		1	1	0	0	0	9999	9999	1	4
940	1	2	24	1	36	1	0	0	0	0	0		1	1	0	0	0	9999	9999	1	2
941	1	2	999	2	999	2	0	0	0	0	0		1	1	0	0	0	5	5	0	0
943	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1
945	1	3	999	2	999	2	999	3	0	0	0		2	1	0	0	0	8	8	1	2
946	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	2
948	1	4	999	2	999	3	999	3	999	3	0		1	1	0	0	0	9999	9999	1	2
949	1	1	999	2	0	0	0	0	0	0	0		1	1	0	0	0	9999	9999	1	2
950	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1
951	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1
953	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1
959	1	3	999	1	999	2	999	3	0	0	0		1	1	0	0	0	9999	9999	1	1

Appendix E: Responses to questionnaire 1 for female animals
(See appendix D for questions and key to responses)

ID	1	2	3a	3b	3c	3d	3e	3f	3g	4a	4b	4c	5	6	7a	7b	7c	7d	7e	7f	8a	8b
CATTLE																						
76	1	120	1	999	0	0	0	0	0	0	0	0	0	1	1	0	2	1	0	0	1	HAS animal = vet
185	1	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
552	2	78	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
553	2	72	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
554	1	60	1	999	0	0	0	0	0	0	0	0	0	1	1	1	99	0	0	0	0	
557	2	96	1	24	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
558	2	54	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
559	2	30	1	12	1	1	1	0	0	0	0	0	0	3	1	7	3	0	1	2	0	
601	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
603	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
604	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
606	2	108	1	30	1	0	0	0	1	1	3	4	0	1	0	0	0	0	0	0	0	
608	2	102	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	more fresh grass
611	1	72	1	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
612	1	60	1	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
613	1	60	1	999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
615	1	36	1	30	1	0	0	0	1	0	0	0	0	0	1	1	99	0	0	99	0	
616	2	72	1	999	1	1	1	0	0	1	2	2	0	1	0	0	0	0	0	0	0	
619	1	78	1	999	1	1	0	0	1	1	2	4	0	1	0	0	0	0	0	0	1	tie in much grass
620	1	18	1	24	1	1	0	0	0	1	2	3	0	1	0	0	0	0	0	0	0	
621	1	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
622	2	42	1	24	1	1	0	0	0	1	2	2	0	1	1	10	7	0	0	0	0	
623	3	30	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
624	2	48	1	999	1	1	0	1	0	1	3	4	0	1	1	4	2	0	0	0	0	
625	2	72	1	18	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
677	2	48	1	18	1	0	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	
678	2	12	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
680	2	72	1	24	1	0	0	0	1	1	2	4	0	1	0	0	0	0	0	0	0	
681	2	24	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
682	2	60	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
683	2	78	1	999	0	0	0	0	0	1	4	4	0	1	1	4	2	0	0	0	1	all grass;h20 3x/day
685	2	24	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
686	1	48	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
689	2	12	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
690	1	30	1	18	1	1	0	1	0	0	0	0	0	1	1	8	7	0	1	1	1	all kinds grass;h20
691	1	84	1	999	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
692	1	24	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
693	1	18	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
694	2	26	1	24	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
695	2	72	1	999	1	1	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	
697	2	72	1	999	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
698	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
699	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

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Appendix E: Responses to questionnaire 1 for female animals
(See appendix D for questions and key to responses)

ID	9a	9b	10a	10b	11a	11b	12a	12b	12c	12d	13a	13b	14	15	16a	16b	16c	17	18	19a	19b
CATTLE																					
76	1	999	999	1	999	1	999	1	999	1	1	baby died	4	2	0	0	0	999	999	1	99
185	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	99
552	1	2	999	1	999	1	0	0	0	0	0		1	1	0	0	0	9999	9999	0	0
553	1	2	999	1	999	1	0	0	0	0	0	.	1	1	0	0	0	3	3	0	0
554	1	2	999	1	999	1	0	0	0	0	0		1	1	0	0	0	9999	9999	1	5
557	1	3	24	1	60	1	84	1	0	0	1	not recorded	2	1	0	0	0	40	40	1	1
558	1	2	999	1	999	1	0	0	0	0	0		1	1	0	0	0	4	4	1	1
559	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	3
601	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
603	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
604	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
606	1	7	42	1	60	1	84	1	0	0	0		1	1	0	0	0	12	12	0	0
608	1	2	999	1	999	1	0	0	0	0	0		1	1	0	0	0	9999	9999	0	0
611	1	2	36	1	60	1	0	0	0	0	0		1	1	0	0	0	9999	9999	0	0
612	1	2	36	1	60	1	0	0	0	0	0		1	1	0	0	0	9999	9999	0	0
613	1	2	999	1	999	1	0	0	0	0	0		1	1	0	0	0	9999	9999	0	0
615	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
616	1	2	999	1	999	1	0	0	0	0	0		1	1	0	0	0	4	4	1	2
619	1	5	999	1	999	1	999	1	999	1	0		1	1	0	0	0	8	8	1	2
620	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	2
621	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
622	1	1	999	1	0	0	0	0	0	0	0		1	1	0	0	0	6	6	0	0
623	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
624	1	1	24	1	0	0	0	0	0	0	0		1	1	0	0	0	9999	9999	1	1
625	1	4	24	1	36	1	48	1	72	1	0		1	1	0	0	0	8	8	1	1
677	1	1	24	1	0	0	0	0	0	0	0		1	1	0	0	0	4	4	0	0
678	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
680	1	3	24	1	48	1	66	1	0	0	0		1	1	1	0	0	12	12	0	0
681	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
682	1	3	999	1	999	1	999	1	0	0	0		1	1	0	0	0	9999	9999	0	0
683	1	5	999	1	999	1	999	1	999	1	0		1	1	0	0	0	9999	9999	1	1
685	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
686	1	999	0	0	0	0	0	0	0	0	0		1	1	0	0	0	9999	9999	0	0
689	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
690	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
691	1	3	999	1	999	1	999	1	0	0	0		1	1	0	0	0	9999	9999	0	0
692	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
693	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
694	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	2
695	1	3	999	1	999	1	999	1	0	0	1	retained placenta	2	1	0	0	0	9999	9999	0	0
697	1	3	999	1	999	1	999	1	0	0	0		1	1	0	0	0	104	104	1	4
698	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
699	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0

Appendix E: Responses to Questionnaire 1 for male animals
(See appendix D for questions and key to responses)

ID	1	2	3A	3B	4A	4B	5	6	7A	7B	7C	8	9A	9B
GOATS														
902	1	12	1	8	1	many	0	0	0	0	0	1	1	99
903	1	14	1	8	1	many	0	0	0	0	0	1	1	99
914	1	2	1	2	0		0	0	1	3	4	1	0	0
926	2	11	1	6	0		0	0	1	3	3	2	1	1
938	3	4	0	0	0		0	0	0	0	0	0	0	0
939	2	4	1	3	0		0	0	1	3	4	2	1	4
942	2	4	0	0	0		0	0	0	0	0	0	0	0
944	2	1	0	0	0		0	0	0	0	0	0	0	0
947	1	5	0	0	0		0	0	0	0	0	0	1	2
952	1	6	1	2	0		0	0	0	0	0	1	1	1
954	1	5	1	999	0		0	0	0	0	0	1	1	1
955	1	5	1	999	0		0	0	0	0	0	1	1	1
956	2	3	1	999	0		0	0	0	0	0	1	1	1
957	1	6	1	999	0		0	0	0	0	0	2	1	1
958	1	5	1	999	0		0	0	0	0	0	2	1	1
CATTLE														
49	2	2	0	0	0		0	0	0	0	0	0	1	99
245	2	54	1	999	1	can't get up	0	0	1	3	4	1	1	99
555	2	18	1	999	0		0	0	0	0	0	1	1	2
556	2	12	0	0	0		0	0	0	0	0	1	1	2
605	3	6	0	0	0		0	0	0	0	0	0	0	0
607	1	1	0	0	0		0	0	0	0	0	0	0	0
609	2	24	1	18	1	"megre"	0	0	1	3	4	2	0	0
610	1	18	0	0	0		0	0	0	0	0	0	0	0
614	2	12	0	0	0		0	0	0	0	0	0	0	0
617	2	18	1	999	0		0	0	1	1	4	1	0	0
618	1	18	1	14	0		0	0	1	12	1	2	0	0
676	2	1	0	0	0		0	0	0	0	0	0	0	0
679	2	18	0	0	0	Ralgro	0	0	0	0	0	0	1	1
684	2	24	1	999	0		0	0	1	3	3	2	0	0
687	1	1	0	0	0		0	0	0	0	0	0	0	0
688	2	12	0	0	0		0	0	0	0	0	0	0	0
696	3	3	0	0	0		0	0	0	0	0	0	1	1

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Appendix E: Responses to questions 1 to 5 for periods 2, 3, and 4
(See Appendix D for questions and key to responses)

ID	PERIOD	1	1A	2	2A	3	3A	4	4A	4B	5
GOATS											
15	2	0		1	ROD FRANK'S GOAT	1		1	1	2	
15	3	0		1	ADE & WORMED IN MAY	1	ABOVE	0	0	0	0
901	2	0		1	FRANK'S GOAT	1		1	2	2	0
901	3	0		1	ADE & WORMED	1	ADE & WORMER	0	0	0	0
901	4	0		1	vet's goat	0		0	0	0	0
902	2	0		1	FRANK'S GOAT	1		0	0	0	0
902	3	0		1	ADE, WORMED IN MAY	1	ABOVE	0	0	0	0
902	4	0		1	vet's animal	1	?regular treatment?	0	0	0	0
903	2	0		1	REGULAR TREATMENT?	1	REG TREATMENT?	0	0	0	0
903	3	0		1	ADE & WORMED IN MAY	1	ABOVE	0	0	0	0
903	4	0		1	vet's animal	0		0	0	0	0
904	2	0		0		0		1	99	2	0
904	3	0		0		0		1	1	2	0
904	4	0		0		1	fey kanpech	1	8	0	0
905	2	0		0		0		0	0	0	0
905	3	0		0		0		0	0	0	1
905	4	0		0		0		0	0	0	1
906	2	0		0		0		0	0	0	0
906	3	0		0		0		0	0	0	1
906	4	0		0		0		0	0	0	1
908	2	0		0		0		1	99	2	0
908	3	0		0		0		1	4	2	0
909	2	0		0		0		0	0	0	0
909	3	0		0		0		1	4	3	0
910	2	0		0		0		0	0	0	0
910	3	0		0		0		1	6	1	0
913	2	0		0		0		0	0	0	0
914	2	0		0		0		0	0	0	0
915	2	0		0		0		0	0	0	0
915	3	0		0		0		0	0	0	1
915	4	0		0		0		0	0	0	1
916	2	0		0		0		0	0	0	0
916	3	0		0		0		0	0	0	0
916	4	0		0		0		0	0	0	0
917	2	0		0		0		0	0	0	0
917	3	0		0		0		0	0	0	0
917	4	0		0		0		0	0	0	0
918	3	0		0		0		0	0	0	0
918	4	0		0		0		1	8	2	0
919	2	0		0		0		0	0	0	0
919	3	0		0		0		0	0	0	1
919	4	0		0		0		1	8	2	0
920	2	0		0		0		0	0	0	0
920	3	0		0		0		0	0	0	0
920	4	0		0		0		0	0	0	0
921	2	0		0		0		0	0	0	0

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Appendix E: Responses to questions 1 to 5 for periods 2, 3, and 4
(See Appendix D for questions and key to responses)

ID	PERIOD	1	1A	2	2A	3	3A	4	4A	4B	5
921	3	0		0		0		0	0	0	0
921	4	0		0		0		1	8	2	0
922	2	0		0		0		1	3	2	0
922	3	0		0		0		0	0	0	0
922	4	1	aborted	0		0		1	8	2	1
923	2	1	DIARRHEA	0		1	DLO SEL	0	0	0	0
923	3	1	DIARRHEA	0		1	DLO SEL	0	0	0	0
923	4	0		0		0		1	8	2	0
925	2	0		0		0		0	0	0	0
925	3	1	DIARRHEA	0		1	DLO SEL	0	0	0	0
925	4	0		0		0		1	7	1	0
926	2	0		0		0		0	0	0	0
926	3	0		0		0		0	0	0	1
927	2	0		0		0		0	0	0	0
927	3	0		1	?REGULAR TREATMENT?	1	?REGULAR TREATMENT?	0	0	0	0
927	4	0		1	?regular treatment?	1	?regular treatment?	0	0	0	0
928	2	0		0		0		1	3	2	0
930	2	0		0		0		0	0	0	0
930	3	0		0		0		0	0	0	0
930	4	0		0		0		0	0	0	0
931	2	0		0		0		0	0	0	0
931	3	0		0		0		0	0	0	0
931	4	0		0		0		1	7	3	0
932	2	0		0		0		1	1	2	0
933	2	0		0		0		1	3	2	0
933	3	0		0		0		0	0	0	0
933	4	0		0		0		0	0	0	0
934	2	0		0		0		1	3	2	0
934	3	0		0		0	N	0	0	0	0
934	4	0		0		0		0	0	0	1
935	2	0		0		0		0	0	0	0
935	3	0		0		0		0	0	0	0
935	4	0		0		0		0	0	0	0
936	2	0		0		0		0	0	0	0
936	3	0		0		0		0	0	0	0
937	2	0		0		0		0	0	0	0
937	3	0		0		0		0	0	0	0
937	4	0	1 baby died - Aug	0		0		1	8	3	0
938	2	0		0		0		0	0	0	0
940	2	0		0		0		0	0	0	0
940	3	0		0		0		0	0	0	0
940	4	0		0		0		0	0	0	0
941	2	0		0		0		0	0	0	0
941	3	0		0		0		0	0	0	0
941	4	0		0		0		1	7	2	0
942	2	0		0		0		0	0	0	0
943	2	0		0		0		0	0	0	0

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Appendix E: Responses to questions 1 to 5 for periods 2, 3, and 4
(See Appendix D for questions and key to responses)

ID	PERIOD	1	1A	2	2A	3	3A	4	4A	4B	5
943	3	0		0		0		0	0	0	1
944	2	0		0		0		0	0	0	0
944	3	0		0		0		0	0	0	0
945	2	0		0		0		1	2	3	0
945	3	0		0		0		0	0	0	0
945	4	0		0		0		0	0	0	1
946	2	0		0		0		0	0	0	0
946	3	0		0		0		0	0	0	1
946	4	0		0		0		1	8	2	0
947	2	0		0		0		0	0	0	0
947	3	0		0		0		0	0	0	0
948	2	0		0		0		0	0	0	0
948	3	0		0		0		1	5	2	0
948	4	0		0		0		0	0	0	1
949	2	0		0		0		1	2	2	0
949	4	0		0		0		0	0	0	1
950	2	0		0		0		0	0	0	0
950	3	0		0		0		0	0	0	0
950	4	0		0		0		0	0	0	0
951	2	0		0		0		0	0	0	0
951	3	0		0		0		0	0	0	0
951	4	0		0		0		0	0	0	0
952	2	0		0		0		0	0	0	0
952	3	0		1	?REGULAR TREATMENT?	1	?REGULAR TREATMENT?	0	0	0	0
952	4	0		0		0		0	0	0	0
953	2	0		0		0		0	0	0	0
953	3	0		0		0		0	0	0	1
953	4	0		0		0		0	0	0	1
954	2	0		0		0		0	0	0	0
955	2	0		0		0		0	0	0	0
956	2	0		0		0		0	0	0	0
956	3	0		0		0		0	0	0	0
959	2	0		0		0		0	0	0	0
959	3	1	DIARRHEA	0		0		1	0	0	0
959	4	0		0		0		0	0	0	1
960	2	0		0		0		0	0	0	0
960	3	0		1	?REGULAR TREATMENT?	1	"LEVAMISOLE"	0	0	0	1
960	4	0		0		0		0	0	0	1
961	2	0		0		0		0	0	0	0
961	3	0		0		0		0	0	0	0
961	4	0		0		0		0	0	0	1
962	2	0		1	?REGULAR TREAMENT?	0		1	3	3	0
963	2	0		0		0		0	0	0	0
964	3	0		1	?REGULAR TREATMENT?	1	?REGULAR TREATMENT?	0	0	0	0
964	4	0		1	?regular treatment?	1	?regular treatment?	0	0	0	1

Appendix E: Responses to questions 1 to 5 for periods 2, 3, and 4
(See Appendix D for questions and key to responses)

ID	PERIOD	1	1A	2	2A	3	3A	4	4A	4B	5
CATTLE											
49	2	0		0		0		0	0	0	0
49	3	0		1	H.A.S. ANIMAL	1	H.A.S. ANIMAL	0	0	0	0
49	4	0		0		0		0	0	0	0
76	2	0		0		0		1	2	1	0
76	3	0		1	H.A.S. ANIMAL	1	H.A.S. ANIMAL	0	0	0	0
76	4	0		0		0		0	0	0	1
185	2	0		0		0		0	0	0	0
185	3	0		1	H.A.S. ANIMAL	1	H.A.S. ANIMAL	0	0	0	1
185	4	0		0		0		0	0	0	1
245	2	1	GAL;DOWN,CAN'T RISE	1	H.A.S. ANIMAL	1		0	0	0	0
245	3	0		1	H.A.S. ANIMAL	1	H.A.S. ANIMAL	0	0	0	0
245	4	0		0		0		0	0	0	0
552	2	0		0		0		0	0	0	0
552	3	0		0		0		0	0	0	0
552	4	0		0		0		0	0	0	1
553	2	0		0		0		0	0	0	0
553	3	0		0		0		0	0	0	0
553	4	0		1	standard treatment	1	?vet treatment?	0	0	0	1
554	2	0		0		0		0	0	0	0
554	3	0		1	?REGULAR TREATMENT?	1	?REGULAR TREATMENT?	0	0	0	1
554	4	0		0		0		0	0	0	1
555	2	0		0		0		0	0	0	0
555	3	0		0		0		0	0	0	0
555	4	1	no appetite	0		0		0	0	0	0
556	2	0		0		0		0	0	0	0
556	3	0		1	?REGULAR TREATMENT?	1	?REGULAR TREATMENT?	0	0	0	0
556	4	0		0		0		0	0	0	0
557	2	0		0		0		0	0	0	0
557	3	0		0		0		0	0	0	1
557	4	0		0		0		0	0	0	1
558	2	0		0		0		0	0	0	0
558	3	0		0		0		0	0	0	0
558	4	0		0		0		0	0	0	1
559	2	0		1	"REMED POU VE"	1	"LEVAMISOL"	1	3	1	0
559	3	0		1	?REGULAR TREATMENT?	1	"LEVAMISOL"	0	0	0	0
560	2	0		0		0		0	0	0	0
560	3	0		0		0		0	0	0	1
560	4	0		0		0		0	0	0	1
562	2	0		1	"LEVAMISOL"	1	"LEVAMISOL"	0	0	0	0
562	3	0		1	?REGULAR TREATMENT?	1	"LEVAMISOL;B COMPLEX	0	0	0	0
563	2	0		0		1	"VERMISSOL"	0	0	0	0
563	3	0		1	?REGULAR TREATMENT?	1	?REGULAR TREATMENT?	0	0	0	0
563	4	0		0		0		0	0	0	0
564	2	0		0		0		0	0	0	0
564	3	0		0		0		0	0	0	0
564	4	0		0		0		0	0	0	1

Appendix E: Responses to questions 1 to 5 for periods 2, 3, and 4
(See Appendix D for questions and key to responses)

ID	PERIOD	1	1A	2	2A	3	3A	4	4A	4B	5
565	2	0		0		0		0	0	0	0
565	3	0		0		0		0	0	0	0
565	4	0		0		0		0	0	0	1
566	2	0		0		0		1	1	1	0
566	3	0		0		0		0	0	0	0
566	4	0		0		0		0	0	0	0
567	2	0		0		0		0	0	0	0
567	3	0		0		0		0	0	0	0
567	4	0		0		0		0	0	0	0
568	2	0		0		0		0	0	0	0
568	3	0		0		0		0	0	0	0
568	4	0		0		0		0	0	0	1
569	2	0		0		0		0	0	0	0
569	4	0		0		0		1	8	0	0
570	2	0		0		0		0	0	0	0
570	3	0		0		0		0	0	0	1
570	4	0		0		0		0	0	0	1
571	2	0		0		0		0	0	0	0
601	2	0		0		0		0	0	0	0
601	3	0		0		0		0	0	0	0
601	4	0		0		0		0	0	0	0
603	2	0		0		0		0	0	0	0
604	2	0		0		0		0	0	0	0
604	4	0		0		0		0	0	0	0
605	2	0		0		0		0	0	0	0
605	4	0		0		0		0	0	0	0
606	2	0		0		0		0	0	0	0
606	3	0		0		0		0	0	0	0
606	4	0		0		0		0	0	0	0
607	2	0		0		0		0	0	0	0
607	3	0		0		0		0	0	0	0
607	4	0		0		0		0	0	0	0
608	2	0		0		0		0	0	0	0
608	4	0		0		0		0	0	0	1
610	2	0		0		0		0	0	0	0
615	2	0		0		0		0	0	0	0
615	4	0		0		0		0	0	0	1
616	2	0		0		0		0	0	0	0
616	3	0		0		0		0	0	0	1
616	4	0		0		0		0	0	0	0
617	2	0		0		0		0	0	0	0
617	3	0		0		0		0	0	0	0
617	4	0		0		0		0	0	0	0
618	2	0		0		0		0	0	0	0
618	3	0		0		0		0	0	0	0
618	4	0		0		0		0	0	0	0
619	2	0		0		0		0	0	0	0

Appendix E: Responses to questions 1 to 5 for periods 2, 3, and 4
(See Appendix D for questions and key to responses)

ID	PERIOD	1	1A	2	2A	3	3A	4	4A	4B	5
619	3	0		0		0		0	0	0	1
619	4	0		0		0		0	0	0	1
620	2	0		0		0		0	0	0	0
620	3	0		0		0		0	0	0	1
620	4	0		0		0		0	0	0	1
621	2	0		0		0		0	0	0	0
621	3	0		0		0		0	0	0	0
621	4	0		0		0		0	0	0	0
622	2	0		0		0		0	0	0	0
622	3	0		0		0		0	0	0	1
622	4	0		0		0		1	8	0	0
623	3	0		0		0		0	0	0	0
623	4	0		0		0		0	0	0	0
624	2	0		0		0		1	1	1	0
624	3	0		0		0		0	0	0	0
624	4	0		0		0		0	0	0	0
625	2	0		0		0		0	0	0	0
625	3	0		0		0		0	0	0	0
625	4	0		0		0		0	0	0	0
676	2	0		0		0		0	0	0	0
676	3	0		0		0		0	0	0	0
677	2	0		0		0		0	0	0	0
677	3	0		0		0		0	0	0	0
677	4	0		0		0		1	8	0	0
678	2	0		0		0		0	0	0	0.
678	3	0		0		0		0	0	0	0
678	4	0		0		0		0	0	0	0
680	2	0		0		0		0	0	0	0
680	3	0		0		0		0	0	0	1
680	4	0		0		0		0	0	0	1
681	3	1	LERI	0		0		0	0	0	0
681	4	0		0		0		0	0	0	0
682	2	0		0		0		0	0	0	0
682	3	0		0		0		0	0	0	0
682	4	0		0		0		0	0	0	0
683	2	0		0		0		1	2	1	0
683	3	0		0		0		0	0	0	0
683	4	0		0		0		0	0	0	0
684	2	0		0		0		0	0	0	0
684	3	0		0		0		0	0	0	0
684	4	0		0		0		0	0	0	0
686	4	0		0		0		0	0	0	0
687	4	0		0		0		0	0	0	0
689	2	0		0		0		0	0	0	0
689	3	0		0		0		0	0	0	0
689	4	0		0		0		0	0	0	0
690	2	0		0		0		0	0	0	0

Appendix E: Responses to questions 1 to 5 for periods 2, 3, and 4
(See Appendix D for questions and key to responses)

ID	PERIOD	1	1A	2	2A	3	3A	4	4A	4B	5
690	3	0		0		0		0	0	0	1
690	4	0		0		0		0	0	0	1
691	4	0		0		0		0	0	0	1
692	4	0		0		0		0	0	0	1
693	2	0		0		0		0	0	0	0
693	3	0		0		0		0	0	0	0
693	4	0		0		0		0	0	0	0
694	2	0		0		0		0	0	0	0
694	3	0		0		0		0	0	0	0
695	2	0		0		0		0	0	0	0
696	2	0		0		0		0	0	0	0
697	2	0		1	?REGULAR TREATMENT?	1	"VERMIFUGE,PENICILL"	0	0	0	0
697	3	0		1	?REGULAR TREATMENT?	1	?REGULAR TREATMENT?	0	0	0	0
698	2	1	"CHECHE"	-1		1	"VERMIFUGE,PENICILL"	0	0	0	0
698	3	0		1	?REGULAR TREATMENT?	1	?REGULAR TREATMENT?	0	0	0	0
698	4	0		0		0		0	0	0	0
699	2	0		0		0		0	0	0	0
699	3	0		0		0		0	0	0	0
699	4	1	diarrhea	1		1	levamisol & assuntol	0	0	0	0

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Appendix E: Responses to questionnaire 2
(See Appendix D for questions and key to responses)

ID	6	7	8a	8b	9	10	11a	11b	12	13a	13b	14a	14b	15a	15b	16
GOATS																
15	5	1	6	9	4		1	JIRS	2	0	0	1	12	0	0	6
901	5	1	6	9	4		1	JIRS	2	0	0	1	12	0	0	6
902	5	1	0	0	0	P	0		0	1	12	1	12	0	0	4
903	5	1	6	9	4		1	JIRS	2	0	0	1	12	0	0	6
904	1	1	5	12	1	JKA	1	JI	2	12	5	12	12	2	3	1
905	1	0	5	12	1	JI	1	JI	3	12	5	1	1	2	3	3
906	1	0	5	12	1	IJK	1	JK	3	12	3	12	12	2	3	3
908	1	0	5	12	1	XIJ	1	JI	2	12	5	12	12	2	3	3
909	1	0	5	12	1	JIVN	1	IJF	2	12	5	12	12	3	4	0
910	1	0	5	12	1	XIJK	1	IJ	2	12	5	12	12	2	3	1
913	1	0	5	12	1	IJKO	0		3	12	5	12	12	2	3	1
914	1	0	5	12	1	IJKT	0		2	12	5	12	12	2	3	1
915	1	0	5	12	1	JO	0		3	12	5	12	12	2	3	1
916	1	1	0	0	0		0		0	1	12	12	12	0	0	1
917	1	0	0	0	0		0		0	1	12	1	12	0	0	5
919	1	1	5	3	1	IJKW	1	JKGW	2	3	5	3	4	5	3	3
920	1	1	5	12	1	AJL	1	JA	2	12	5	12	12	5	6	3
921	1	1	5	12	1	AJLO	1	AK	2	12	5	12	12	2	3	3
922	1	0	5	12	1	AJKL	1	IL	2	12	5	12	12	2	3	3
923	1	1	5	12	1	ABJKN	1	JKI	2	12	5	5	5	2	3	3
925	1	1	5	12	1	JILN	1	AJ	2	12	5	12	12	2	3	3
926	1	0	5	12	1	AJKL	1	AJ	2	12	5	12	12	2	3	3
927	1	1	5	12	1	AJIL	1	AJK	2	12	5	12	12	5	6	3
928	1	1	5	1	1	IJNU	1	IKO	2	1	5	8	12	2	3	5
930	1	0	5	12	1	IJO	1	KF	2	12	5	12	12	2	3	3
931	4	0	5	12	1	JMF	1	JIO	2	12	5	12	12	2	3	3
932	1	0	5	12	1	JIKAL	1	AM	2	12	5	12	12	2	3	3
933	1	1	5	12	1	JIKL	0		2	12	5	12	12	2	3	4
934	1	0	5	12	1	JILO	1	AJ	1	12	5	12	12	2	3	3
935	4	0	5	12	1	JIUN	1	JI	2	12	5	1	4	5	6	1
936	1	1	5	12	1	JLN	0		2	12	5	4	5	2	3	3
937	1	0	5	12	1	XJL	1	FM	2	12	5	12	12	2	3	3
938	1	0	5	12	1	OMK	1	JI	2	12	5	12	12	2	3	5
940	1	0	5	12	1	JKFM	1	LO	2	12	5	12	12	2	3	3
941	4	0	5	12	1	JMFO	1	IM	2	12	5	12	12	2	3	3
942	4	0	5	12	1	JIKNO	1	JF	2	12	5	12	12	2	3	3
943	1	1	5	12	1	JKLO	1	JI	2	12	5	12	12	2	3	3
944	1	1	5	12	1	JIKL	1	JKO	2	12	5	12	12	2	3	3
945	3	1	5	12	1	JABI	1	JA	2	12	5	4	4	5	5	3
946	1	1	5	12	1	ABJKU	0		2	12	5	5	5	2	3	3
947	1	0	5	12	1	JIKPN	1	JK	2	12	5	12	12	2	3	3
948	1	1	5	12	1	JIAB	0		2	12	5	5	5	2	3	3
949	1	0	5	12	1	ABJI	0		2	12	5	5	5	2	3	3
950	1	1	5	10	1	ABJK	1	JKW	2	10	5	10	11	4	6	3
951	1	1	5	10	1	AJKWO	1	JI	2	10	5	10	11	4	5	3
952	1	1	5	10	1	AJWK	1	AJ	2	10	5	10	11	4	5	3
953	1	1	5	1	1	JIAW	1	JAO	2	1	5	12	12	2	3	3
954	3	0	5	12	1	AJIW	1	AJW	2	1	5	12	12	2	3	3
955	3	0	5	1	1	AJKW	0		2	1	5	12	12	2	3	3

Appendix E: Responses to questionnaire 2
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ID	6	7	8a	8b	9	10	11a	11b	12	13a	13b	14a	14b	15a	15b	16
956	1	1	5	12	1	JIKAB	1	JI	2	12	5	5	7	3	3	3
959	3	0	0	0	0		0		0	1	12	1	12	0	0	3
960	1	1	5	12	1	ABJIK	1	JI	2	12	5	12	5	2	3	3
961	1	1	5	12	1	ABJI	1	JI	2	12	5	5	2	2	3	3
962	3	0	5	12	1	AJIK	1	JA	2	12	5	12	12	0	0	3
963	1	0	0	0	0		0		0	1	12	1	12	0	0	3
CATTLE																
49	5	1	0	0	0		0		0	1	12	1	12	0	0	4
76	5	1	0	0	0		0		0	1	12	1	12	0	0	4
185	5	1	0	0	0		0		0	1	12	1	12	0	0	4
245	5	1	0	0	0		0		0	1	12	1	12	0	0	4
552	4	0	5	12	1	AID	0		1	12	5	12	12	2	3	3
553	2	0	1	12	0	ABIP	0		1	0	0	6	8	11	11	3
554	2	0	1	12	1	PNJD	0		1	0	0	5	6	11	12	3
555	3	0	5	2	1	ABDI	0		1	1	5	6	7	11	11	3
556	3	0	5	1	1	ABNPD	0		1	1	5	6	7	11	11	3
557	2	1	1	12	0	XID	1	AI	1	0	0	99	99	99	99	3
558	2	0	1	12	1	NGCF	1	B	1	0	0	5	1	2	3	3
559	2	0	1	12	2	XONP	0		1	0	0	7	8	2	3	3
560	4	0	5	12	1	NQOP	0		1	12	5	6	7	3	3	3
562	2	0	1	12	2	ABIO	0		1	0	0	7	12	2	3	3
563	3	0	0	0	0		0		1	1	12	1	12	0	0	3
564	2	0	1	12	2	ABNO	0		1	0	0	6	2	2	6	3
565	2	0	1	12	0	AEF	1	EF	1	0	0	12	12	7	7	3
566	3	0	5	1	1	ABEN	0		1	12	5	12	1	6	7	3
567	3	0	0	0	0		0		0	1	12	1	12	0	0	3
568	3	0	1	12	0	ABDI	1	BI	1	0	0	1	12	0	0	3
569	2	0	1	12	2	ABIL	0		1	0	0	1	12	0	0	3
570	2	0	5	12	1	GIA	1	GI	1	12	5	6	9	2	4	3
571	1	0	0	0	0		0		0	1	12	1	12	0	0	3
601	4	0	3	12	1	AN	0		1	12	5	7	7	11	3	3
603	4	0	0	0	0		0		0	1	12	12	12	2	3	3
604	4	0	0	0	0		0		0	1	12	5	6	2	3	3
605	4	0	0	0	0		0		0	1	12	7	7	7	7	3
606	4	0	5	12	1	NQI	0		1	12	5	6	7	2	3	3
607	4	0	5	12	1	NQI	0		1	12	5	6	7	2	3	3
608	4	0	5	12	1	NQB	0		1	12	5	12	12	2	3	3
610	4	0	5	12	1	TNOQ	0		1	12	5	5	7	2	3	3
615	2	0	1	12	2	X	0		1	0	0	1	12	7	12	1
616	4	0	5	2	1	ABIO	1	HD	1	2	5	6	8	2	3	3
617	1	1	1	12	3	BAGID	1	DAG	1	0	0	5	12	2	3	3
618	3	0	5	1	1	XIA	0		1	1	5	6	8	1	2	3
619	2	0	1	12	3	ABDP	0		1	0	0	12	12	3	3	3
620	3	0	1	12	3	ABDI	0		1	0	0	12	12	3	3	3
621	2	0	1	12	3	ABOPI	0		1	0	0	12	12	3	3	3
622	4	0	5	2	1	XGDA	0		1	2	5	6	2	2	5	3
624	4	0	1	12	1	FIJL	1	FB	1	0	0	12	12	2	3	3
625	4	0	1	12	1	BEDA	1	AB	1	0	0	12	12	2	3	3
676	4	0	0	0	0		0		0	1	12	1	12	0	0	3
677	3	0	5	12	1	NUDIO	0		1	12	5	6	8	2	3	3

Appendix E: Responses to questionnaire 2
(See Appendix D for questions and key to responses)

ID	6	7	8a	8b	9	10	11a	11b	12	13a	13b	14a	14b	15a	15b	16
678	4	0	5	12	1	ABIO	0		1	12	5	6	8	2	3	3
680	2	0	1	12	1	XDJF	0		1	0	0	5	5	2	3	1
682	3	0	5	2	1	ABID	0		1	3	5	11	22	0	3	3
683	3	0	5	12	1	ABFDO	1	BI	1	2	5	12	12	2	3	3
684	4	0	5	2	1	XNI	0		1	2	5	2	4	6	6	2
689	3	0	5	12	0	ADBI	0		1	2	3	5	5	2	3	3
690	3	0	5	12	1	ABKI	0		1	12	5	4	5	2	3	3
693	3	0	5	12	1	XPND	1	ID	1	12	5	9	9	7	8	3
694	2	0	1	12	1	DFIO	1	DB	1	0	0	12	12	2	3	3
695	2	1	1	12	1	ABIDN	1	DB	1	0	0	12	12	2	3	3
696	3	0	0	0	0		0		0	1	12	12	12	2	3	3
697	4	0	5	12	1	XDI	0		1	12	5	5	5	2	3	3
698	3	0	5	12	1	XPNI	0		2	12	5	5	12	2	3	3
699	3	0	5	12	1	ABD	0		1	12	5	12	12	2	3	3

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Appendix E: Responses to questionnaire 3
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ID	6	7	8a	8b	9	10	11a	11b	12	13a	13b	14	15
GOATS													
15	0	0	0		0	7	1	INT & EXT PARAS	1	1	ASUNTOL & LEVAMISOLE	1	1
901	0	0	0		0	7	1	INT & EXT PARAS	1	1	ASUNTOL & LEVAMISOLE	1	1
902	0	0	0		0	2	0		1	0		0	3
903	0	0	0		0	7	1	INT & EXT PARAS	1	1	ASUNTOL & LEVAMISOLE	1	1
904	2	99	0		0	2	0		1	0		0	3
905	0	0	0		0	2	0		1	0		0	3
906	0	0	0		0	2	0		1	0		0	3
908	0	0	0		0	0	0		0	0		0	0
909	0	0	0		0	0	0		0	0		0	0
910	0	0	0		0	0	0		0	0		0	0
915	0	0	0		0	0	0		0	0		0	0
916	0	0	0		0	2	0		3	0		0	2
917	0	0	0		0	4	1	A LOT OF RAIN	1	1	BENYEN AVEK FEY LABE	1	1
918	0	0	0		0	0	0		0	0		0	0
919	0	0	0		0	2	1	BWA PATAT	1	1	DLO SEL	1	1
920	2	4	1	DLO SEL	5	2	0		1	1	DLO SEL	1	1
921	0	0	0		0	2	0		1	1	DLO SEL	1	1
922	0	0	0		0	2	0		1	1	DLO SEL	1	1
923	2	4	1	DLO SEL	0	2	0		1	1	DLO SEL	1	1
925	2	5	1	DLO SEL	0	2	0		1	1	DLO SEL	1	1
926	0	0	0		0	2	0		1	1	DLO SEL	1	1
927	2	4	0		0	2	0		1	1	SEE VETERINARIAN	1	3
930	0	0	0		0	4	0		1	0		0	2
931	0	0	0		0	4	0		1	0		0	2
933	0	0	0		0	4	1	"MAL MANGE"	1	1	FEY TI LABE	1	1
934	0	0	0		0	4	1	"MAL MANGE"	1	1	FEY TI LABE	1	1
935	0	0	0		0	4	0		1	0		0	1
936	2	4	0		0	2	0		1	0		0	1
937	0	0	0		0	2	0		1	0		0	2
940	0	0	0		0	4	0		1	0		0	2
941	0	0	0		0	4	0		1	0		0	2
943	0	0	0		0	4	1	A LOT OF RAIN	1	1	BENYEN AVEK FEY TI LABE	1	1
944	0	0	0		0	4	1	A LOT OF RAIN	1	1	BENYEN AVEK FEY TI LABE	1	1
945	4	99	1	VACCINE	0	4	0		1	1	VACCINE & BENYEN LIT	0	1
946	0	0	0		0	4	0		1	1	VACCINE & BENYEN LI	0	1
947	0	0	0		0	4	0		1	1	VACCINE & BENYEN LI	1	1
948	0	0	0		4	2	0		1	0		0	1
950	0	0	0		0	4	0		1	0		0	1
951	2	5	0		0	4	0		1	0		0	1
952	0	0	0		2	4	0		1	0		0	1
953	2	4	1	DLO SEL	5	2	1	BWA PATAT	1	0		0	2
956	0	0	0		0	0	0		0	0		0	0
959	2	99	0		0	2	0		1	0		0	2
960	0	0	0		0	2	0		1	1	"LEVAMISOLE"	1	1
961	0	0	0		0	0	0		0	0		0	0
964	2	4	1	SAW VET	0	0	0		0	0		0	0

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ID	6	7	8a	8b	9	10	11a	11b	12	13a	13b	14	15
CATTLE													
49	0	0	0		0	1	0		1	0		0	2
76	0	0	0		0	1	0		1	0		0	2
185	0	0	0		0	1	0		1	0		0	2
245	0	0	0		0	1	0		1	0		0	2
552	0	0	0		6	1	0		1	1	VETERINARIAN	1	2
553	0	0	0		0	7	0		0	0		0	1
554	0	0	0		7	7	0		0	0		0	1
555	0	0	0		0	7	0		0	0		0	1
556	7	4	1	VETERINAR.	0	7	0		0	0		0	1
557	1	0	0		0	9	0		3	0		0	2
558	0	0	0		0	1	0		1	0		0	2
559	0	0	0		0	0	0		0	0		0	0
560	0	0	0		0	1	0		1	0		0	2
562	3	99	1	ASUNTOL	0	2	1	WORMS	1	1	LEVAMISOL	1	1
563	0	0	0		0	0	0		0	0		0	0
564	0	0	0		0	0	0		0	0		0	0
565	0	0	0		0	3	0		1	0		0	1
566	3	4	0		0	3	0		1	0		0	1
567	0	0	0		0	3	0		1	0		0	1
568	0	0	0		0	1	0		1	0		0	2
570	0	0	0		0	1	0		1	0		0	2
601	0	0	0		0	1	0		1	0		0	2
606	5	5	0		2	3	0		1	0		0	1
607	0	0	0		0	1	1	LACK OF FOOD	1	1	VETERINARIAN	1	2
616	0	0	0		0	1	0		1	0		0	2
617	0	0	0		0	1	0		1	0		0	2
618	0	0	0		0	10	1	WORMS	1	0		0	1
619	0	0	0		0	1	0		1	1	SEE VETERINARIAN	1	3
620	0	0	0		0	1	0		1	1	SEE VETERINARIAN	1	3
621	0	0	0		0	1	0		1	1	SEE VETERINARIAN	1	3
622	0	0	0		0	1	0		1	0		0	2
623	0	0	0		0	8	0		1	0		0	1
624	0	0	0		0	1	0		1	0		0	2
625	0	0	0		0	1	0		1	0		0	2
676	0	0	0		0	1	0		1	0		0	2
677	3	4	0		0	3	0		0	0		0	1
678	0	0	0		0	3	0		0	0		0	1
680	0	0	0		0	2	0		1	0		0	1
681	8	4	0		0	8	0		1	0		0	1
682	0	0	0		0	0	0		0	0		0	0
683	2	5	0		0	2	0		1	0		0	1
684	0	0	0		0	3	0		1	0		0	1
689	0	0	0		0	1	0		1	0		0	2
690	0	0	0		0	1	0		1	0		0	2
693	0	0	0		0	1	0		1	0		0	2
694	0	0	0		0	2	1	"HOVE ZEB"	1	0		0	1
697	0	0	0		0	1	0		1	1	SEE VETERINARIAN	1	2
698	0	0	0		0	1	0		1	1	SEE VETERINARIAN	1	2
699	0	0	0		0	1	0		1	1	SEE VETERINARIAN	1	2

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Appendix E: Responses to questionnaire 3
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ID	16a	16b	16c	16d	16e	16f	16g	16h	17a	17b	17c	17d	17e	17f	17g	17h	18	19a
GOATS																		
15	12	1	PARASITES	1	1	ASUNTOL & LEVAMISOLE	1	1	0	0		0	0		0	0	0	0
901	12	1	PARASITES	1	1	ASUNTOL & LEVAMISOLE	1	1	0	0		0	0		0	0	0	0
902	4	0		1	1	SEE VETERINARIAN	1	1	9	0		1	1	SEE V	1	0	2	0
903	12	1	PARASITES	1	1	ASUNTOL & LEVAMISOLE	1	1	0	0		0	0		0	0	0	0
904	0	0		0	0		0	0	0	0		0	0		0	0	2	0
905	4	1	A LOT OF RAIN	1	0		0	3	5	1	LICE	1	0	VET C	0	3	2	0
906	4	1	A LOT OF RAIN	1	0		0	3	5	1	LICE	1	0	VET C	0	3	2	0
908	0	0		0	0		0	0	0	0		0	0		0	0	0	0
909	0	0		0	0		0	0	0	0		0	0		0	0	0	0
910	0	0		0	0		0	0	0	0		0	0		0	0	0	0
915	0	0		0	0		0	0	0	0		0	0		0	0	0	0
916	0	0		0	0		0	0	0	0		0	0		0	0	2	0
917	0	0		0	0		0	0	0	0		0	0		0	0	2	0
918	0	0		0	0		0	0	0	0		0	0		0	0	0	0
919	4	0		1	1	BENYEN AVEX FEY LABE	1	1	0	0		0	0		0	0	2	0
920	5	0		1	0		0	1	0	0		0	0		0	0	2	0
921	5	0		1	0		0	1	0	0		0	0		0	0	2	0
922	0	0		0	0		0	0	0	0		0	0		0	0	2	0
923	0	0		0	0		0	0	0	0		0	0		0	0	2	0
925	0	0		0	0		0	0	0	0		0	0		0	0	2	0
926	0	0		0	0		0	0	0	0		0	0		0	0	2	0
927	4	0		1	1	SEE VETERINARIAN	1	1	0	0		0	0		0	0	2	0
930	2	0		1	0		0	2	0	0		0	0		0	0	2	0
931	2	0		1	0		0	2	0	0		0	0		0	0	2	0
933	2	0		1	1	DLO SEL	1	2	0	0		0	0		0	0	2	0
934	2	0		1	1	DLO SEL	1	2	0	0		0	0		0	0	2	0
935	2	0		1	1	DLO SEL	1	1	0	0		0	0		0	0	2	0
936	4	0		1	0		0	1	0	0		0	0		0	0	2	0
937	0	0		0	0		0	0	0	0		0	0		0	0	2	0
940	2	0		1	0		0	2	0	0		0	0		0	0	2	0
941	2	0		1	0		0	2	0	0		0	0		0	0	2	0
943	2	0		1	0		0	2	0	0		0	0		0	0	2	0
944	2	0		1	0		0	2	0	0		0	0		0	0	2	0
945	2	0		1	0		0	1	0	0		0	0		0	0	4	0
946	2	0		1	0		0	1	0	0		0	0		0	0	4	0
947	2	0		1	0		0	1	0	0		0	0		0	0	4	0
948	0	0		0	0		0	0	0	0		0	0		0	0	2	0
950	0	0		0	0		0	0	0	0		0	0		0	0	0	0
951	0	0		0	0		0	0	0	0		0	0		0	0	0	0
952	0	0		0	0		0	0	0	0		0	0		0	0	0	0
953	0	0		0	0		0	0	0	0		0	0		0	0	2	0
956	0	0		0	0		0	0	0	0		0	0		0	0	0	0
959	0	0		0	0		0	0	0	0		0	0		0	0	2	0
960	0	0		0	0		0	0	0	0		0	0		0	0	2	0
961	0	0		0	0		0	0	0	0		0	0		0	0	0	0
964	0	0		0	0		0	0	0	0		0	0		0	0	0	0

Appendix E: Responses to questionnaire 3
(See appendix D for questions and key to responses)

ID	16a	16b	16c	16d	16e	16f	16g	16h	17a	17b	17c	17d	17e	17f	17g	17h	18	19a	19b
CATTLE																			
49	6	0		1	0		0	2	11	0		1	0		0	0	1	0	1
76	6	0		1	0		0	2	11	0		1	0		0	0	1	0	1
185	6	0		1	0		0	2	11	0		1	0		0	0	1	0	1
245	6	0		1	0		0	2	11	0		1	0		0	0	1	0	1
552	6	0		1	0		0	3	0	0		0	0		0	0	1	0	1
553	0	0		0	0		0	0	0	0		0	0		0	0	7	0	7
554	0	0		0	0		0	0	0	0		0	0		0	0	7	0	7
555	0	0		0	0		0	0	0	0		0	0		0	0	7	0	7
556	0	0		0	0		0	0	0	0		0	0		0	0	7	0	7
557	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
558	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
559	0	0		0	0		0	0	0	0		0	0		0	0	0	0	0
560	2	0		1	0		0	1	3	0		1	0		0	0	1	0	1
562	0	0		0	0		0	0	0	0		0	0		0	0	2	0	2
563	0	0		0	0		0	0	0	0		0	0		0	0	0	0	0
564	0	0		0	0		0	0	0	0		0	0		0	0	0	0	0
565	0	0		0	0		0	0	0	0		0	0		0	0	3	0	3
566	0	0		0	0		0	0	0	0		0	0		0	0	3	0	3
567	0	0		0	0		0	0	0	0		0	0		0	0	3	0	3
568	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
570	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
601	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
606	2	0		1	0		0	0	0	0		0	0		0	0	1	0	1
607	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
616	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
617	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
618	0	0		0	0		0	0	0	0		0	0		0	0	10	0	10
619	2	0		1	1	SEE VETERINARIAN	1	1	0	0		0	0		0	0	1	0	1
620	2	0		1	1	SEE VETERINARIAN	1	1	0	0		0	0		0	0	1	0	1
621	2	0		1	1	SEE VETERINARIAN	1	1	0	0		0	0		0	0	1	0	1
622	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
623	1	0		1	0		0	2	2	0		1	0		0	0	1	0	1
624	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
625	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
676	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
677	0	0		0	0		0	0	0	0		0	0		0	0	3	0	3
678	0	0		0	0		0	0	0	0		0	0		0	0	3	0	3
680	0	0		0	0		0	0	0	0		0	0		0	0	2	0	2
681	1	0		1	0		0	2	2	0		1	0		0	0	1	0	1
682	0	0		0	0		0	0	0	0		0	0		0	0	0	0	0
683	1	0		1	0		0	2	0	0		0	0		0	0	1	0	1
684	0	0		0	0		0	0	0	0		0	0		0	0	3	0	3
689	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
690	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
693	0	0		0	0		0	0	0	0		0	0		0	0	1	0	1
694	1	0		1	0		0	2	0	0		0	0		0	0	1	0	1
697	6	0		1	0		0	3	0	0		0	0		0	0	1	0	1
698	6	0		1	0		0	3	0	0		0	0		0	0	1	0	1
699	6	0		1	0		0	3	0	0		0	0		0	0	1	0	1

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Appendix E: Responses to questionnaire 4
(See Appendix D for questions and key to responses)

ID	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20a	20b	21	22	23a	23b
GOATS																				
901	2	1	0	1	3	3	4	2	125	125	125	0	1	1	0	0	0			
902	1	1	0	1	3	3	4	1	20	20	15	12	2	0	0	0	0			
903	2	1	0	1	3	3	4	2	125	125	125	0	1	1	0	0	0			
904	0	0	0	0	1	1	1	1	20	15	0	0	1	0	0	0	0			
905	2	1	0	1	3	3	4	2	30	35	20	0	1	1	0	0	0			
906	2	1	0	1	3	3	4	2	30	35	20	0	1	1	0	0	0			
915	2	1	0	1	1	1	5	1	20	25	15	0	1	0	0	0	0			
916	2	1	0	1	1	1	4	1	10	15	10	0	1	1	0	0	0			
917	1	1	0	1	3	1	4	1	0	0	0	0	0	1	0	0	0			
918	3	1	0	1	1	1	4	1	20	13	6	7	1	1	0	0	0			
919	3	1	1	1	1	1	4	2	24	16	14	8	1	1	0	0	0			
920	3	1	0	1	2	2	2	2	16	13	6	7	1	0	0	0	0			
921	3	1	1	1	2	2	2	2	16	13	6	7	1	0	0	0	0			
922	3	1	0	1	1	1	4	2	15	18	12	8	0	0	0	0	0			
923	3	1	0	1	1	1	4	2	15	18	12	8	0	0	0	0	0			
925	3	1	0	1	1	1	4	1	14	10	7	6	1	0	0	0	0			
927	3	1	0	1	2	2	4	1	30	25	14	9	1	1	0	0	0			
930	3	1	1	1	2	2	4	1	20	13	8	7	0	0	0	0	1			
931	2	1	1	1	2	2	4	1	20	13	8	7	0	0	0	0	1			
933	3	1	1	1	2	2	2	2	20	15	10	13	0	1	0	0	0			
934	3	1	1	1	2	2	2	2	20	15	10	13	0	1	0	0	0			
935	3	1	0	1	1	1	4	1	30	25	15	14	1	1	0	0	0			
937	3	1	1	1	1	1	4	1	15	17	7	6	1	1	0	0	0			
940	3	1	0	1	2	2	4	1	20	13	8	7	0	0	0	0	1			
941	3	1	0	1	2	2	4	1	20	13	8	7	0	0	0	0	1			
945	2	1	1	1	1	1	5	1	20	25	12	10	1	1	0	0	0			
946	2	1	0	1	1	1	5	1	20	25	12	10	1	1	0	0	0			
948	2	1	0	1	2	2	4	1	16	25	10	12	1	1	0	0	0			
949	2	1	0	1	2	2	4	1	16	25	10	12	1	1	0	0	0			
950	3	1	1	1	1	1	4	1	15	20	10	10	1	1	0	0	0			
951	2	1	0	1	3	3	4	1	15	20	7	5	1	1	0	0	0			
952	3	1	1	1	1	1	4	1	25	20	15	7	1	1	0	0	0			
953	2	1	1	1	2	2	4	1	15	22	13	15	1	1	0	0	1			
959	2	1	0	1	1	1	4	1	20	15	7	0	1	1	0	0	0			
960	3	1	0	1	1	1	4	1	20	25	9	7	1	1	0	0	0			
961	2	1	0	1	1	1	4	1	25	15	10	8	1	1	0	0	0			
964	3	1	0	1	2	2	4	1	30	25	14	9	1	1	0	0	0			
CATTLE																				
49	1	1	1	1	3	3	1	1	0	0	0	0	1	0	0	0	0	0	0	0
76	1	1	1	1	3	3	1	1	0	0	0	0	1	0	0	0	0	0	0	0
185	3	1	1	1	3	3	1	1	0	0	0	0	1	0	0	0	0	0	0	0
245	1	1	1	1	3	3	1	1	0	0	0	0	1	0	0	0	0	0	0	0
552	3	1	0	1	2	2	1	1	200	300	120	100	3	0	1	2	3	0	1	1
553	3	1	0	1	1	1	1	1	300	100	120	50	3	1	1	1	3	0	1	2
554	3	1	0	1	1	1	1	1	300	100	120	50	3	1	1	1	3	0	1	2
555	1	1	0	1	1	1	1	1	300	100	120	50	3	1	1	1	3	0	1	2

Appendix E: Responses to questionnaire 4
(See Appendix D for questions and key to responses)

ID	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20a	20b	21	22	23a	23b
556	3	1	1	1	1	1	1	1	300	100	120	50	3	1	1	1	3	0	1	2
557	2	1	1	1	3	3	1	1	200	300	100	120	3	0	1	2	3	0	0	0
558	2	1	1	1	2	2	1	1	200	210	150	100	3	1	1	2	3	0	0	0
560	2	1	0	1	1	1	1	1	300	400	120	100	1	1	1	1	3	0	1	2
563	3	1	0	1	3	3	1	1	200	200	150	100	3	1	1	2	3	0	1	2
564	2	1	0	1	1	1	1	1	300	400	150	100	3	0	1	2	3	0	1	1
565	2	1	0	1	1	1	1	1	300	200	90	80	1	1	1	1	0	0	0	0
566	3	1	1	1	1	1	1	1	200	240	100	60	3	1	1	1	3	0	0	0
567	3	1	0	1	1	1	1	1	200	240	100	60	3	1	1	1	3	0	0	0
568	2	1	0	1	1	1	1	1	300	350	200	120	1	1	1	1	3	0	0	0
569	3	1	1	1	1	1	1	2	200	300	120	110	1	0	1	1	3	0	0	0
570	3	1	1	1	1	1	1	1	300	350	140	100	1	1	1	1	3	0	1	1
601	2	1	0	1	1	1	1	1	300	190	100	120	1	0	1	1	3	0	0	0
604	2	1	0	1	1	1	1	1	200	220	90	90	1	1	1	1	3	0	1	2
605	1	1	0	1	1	1	1	1	300	190	100	120	1	0	1	1	3	0	0	0
606	0	1	0	1	3	3	1	2	200	220	120	100	1	1	1	2	3	0	0	0
607	1	1	0	1	3	3	1	2	200	220	120	100	1	1	1	2	3	0	0	0
608	2	1	0	1	3	3	1	2	200	220	120	100	1	1	1	2	3	0	0	0
615	2	1	0	1	1	1	1	1	400	600	100	100	1	0	1	1	3	0	0	0
616	2	1	1	1	1	1	1	1	240	200	120	100	1	1	1	2	3	0	1	1
617	1	1	1	1	3	3	1	1	300	0	90	140	3	1	1	2	3	0	1	1
618	1	1	1	1	3	3	1	1	300	200	120	80	1	1	1	2	3	0	1	1
619	2	1	0	1	3	3	1	1	300	350	180	100	1	0	1	1	3	0	1	2
620	2	1	1	1	1	1	1	1	300	350	200	140	1	1	1	1	3	0	0	0
621	2	1	0	1	1	1	1	1	300	350	200	140	1	1	1	1	3	0	0	0
622	3	1	1	1	1	1	1	1	240	300	160	100	1	1	1	1	3	0	0	0
623	2	1	0	1	2	2	1	1	250	300	80	120	1	1	1	2	3	0	0	0
624	3	1	1	1	2	2	1	2	200	250	140	90	1	1	1	2	3	0	0	0
625	3	1	1	1	2	2	1	2	200	250	140	90	1	1	1	2	3	0	0	0
677	2	1	1	1	1	1	1	1	200	300	120	120	1	1	1	1	3	0	1	2
678	2	1	0	1	1	1	1	1	200	300	120	120	1	1	1	1	3	0	1	2
680	2	1	0	1	1	1	0	1	220	300	130	100	1	1	1	1	3	0	1	2
681	3	1	1	1	2	2	1	1	250	300	80	120	1	1	1	2	3	0	0	0
682	2	1	0	1	1	1	1	1	190	200	150	140	3	1	1	1	3	0	0	0
683	3	1	1	1	2	2	1	2	300	340	120	90	1	1	1	2	3	0	0	0
684	1	1	0	1	1	1	1	1	160	200	100	80	3	1	1	1	3	0	0	0
686	2	1	0	1	3	3	1	1	300	200	90	80	1	1	1	2	3	0	1	1
687	1	1	1	1	3	3	1	1	300	200	90	80	1	1	1	2	3	0	1	1
689	3	1	0	1	1	1	1	1	180	140	80	60	3	1	1	1	3	0	0	0
690	3	1	0	1	1	1	1	1	180	140	80	60	1	1	1	1	3	0	0	0
691	3	1	0	1	1	1	1	2	300	400	140	100	3	1	1	1	0	0	0	0
692	3	1	1	1	1	1	1	2	300	400	140	100	3	1	1	1	0	0	0	0
693	3	1	0	1	3	3	1	1	300	250	200	180	1	1	1	2	3	0	0	0
698	2	1	0	1	2	2	1	1	200	300	120	100	3	0	1	2	3	0	1	1
699	2	1	0	1	2	2	1	1	200	300	120	100	3	0	1	2	3	0	1	1

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APPENDIX F1: Weight, Hematocrits (PCV) and White Blood Cell Counts (WBC)
CATTLE

ID	DATE	LBS	PCV	WBC
049	02/05/86	161	28	5505
049	04/03/86	221	33	4550
049	06/12/86	309	39	15200
049	08/21/86	370	32	12500
076	02/05/86	837	28	5505
076	04/03/86	713	28	4000
076	06/12/86	758	30	7850
076	08/21/86	655	30	15400
185	02/05/86	614	35	14400
185	04/03/86	655	34	6300
185	06/12/86	684	35	20450
185	08/21/86	758	31	10000
245	02/05/86	1232	23	4097
245	04/03/86	1250	24	4500
245	06/12/86	1272	23	7200
245	08/21/86	1212	21	10200
552	02/06/86	655	27	7285
552	04/03/86	692	27	5200
552	06/12/86	743	33	12300
552	08/21/86	743	35	9700
553	02/06/86	586	24	6860
553	04/04/86	560	28	4900
553	06/12/86	586	26	13150
553	08/21/86	600	28	11300
554	02/05/86	713	33	9062
554	04/03/86	775	33	4000
554	06/12/86	806	36	14500
554	08/21/86	921	34	10500
555	02/05/86	359	23	6015
555	04/04/86	309	23	4550
555	06/12/86	359	33	10000
555	08/21/86	349	20	8950
556	02/05/86	290	24	5505
556	04/04/86	329	25	4300
556	06/12/86	349	30	9600
556	08/21/86	391	25	13200
557	02/06/86	508	27	5435
557	04/05/86	560	27	4800
557	06/12/86	560	27	12000
557	08/22/86	572	25	7200
558	02/06/86	508	28	5930
558	04/05/86	572	31	4900
558	06/11/86	521	28	8700
558	08/22/86	560	28	7100
559	02/06/86	459	31	8300
559	04/05/86	413	29	4600
559	06/09/86	424	25	9050
560	01/29/86	546	29	10757
560	04/01/86	560	29	4550
560	06/10/86	562	36	12250
616	01/30/86	614	29	10672
616	04/05/86	614	25	11000
616	06/13/86	614	30	6500
616	08/21/86	642	34	7300
617	01/30/86	521	30	10926
617	04/02/86	496	29	4150
617	06/11/86	586	25	9950
617	08/21/86	586	26	8550
618	01/30/86	329	26	7708
618	04/05/86	391	31	7900
618	06/12/86	436	29	15750
618	08/21/86	447	33	13200
619	02/01/86	669	34	7962
619	04/04/86	743	33	4750
619	06/12/86	758	35	14550
619	08/20/86	870	36	9700
620	02/01/86	655	36	10249
620	04/03/86	728	32	6150
620	06/11/86	743	34	14200
620	08/19/86	791	38	16100
621	02/01/86	370	29	18295
621	04/03/86	459	32	9400
621	06/11/86	471	32	16800
621	08/19/86	508	30	19100
622	02/01/86	600	36	10249
622	04/05/86	628	34	6200
622	06/13/86	669	30	10600
622	08/20/86	642	33	9000
623	02/01/86	263	28	13467
623	06/11/86	318	27	13150
623	08/19/86	329	28	12100
624	02/01/86	628	37	9571
624	04/02/86	655	37	4600
624	06/12/86	586	34	16300
624	08/20/86	600	35	7000
625	02/01/86	728	33	6352
625	04/02/86	743	26	4000
625	06/12/86	642	29	9950
625	08/20/86	684	31	8100
676	02/01/86	96	32	3980
676	04/02/86	124	28	4000
676	06/12/86	182	29	10450
677	02/01/86	521	33	9655
677	04/05/86	586	29	9400
677	06/12/86	533	26	9700
677	08/19/86	533	29	7350
678	02/01/86	329	27	12112
678	04/05/86	329	30	7450
678	06/12/86	380	29	13700
678	08/19/86	391	25	10900

APPENDIX F1: Weight, Hematocrits (PCV) and White Blood Cell Counts (WBC)
CATTLE

ID	DATE	LBS	PCV	WBC
560	08/19/86	572	35	9500
562	04/05/86	560	33	7200
562	06/09/86	521	29	9300
563	04/05/86	129	33	12500
563	06/09/86	161	36	13350
563	08/22/86	212	36	12100
564	04/05/86	600	28	6100
564	06/11/86	642	32	10500
564	08/22/86	684	30	10300
565	04/05/86	655	40	6300
565	06/12/86	728	40	8800
565	08/21/86	743	45	15400
566	04/05/86	546	29	7200
566	06/13/86	533	27	8850
566	08/21/86	560	31	11550
567	04/05/86	148	30	8400
567	06/13/86	205	30	14900
567	08/21/86	272	33	13200
568	04/05/86	484	31	4650
568	06/10/86	496	33	14250
568	08/19/86	521	33	10000
569	04/05/86	572	36	7850
569	08/20/86	600	37	8700
570	04/05/86	496	33	9000
570	06/13/86	572	35	15700
570	08/20/86	600	34	11000
571	04/05/86	174	29	5650
601	01/28/86	118		
601	04/01/86	161	33	4950
601	06/14/86	221	27	12500
601	08/19/86	237	24	11150
603	01/28/86	91	25	6861
603	04/01/86	124	29	7900
604	01/28/86	118	26	3388
604	04/01/86	137	29	5400
604	08/19/86	221	28	5850
605	01/28/86	70	24	5676
605	04/01/86	66	19	4000
605	08/19/86	174	25	8800
606	01/29/86	713	22	4827
606	04/01/86	692	25	4350
606	06/10/86	655	26	9100
606	08/18/86	642	21	6300
607	01/29/86	0	40	7115
607	04/01/86	91	31	3750
607	06/10/86	159	26	10850
607	08/18/86	221	29	11900
608	01/29/86	684	25	5426
608	04/01/86	655	29	3625
608	08/18/86	728	32	11300
679	02/03/86	600	30	6954
680	02/03/86	614	32	4065
680	04/03/86	669	29	4150
680	06/11/86	692	32	7900
680	08/19/86	713	28	8700
681	02/03/86	272	32	20921
681	06/13/86	299	26	14700
681	08/20/86	391	28	17500
682	02/03/86	508	25	4658
682	04/03/86	533	23	5250
682	06/13/86	618	28	9950
682	08/22/86	560	21	5700
683	02/04/86	692	33	6088
683	04/03/86	692	30	5000
683	06/11/86	692	32	8750
683	08/19/86	655	34	7300
684	02/04/86	546	28	10248
684	03/31/86	533	26	5800
684	06/12/86	586	25	10400
684	08/21/86	628	28	11400
685	02/04/86	447	31	7538
686	02/04/86	655	33	7100
686	08/21/86	560	29	9150
687	02/04/86	101	38	8470
687	08/21/86	309	31	8450
688	02/04/86	349	25	7792
689	02/04/86	272	29	9570
689	04/03/86	272	31	7850
689	06/13/86	329	31	15900
689	08/21/86	338	30	14300
690	02/04/86	413	36	6990
690	04/03/86	546	31	8250
690	06/13/86	572	30	11800
690	08/21/86	471	33	13200
691	02/04/86	642	33	5420
691	08/22/86	692	33	7600
692	02/04/86	484	26	10165
692	08/22/86	484	29	14700
693	02/04/86	471	35	10164
693	04/03/86	508	40	10400
693	08/20/86	484	33	12700
694	02/04/86	391	31	6945
694	04/03/86	391	27	6300
694	06/11/86	424	28	13750
695	02/04/86	669	29	9570
695	04/03/86	642	29	5000
696	02/04/86	101	28	5082
696	04/03/86	118	21	4150
697	02/05/86	870	34	4235
697	04/03/86	822	36	9400

APPENDIX F1: Weight, Hematocrits (PCV) and White Blood Cell Counts (WBC)

CATTLE

ID	DATE	LBS	PCV	WBC	ID	DATE	LBS	PCV	WBC
609	01/29/86	533	26	7284	697	06/12/86	791	34	10900
610	01/29/86	349	30	5082	698	02/05/86	129	35	7453
610	04/10/86	329	26	6850	698	04/03/86	190	25	5550
611	01/29/86	655	36	5505	698	06/12/86	254	30	13400
612	01/29/86	614	32	5167	698	08/21/86	263	34	11300
614	01/29/86	272	34	12196	699	02/05/86	174	31	8555
615	01/29/86	669	33	6352	699	04/03/86	221	30	7350
615	04/01/86	642	33	4000	699	06/12/86	349	31	13800
615	08/19/86	684	27	8600	699	08/21/86	436	33	10500

APPENDIX F2: Weight, Hematocrits (PCV), and White Blood Cell Counts (WBC)

GOATS

ID	DATE	LBS	PCV	WBC
015	01/28/86	88	13	2965
015	03/31/86	95	28	6000
015	06/10/86		27	17350
901	01/28/86		28	6864
901	03/31/86	97	31	7250
901	06/10/86	98	26	17900
901	08/18/86	90	22	12800
902	01/28/86	93	27	8811
902	04/02/86	96	28	6200
902	06/12/86	0	28	17900
902	08/21/86		32	11450
903	01/28/86	95	22	9658
903	03/31/86	124	36	5000
903	06/10/86		21	8100
903	08/18/86		25	11600
904	01/28/86		26	8470
904	04/01/86	70	28	8850
904	06/09/86	63	33	14450
904	08/18/86	56	14	18300
905	01/29/86	82	23	13721
905	04/01/86	74	24	8550
905	06/09/86	58	24	14150
905	08/18/86	56	24	10900
906	01/29/86	82	24	9530
906	04/01/86	67	26	8000
906	06/09/86	57	28	13850
906	08/18/86	55	24	14000
907	01/29/86		29	20328
908	01/29/86	62	27	8978
908	04/01/86	50	33	8100
908	06/09/86	45	30	18400
909	01/29/86	60	24	8978
909	04/01/86	82	27	10900
909	06/09/86	56	30	9740
910	01/29/86	23	23	9147
910	04/01/86	36	27	8300
910	06/09/86	34	22	13850
911	01/29/86	50	28	8300
912	01/29/86	56	28	10079
913	01/29/86	36	22	7114
913	04/01/86	44	23	8950
914	01/29/86	20	27	8300
914	04/01/86	35	27	8850
915	01/29/86	51	21	7707
915	04/01/86		27	6900
915	06/10/86	46	26	19950
915	08/18/86	56	22	10700
916	01/29/86	20	23	6098
916	04/01/86	26	31	6100
916	06/09/86	29	27	15650
931	06/10/86	62	25	11150
931	08/19/86	56	25	17700
932	02/01/86	70	27	10418
932	04/02/86	58	22	4850
933	02/03/86	75	30	14314
933	04/03/86	59	30	7000
933	06/11/86	60	24	18950
933	08/19/86	59	24	19000
934	02/03/86	65	25	11095
934	04/03/86	55	28	6250
934	06/11/86	51	30	18350
934	08/19/86	54	19	15700
935	02/03/86	77	24	12196
935	03/31/86	68	27	7900
935	06/12/86	58	21	17550
935	08/21/86	51	18	12300
936	02/03/86	22	24	16005
936	04/04/86	25	23	9950
936	06/13/86	30	28	18200
937	02/04/86	71	25	11942
937	04/02/86	79	27	7700
937	06/00/86		25	10900
937	08/20/86	66	17	11000
938	02/04/86	13	18	12620
938	04/02/86	21	24	7400
939	02/04/86	24	28	8130
940	02/04/86	90	33	14737
940	04/02/86	68	26	7900
940	06/10/86	58	25	12550
940	08/19/86	55	26	18350
941	02/04/86	60	28	9995
941	04/02/86		24	7650
941	06/10/86	67	10	15850
941	08/19/86	60	18	16100
942	02/04/86	25	23	7625
942	04/02/86	30	27	4200
943	02/04/86	32	25	14229
943	04/03/86	38	29	8400
943	06/11/86	39	27	14900
944	02/04/86	11	27	9230
944	04/03/86	19	30	9450
944	06/11/86	22	26	15400
945	02/05/86	100	27	9655
945	04/04/86	77	26	6500
945	06/09/86	72	29	13750
945	08/20/86	80	24	8000
946	02/05/86	29	27	14655
946	04/04/86	34	23	8950
946	06/09/86	39	24	15350
946	08/20/86	40	27	17400

x 1150

APPENDIX F2: Weight, Hematocrits (PCV), and White Blood Cell Counts (WBC)
GOATS

ID	DATE	LBS	PCV	WBC
916	08/18/86	36	23	16700
917	01/30/86	26	34	9317
917	04/02/86	31	33	5850
917	06/11/86	33	39	15900
917	08/18/86	36	24	15900
918	01/30/86	57	24	7877
918	06/11/86		21	12500
918	08/22/86	40	13	11000
919	01/30/86	74	32	13891
919	04/02/86	73	33	8950
919	06/10/86	70	34	16550
919	08/20/86	57	33	19500
920	01/30/86	22	30	6776
920	04/02/86	22	25	6100
920	06/10/86	25	30	16400
920	08/19/86	26	28	18250
921	01/30/86	40	24	8555
921	04/02/86	43	23	10200
921	06/10/86	51	20	17000
921	08/19/86	38	22	11200
922	01/30/86	75	23	5675
922	04/02/86	60	15	7200
922	06/10/86	52	24	15700
922	08/19/86	52	19	7900
923	01/30/86	47	26	6099
923	04/03/86	45	26	11750
923	06/10/86	50	24	15250
923	08/19/86	47	20	16600
924	01/30/86	17	22	13044
925	01/30/86	37	27	14823
925	04/02/86	37	24	10300
925	06/11/86	40	25	18150
925	08/20/86	38	22	14800
926	01/30/86	26	14	20582
926	04/02/86	26	24	12000
926	06/11/86	29	27	19000
927	02/01/86	54	27	13890
927	04/03/86	60	30	6150
927	06/12/86	55	23	14200
927	08/21/86	63	23	9550
928	02/01/86	47	25	8639
928	04/02/86	38	28	7150
929	02/01/86	49	28	12196
930	02/01/86	75	26	17363
930	04/02/86	73	26	7750
930	06/10/86	70	24	14450
930	08/19/86	66	21	18100
931	02/01/86	50	26	14737
931	04/02/86	56	26	13800
947	02/05/86	35	27	13045
947	04/04/86	40	24	9900
947	06/09/86	45	26	16600
948	02/05/86		28	9235
948	04/04/86	124	21	4000
948	06/09/86		22	14350
948	08/20/86	92	19	8700
949	02/05/86	45	23	12535
949	04/04/86	43	22	5150
949	08/20/86	42	22	17200
950	02/06/86	15	32	9485
950	04/04/86	20	27	4950
950	06/09/86	26	27	16350
950	08/22/86	30	22	17200
951	02/06/86	15	34	8640
951	04/04/86	20	30	4000
951	06/09/86	20	27	15350
951	08/20/86	20	17	9100
952	02/06/86	25	24	11520
952	04/04/86		24	4550
952	06/09/86	26	26	15750
952	08/20/86	38	27	7400
953	02/06/86	33	25	14400
953	04/04/86	37	23	4200
953	06/11/86	44	25	16000
953	08/22/86	45	24	16500
954	02/06/86	35	33	11770
954	04/04/86	36	22	5400
955	02/06/86	32	24	9945
955	04/04/86	37	23	4500
956	02/06/86	20	23	11605
956	04/04/86	27	27	5300
956	06/09/86	27	27	15550
957	02/06/86	34	22	14060
958	02/06/86	23	23	12535
959	02/06/86	59	23	8895
959	04/04/86	64	22	7700
959	06/11/86	54	22	14600
959	08/22/86	59	27	17000
960	04/05/86	36	28	19300
960	06/09/86	0	27	17550
960	08/20/86	35	28	18000
961	04/05/86	26	38	13250
961	06/11/86	25	28	16100
961	08/22/86	26	11	5500
962	04/05/86	69	28	8200
963	04/05/86	17	18	9450
964	06/12/86		22	17400
964	08/21/86	68	23	14300

Appendix G1: Goats -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	(HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	(HAIR) (ppm)	>>> SERUM VITAMINS << VIT - A (ug/dl)	VIT - E (ug/dl)
15-1		0.33		125		29.4	148.8
15-2		0.17		110		17.6	80.5
901-1	M	0.41	0.10	105	22.18	22.1	
901-2	M	0.18	0.07		83.61	13.7	75.2
901-3	M	0.31	0.08	145	56.02	30.5	27.3
901-4	M	0.30	0.18	150	51.77	31.1	35.0
902-1	M		0.17		78.48		
902-2	M	0.87	0.15	125	64.13	22.3	68.5
902-3	B	0.21	0.08	125	50.33	32.0	64.3
902-4	B	0.76	0.57	120	54.90	31.1	51.7
903-1	M	0.47	0.50	130	100.10	17.9	29.6
903-2	M	0.70	0.31	105	29.39	21.6	71.2
903-3	BR		0.29	160	32.52	22.7	19.2
903-4	BR	0.30	3.70	140	47.35	33.5	28.1
904-1	W	0.22	0.41	135	20.22	22.5	151.9
904-2	W		0.49	100	34.65	28.5	15.0
904-3	W	0.37	0.41		34.90	34.4	30.9
904-4	W	0.22		140		34.9	17.0
905-1	M	0.18	0.55	115	108.52	29.3	133.2
905-2	M	0.16	0.59	120	24.08	26.3	
905-3	M	0.72	0.84	90	48.82	22.7	31.8
905-4	M	0.52	0.26	105	22.19	30.2	60.1
906-1	B	0.27	0.37	100	13.48	15.2	99.6
906-2	B		0.21		17.29		
906-3	B	0.37	0.36	130	9.13	30.5	24.7
906-4	B	0.22	0.36	110	5.30	22.3	27.7

Appendix G: Cattle -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	(HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	(HAIR) (ppm)	>>> SERUM VITAMINS <<< VIT - A (ug/dl)	VIT - E (ug/dl)
49-1	B	0.15		125	67.82	22.1	1342
49-2	B	0.61	0.01	160	556.47		1477
49-3	B		0.09	150	415.64	42.4	560
49-4	B	0.14	0.36	125	787.21	42.4	390
63-1		0.15		175		23.0	2157
63-2		0.26		145		36.2	2673
185-1	B	0.05	0.26	80	60.44	29.3	2330
185-2	B	0.24	0.27	170		31.1	2306
185-3	B	0.16	0.64	150	611.41		775
185-4	B	0.13	0.01	105		42.1	694
245-1	W	0.56	0.01	105	595.54	29.3	1516
245-2	W	0.68	0.13	165	692.97	35.1	1496
245-3	W	0.11	0.15	130	674.44	25.6	440
245-4	BR	0.29	0.19	130	637.33	28.7	595
552-1	B	0.84	0.27	165	451.71	15.2	1268
552-2	B	0.42	0.41	125	573.27	22.5	
552-3	B	0.22	0.68	165	441.70	27.4	660
552-4	B	0.45	0.19	165	723.80	29.3	672
553-1	W	0.32	0.22	140	473.23	21.9	2034
553-2	W	0.02	0.52	210		18.5	617
553-3	W	0.65	0.50	160		37.1	544
553-4	W	0.46	0.57	135	619.47	37.7	643
554-1	W	0.82	0.23	120	385.14	28.5	2358
554-2	W	0.20	0.37	130	345.80	22.3	2511
554-3	W	0.22	0.59	165	542.53		1428
554-4	W	0.24	0.40	200	401.03		828

Appendix G1: Goats — Mineral and Vitamin Levels in Serum and Hair

ID-PERIOD	HAIR COLOR	>>> CALCIUM <<< (SERUM) (mg/dl)	>>> CALCIUM <<< (HAIR) (ppm)	>>> PHOSPHORUS <<< (SERUM) (mg/dl)	>>> PHOSPHORUS <<< (HAIR) (ppm)	>>> MAGNESIUM <<< (SERUM) (mg/dl)	>>> MAGNESIUM <<< (HAIR) (ppm)	>>> IRON <<< (SERUM) (ug/dl)	>>> IRON <<< (HAIR) (ppm)
956-1		12.93		7.8		3.16		195	
956-2		10.00				3.22		390	
957-1		18.79		7.8		3.33		80	
958-1		11.82		6.6		2.83		95	
959-1	W	9.90	1082.10	4.0	105.41	3.23	118.59	105	2.77
959-2	W	10.81	1431.03	6.0	318.74	4.66	118.87	315	0.28
959-3	W	10.20		2.8	1414.67	3.73		235	222.81
959-4	W	7.47	1052.43	3.6	152.29	3.10	150.11	145	51.85
960-2		13.94		8.0		5.29		325	
960-3		9.29		3.2		3.94		225	
960-4		12.73		0.6		4.91		180	
961-2		15.76		9.4		4.71		265	
962-2		11.92		4.0		3.24		100	
963-2		8.38		7.4		4.14			
COUNT:		165	120	173	122	173	117	168	117
MAXIMUM:		23.43	17531.25	10.20	12954.40	5.75	1303.21	575.00	261.19
MINIMUM:		4.65	.34.33	0.20	11.69	1.63	15.20	10.00	0.28
AVERAGE:		11.71	2394.63	4.78	342.58	3.90	205.37	261.43	36.29

Appendix G1: Goats -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	>>> SELENIUM <<< (HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	>>> ZINC <<< (HAIR) (ppm)	>>> SERUM VITAMINS << VIT - A (ug/dl)	>>> SERUM VITAMINS << VIT - E (ug/dl)
956-1		0.09		120		15.5	163.6
956-2		0.08		110		29.6	163.0
957-1		0.29		115		22.9	27.8
958-1		0.46		85		38.6	118.6
959-1	W		0.16	105	38.88		109.2
959-2	W	0.53	0.01	110	69.45	24.5	137.8
959-3	W	0.45	3.32	110		26.0	36.3
959-4	W	0.70	0.07	75	57.34	38.2	40.8
960-2		0.24		105		30.5	172.0
960-3		0.29				26.3	30.0
960-4				130		30.2	28.0
961-2		0.29		135		22.1	
962-2		0.50		100		24.5	134.7
963-2		0.29		60		29.3	16.9
COUNT:		164	119	169	117	170	165.0
MAXIMUM:		0.92	13.81	200.00	545.97	43.71	200.5
MINIMUM:		.00	0.01	55.00	3.54	13.72	0.1
AVERAGE:		0.35	1.18	119.44	82.44	28.51	68.1

Appendix G1: Goats — Mineral and Vitamin Levels in Serum and Hair

ID-PERIOD	HAIR COLOR	>>> CALCIUM <<< (SERUM) (mg/dl)	>>> CALCIUM <<< (HAIR) (ppm)	>>> PHOSPHORUS <<< (SERUM) (mg/dl)	>>> PHOSPHORUS <<< (HAIR) (ppm)	>>> MAGNESIUM <<< (SERUM) (mg/dl)	>>> MAGNESIUM <<< (HAIR) (ppm)	>>> IRON <<< (SERUM) (ug/dl)	>>> IRON <<< (HAIR) (ppm)
948-1	B		5225.00	5.2	400.00	5.43	1100.00	355	54.60
948-2	B	10.10	11397.90	7.8	527.07	2.95		290	226.90
948-3	B	4.65		3.8	12954.40	4.37		210	
948-4	B	8.89	5290.02	2.0	246.05	4.96	353.08	235	17.57
949-1		18.18		4.4		4.12		160	
949-2		7.58		7.2		3.13		220	
950-1	M	9.80	1216.87	10.0	67.60	2.61	176.62	205	20.59
950-2	W	14.14	1034.82	10.0	113.41	4.17	218.31	335	28.58
950-3	W		441.43		20.65		43.11		3.25
950-4	W		1183.56		1578.08		473.43		136.70
951-1	M	11.21	2861.66	9.0	1359.29	3.04	391.69	100	27.79
951-2	M	15.86	3677.37		1342.77	4.87	532.53	480	233.28
951-3	B	17.07	4541.55	3.0	722.52	4.13	521.25	290	261.19
951-4	M	11.51	5269.29	2.0	464.94	3.57	486.25	375	73.23
952-1	W	11.01	857.78	7.0	127.55	1.63	119.90	135	5.89
952-2	W	17.88	1898.49	6.0	154.98	4.14	321.58	360	40.68
952-3		9.90		3.6		3.68		210	
952-4	W	9.19	1285.99	1.4	52.49	3.65	244.73	125	44.64
953-1	W	11.82	823.89	6.6	32.31	2.13	106.62	160	2.37
953-2	W	12.83	674.42	10.0	23.98	4.28	149.87	465	6.29
953-3	W	10.61	363.58	2.2	35.91	4.88	28.28	215	6.41
953-4	W	8.28	475.85	4.6	24.25	4.13	64.86	260	8.40
954-1		8.08		6.0		2.59		260	
954-2		11.82		6.0		4.87			
955-1		9.60		8.4		2.65		125	

Appendix G1: Goats — Mineral and Vitamin Levels in Serum and Hair

		>>> CALCIUM <<<		>>> PHOSPHORUS <<<		>>> MAGNESIUM <<<		>>> IRON <<<	
		(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)
ID-PERIOD	HAIR COLOR	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(ug/dl)	(ppm)
940-3	BR	12.63	489.53	0.6	317.53	4.05	181.92	470	24.45
940-4	W	12.63	590.76	1.2	11.87	4.09	95.59		2.24
941-1	B	10.61	1295.86	4.0	173.61	4.44	19.53	220	6.25
941-2	B	11.01	1084.38	2.4	81.84	2.37	136.94	195	1.72
941-3	B	9.29	1285.40	4.0	72.93	3.94	122.39	190	17.42
941-4	B	8.89	3245.64	4.6	112.31	4.52	245.67	130	18.87
942-1		10.20		6.2		3.22		245	
942-2		12.02		3.6		1.79		135	
943-1		10.50		5.2		3.14		185	
943-2		11.92		4.8		4.63			
944-1		10.71		9.0		3.43		235	
944-2		10.91		6.8		3.07		260	
945-1	W		134.33	5.6	14.33	3.77	107.83	480	27.38
945-2	W	10.30	947.08	6.6	131.77	3.23	135.47	340	71.60
945-3	W	8.48	245.51	3.2	38.26	4.29	60.90	185	4.15
945-4	W	8.18	701.68	4.8	110.34	4.18	126.03	240	4.05
946-1	W	21.61	1405.11	7.4	40.73	4.11	217.38	270	8.98
946-2	W	10.61	4273.37	6.0	136.47	4.64	510.93	210	10.75
946-3	W	14.54	3909.28	0.2	100.88	4.57	519.56	190	45.55
946-4	W	16.97	3102.18	0.4	117.62	5.58	451.36	190	79.04
947-1				8.2		4.77			
947-2		10.10		10.0		4.75		275	
947-3		9.80		3.2		4.43		270	
947-4		9.60		3.8		4.23		275	

Appendix G1: Goats -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	(HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	(HAIR) (ppm)	>>> SERUM VITAMINS << VIT - A (ug/dl)	VIT - E (ug/dl)
948-1	B	0.37	1.37	130		32.9	
948-2	B	0.30	8.56	145		29.8	61.8
948-3	B	0.30		200	512.70	43.7	27.5
948-4	B	0.20	1.07	145	59.94	43.0	28.3
949-1		0.30		100		25.6	47.9
949-2		0.28		120		16.6	58.0
950-1	M	0.29	1.46	170	38.33	17.9	200.5
950-2	W	0.44	3.65		36.91	29.3	
950-3	W		0.71		25.37		
950-4	W		13.81		153.27		
951-1	M	0.20	0.41	150	45.82	29.6	162.7
951-2	M	0.27	1.43	105	108.95	36.8	43.8
951-3	B	0.06	1.59	110	132.22	30.4	31.4
951-4	M	0.21	0.42	100	292.91	28.2	34.8
952-1	W	0.18	0.40	120	95.09	19.4	148.6
952-2	W	0.20	4.20	115	135.06	29.3	
952-3				165		30.5	66.0
952-4	W	0.28	0.25	95	122.90	31.1	36.0
953-1	W	0.41	1.14	100	45.46	15.4	85.7
953-2	W	0.44	0.10	75	28.20	29.6	26.2
953-3	W	0.42	1.09	110	12.82	41.0	33.5
953-4	W	.00	0.77	170	24.44	30.5	55.4
954-1		0.17		175		23.4	134.2
954-2		0.20		110		22.5	36.3
955-1		0.07		105		23.0	147.9

Appendix G1: Goats — Mineral and Vitamin Levels in Serum and Hair

ID-PERIOD	HAIR COLOR	>>> CALCIUM <<< (SERUM) (mg/dl)	>>> CALCIUM <<< (HAIR) (ppm)	>>> PHOSPHORUS <<< (SERUM) (mg/dl)	>>> PHOSPHORUS <<< (HAIR) (ppm)	>>> MAGNESIUM <<< (SERUM) (mg/dl)	>>> MAGNESIUM <<< (HAIR) (ppm)	>>> IRON <<< (SERUM) (ug/dl)	>>> IRON <<< (HAIR) (ppm)
932-2		9.39		3.0		2.68		175	
933-1	M	11.51	1810.72	8.6	11.69	5.18	15.20	350	9.21
933-2	M	9.29	1140.58	2.2	53.36	4.01	143.41	285	16.81
933-3	BR	6.77	176.50	1.2	17.22	3.45	34.87	150	1.63
933-4	M	10.20	598.24	1.2	108.77	3.28	75.12	255	5.71
934-1	B	13.33	5226.14	9.6	132.73	4.50	571.56	365	
934-2	B	12.83	4959.46		240.46	5.54	542.53	290	28.40
934-3	B	11.01	4371.35	2.8	182.62	4.35	491.92	230	6.71
934-4	B	8.59	2929.69	1.6	156.25	4.07	476.56	300	164.06
935-1	M	10.71	1021.73	5.0	47.99	4.62	132.96	330	7.05
935-2	M		1261.07	4.2	54.43	5.37	181.90	190	3.43
935-3	M	11.82	803.63	1.0	40.69	3.99	113.76	180	5.41
935-4	M	10.71	1612.75	1.2	309.96	4.37	199.05	125	35.39
936-1		17.68		9.0		4.91		410	
936-2		8.18		10.2		2.81		215	
937-1	B	11.82	2889.28	4.4	18.50	3.50	31.68	310	20.40
937-2	B	11.41	2148.52	4.4	24.12	2.47	18.70	220	3.55
937-3	B	7.58	3063.44	0.6	76.95	3.51	44.73	220	27.47
937-4	B	7.27		2.4	6430.04	3.19		120	213.80
938-1		11.41		5.4		2.44		245	
938-2		12.32		5.2		2.49		360	
939-1		11.92		7.8		3.41		180	
940-1	M	9.90	696.77	8.4	15.57	3.23	103.35	245	30.57
940-2	W	11.72	1094.12	4.2	47.31	3.07	179.20	355	13.41

Appendix G1: Goats -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	(HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	(HAIR) (ppm)	>>> SERUM VITAMINS << VIT - A (ug/dl)	VIT - E (ug/dl)
940-3	BR	0.31	0.89	105	158.93	34.4	32.4
940-4	W	0.41	0.53	120	41.89	33.5	36.5
941-1	B	0.03	0.17	115	51.56	19.2	150.9
941-2	B	0.45	0.15	115	31.67	34.2	43.4
941-3	B	0.66	0.27	135	52.65		31.0
941-4	B	0.28	0.61	80	59.43	41.3	28.1
942-1		0.70		80		28.2	115.0
942-2		0.07		95			53.0
943-1		0.24		80		36.2	109.3
943-2		0.15		90		22.3	40.3
944-1		0.71		125		29.6	145.9
944-2		0.35		105		29.3	
945-1	W	0.09	0.45	125	71.17	15.2	110.5
945-2	W		0.69	100	39.09	29.6	126.7
945-3	W	0.75	0.51	195	28.52	20.7	29.5
945-4	W	0.45	0.08	120	59.38	26.7	49.8
946-1	W	0.72	0.49	120	105.20	35.5	
946-2	W	0.07	0.03	130	545.97	29.4	180.0
946-3	W	0.36	0.76	125	262.70	21.6	51.0
946-4	W	0.42	3.25	140	389.02	30.2	33.3
947-1		0.41		125		36.6	148.9
947-2		0.27		110		38.0	
947-3		0.79		160		22.3	24.0
947-4		0.11		140		43.7	40.5

Appendix G1: Goats -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	(HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	(HAIR) (ppm)	>>> SERUM VITAMINS << VIT - A (ug/dl)	VIT - E (ug/dl)
932-2		0.10		100		18.3	70.4
933-1	M	0.42	0.45	110	23.45	24.1	140.2
933-2	M	0.12	2.31	125	86.84	33.7	6.2
933-3	BR	0.53	0.83	105	36.52	40.2	21.5
933-4	M	0.46	0.74	120	67.95	42.4	27.5
934-1	B	0.05	1.11	125	287.09	22.3	135.8
934-2	B	0.05	0.69	105	195.67	22.5	189.2
934-3	B	0.22	0.63	110	197.50	30.0	32.2
934-4	B	0.31	0.91	110	205.08	37.7	21.4
935-1	M		0.21	110	48.71	31.1	
935-2	M	0.54	0.33	165	50.68	30.4	57.7
935-3	M	0.15	0.65	120	60.81	32.4	21.3
935-4	M	0.05	1.50	120	125.71	31.8	22.8
936-1		0.87		130		32.6	128.8
936-2		0.82		125		32.0	97.3
937-1	B	0.75	0.39	135	50.50	24.3	111.3
937-2	B	0.21	0.17	125	46.35	43.5	74.1
937-3	B	0.44	0.41	125	87.66	37.3	45.9
937-4	B	0.23		55		37.3	36.7
938-1		0.31		75		22.1	144.2
938-2		0.36		100		15.2	58.9
939-1		0.63		105		31.3	66.3
940-1	M	0.04	0.58	105	43.00	29.6	172.7
940-2	W	0.20	1.91	135	92.40	34.2	79.1

Appendix G1: Goats -- Mineral and Vitamin Levels in Serum and Hair

ID-PERIOD	HAIR COLOR	>>> CALCIUM <<< (SERUM) (mg/dl)	>>> CALCIUM <<< (HAIR) (ppm)	>>> PHOSPHORUS <<< (SERUM) (mg/dl)	>>> PHOSPHORUS <<< (HAIR) (ppm)	>>> MAGNESIUM <<< (SERUM) (mg/dl)	>>> MAGNESIUM <<< (HAIR) (ppm)	>>> IRON <<< (SERUM) (ug/dl)	>>> IRON <<< (HAIR) (ppm)
924-1		23.43		6.2		4.36		230	
925-1	B		4376.60	4.6	218.83	2.85	671.53	225	60.89
925-2	B		3569.03	10.2	108.77	5.75	43.17	295	15.13
925-3	B	10.50	3587.96	0.2	185.19	3.88	368.83	310	20.74
925-4	B	12.73	17531.25	0.2	195.06	4.75	548.61	215	98.31
926-1		22.52		3.4		3.15		275	
926-2		13.03		7.4		4.19		510	
927-1	BR	13.43	544.90	5.0	20.76	3.74	118.84	325	1.09
927-2	BR	15.45	1008.38	3.4	34.04	4.57	85.10	10	1.79
927-3	BR	7.17	702.53	2.0	39.86	3.14	75.73	155	66.96
927-4	BR	8.38	648.83	3.0	25.95	3.68	129.44	185	2.18
928-1		11.82		5.6		3.23		280	
928-2		10.81		3.2		5.00		305	
929-1				2.8				275	
930-1	M		2025.11	6.8	55.23		23.93	210	3.29
930-2	M	10.50	1798.82	5.6	69.25	2.82	18.70	195	6.54
930-3	M		2083.81		238.15		24.56		47.82
930-4	M		9417.47		49.21		57.21		70.27
931-1	B	15.55	2769.60	3.4	239.79	2.62	249.38	205	8.81
931-2	B	9.49	1387.00	2.6	260.37	2.17	192.28	105	5.47
931-3	B	10.61	5353.01	0.6	771.60	4.99	1041.67	240	141.78
931-4	B	9.90	4573.47	2.0	144.62	4.76	500.73	245	72.89
932-1		17.57		6.4		4.93		225	

Appendix G1: Goats -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	(HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	(HAIR) (ppm)	>>> SERUM VITAMINS << VIT - A (ug/dl)	VIT - E (ug/dl)
924-1				120		29.6	91.4
925-1	B	0.37	1.65	95	67.78	22.3	99.0
925-2	B	0.34	0.51	120	44.26	27.1	110.6
925-3	B	0.24	1.31	145	121.85	30.0	32.0
925-4	B	0.41	0.77	105	54.28	37.1	30.9
926-1		0.30		125		22.3	76.3
926-2				100		29.4	33.3
927-1	BR	0.62	0.39	150	45.55	32.9	74.0
927-2	BR	0.06	0.86	95	35.03	33.5	33.9
927-3	BR	0.16	1.26	100	97.10	29.8	31.3
927-4	BR	0.43	0.74	135	36.79	42.2	48.2
928-1				200		14.8	96.2
928-2		0.15		155		22.1	167.2
929-1		0.22		90		28.9	95.3
930-1	M	0.61	0.67	95	67.27	36.4	91.5
930-2	M	0.21	0.10	100	69.22	36.6	69.9
930-3	M		0.66		79.39		
930-4	M		1.74		109.54		
931-1	B	0.44	0.30	110	69.49	29.3	44.9
931-2	B	0.16	0.33	80	47.74	26.3	60.5
931-3	B	0.36	6.96	100		26.7	21.5
931-4	B	0.44	1.68	110	290.03	25.6	29.2
932-1		0.42		75			90.6

Appendix G1: Goats -- Mineral and Vitamin Levels in Serum and Hair

ID-PERIOD	HAIR COLOR	>>> CALCIUM <<< (SERUM) (mg/dl)	>>> CALCIUM <<< (HAIR) (ppm)	>>> PHOSPHORUS <<< (SERUM) (mg/dl)	>>> PHOSPHORUS <<< (HAIR) (ppm)	>>> MAGNESIUM <<< (SERUM) (mg/dl)	>>> MAGNESIUM <<< (HAIR) (ppm)	>>> IRON <<< (SERUM) (ug/dl)	>>> IRON <<< (HAIR) (ppm)
917-1	B	22.32	1316.60	7.0	224.10	3.47	301.14	370	100.01
917-2	B	13.84	2354.19	5.8	272.95	4.19	515.19	485	
917-3	B	12.42	3014.95	2.6	730.90	4.60	398.08	255	230.23
917-4	B	10.10	2096.75	1.4	72.93	4.27	285.34	205	15.32
918-1		16.26		2.4		2.35		180	
918-3		10.71		6.6		3.72		285	
919-1	M	20.81	2356.13	3.4	77.14	3.47	41.63	245	22.55
919-2	B	19.70	2053.36	3.2	76.52	5.12	33.48	140	17.68
919-3	B	10.81	3805.83	4.4	164.20	5.02	31.37	205	63.05
919-4	B	8.38	15968.85	7.0	244.73	4.24	1303.21	190	
920-1	M		2069.77	1.8	25.95	5.06	132.69	195	7.63
920-2	M		8491.85		1476.84	2.41			
920-3	M	11.41	8481.47	1.4	152.82	4.17	362.95	310	9.63
920-4	M	11.51	822.84	1.0	75.66	4.39	89.85	270	12.45
921-1	M		4408.15	5.0	46.59	4.36	322.02	160	17.12
921-2	M	7.88	2125.25	3.2	76.59	2.64	265.18	155	14.47
921-3	M	10.61	903.90	0.2	69.53	4.39	73.01	205	73.74
921-4	M	11.92	2853.57	0.4	228.29	4.61	382.38	280	158.20
922-1	M	19.80	1495.11	4.2	32.28	3.25	121.67	230	1.36
922-2	M	20.60	699.66	7.0	34.77		72.79	180	1.83
922-3	M	11.62	318.89	1.2	102.04	4.68	51.39	175	3.67
922-4	M	8.59	1691.06	2.4	178.55	4.41	89.79	120	4.33
923-1				2.8		2.13		245	
923-2		11.21		4.0		4.12		355	
923-3		9.70		2.4		4.45		235	
923-4		8.69		0.8		4.70		200	

Appendix G1: Goats -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	(HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	(HAIR) (ppm)	>>> SERUM VITAMINS << VIT - A (ug/dl)	VIT - E (ug/dl)
917-1	B	0.54	2.42	170	148.24		93.6
917-2	B	0.64	8.91	135	151.90	14.1	135.5
917-3	B	0.53	1.62	170	140.33	19.2	21.6
917-4	B	0.44	2.69	110	100.32	32.4	35.2
918-1		0.71		135		30.5	0.1
918-3		0.25		125		26.5	136.8
919-1	M	0.27	0.23	165	30.92	14.3	123.6
919-2	B	0.45	0.18	85	24.91	36.0	131.0
919-3	B	0.62	0.01	120	56.40	26.7	33.0
919-4	B	0.32	3.39	120	20.56	22.7	42.8
920-1	M	0.39	1.27	55	3.54	24.3	81.9
920-2	M				46.52		
920-3	M	0.30	4.29	140	11.23	35.8	22.4
920-4	M	0.12	0.98	135	4.24	36.4	26.0
921-1	M	0.21	1.14	115	35.22	29.3	91.9
921-2	M	0.92	2.45	110	93.28		76.6
921-3	M	0.23	2.17	135	46.72	27.8	22.8
921-4	M	0.45	4.28	115	76.70	22.9	60.0
922-1	M	0.71	0.40	135	50.34	29.3	145.2
922-2	M	0.42	0.26	80	45.26	28.3	107.5
922-3	M	0.33	0.41	130	42.86	32.0	20.8
922-4	M	0.57	0.39	95	41.53	42.6	43.5
923-1		0.42		135		28.5	88.2
923-2		0.68		125		28.0	31.7
923-3		0.15		100		30.5	45.8
923-4				95		30.2	48.5

Appendix G1: Goats -- Mineral and Vitamin Levels in Serum and Hair

ID-PERIOD	HAIR COLOR	>>> CALCIUM <<< (SERUM) (mg/dl)	>>> CALCIUM <<< (HAIR) (ppm)	>>> PHOSPHORUS <<< (SERUM) (mg/dl)	>>> PHOSPHORUS <<< (HAIR) (ppm)	>>> MAGNESIUM <<< (SERUM) (mg/dl)	>>> MAGNESIUM <<< (HAIR) (ppm)	>>> IRON <<< (SERUM) (ug/dl)	>>> IRON <<< (HAIR) (ppm)
907-1		11.41		6.0		3.52		265	
908-1		14.14		6.0		4.05			
908-2		10.30		8.0		3.16		200	
909-1		10.20		6.0		3.75		435	
909-2		10.71		8.0		3.45		320	
910-1		11.62		8.0		3.67		405	
910-2		13.53		10.0		4.73		545	
911-1		10.91		6.0		3.96		375	
912-1		15.25		8.0		5.20		390	
913-1		11.31		2.0		4.42		555	
913-2		12.32		6.0		4.61		435	
914-1		13.84		8.0		3.16		435	
914-2		10.30		10.0		2.51		210	
915-1	W	11.51	494.05	4.0	61.76	4.24	76.58	345	0.52
915-2	W	9.19	2434.27	6.0	285.34	4.39	252.79	215	78.65
915-3	W	10.81	239.80	3.0	13.23	2.46	42.17	360	11.25
915-4	W	8.59	686.40	1.8	45.89	2.84	91.01	565	3.69
916-1	W	13.43	1773.39	6.0	55.64	3.07	182.21	575	16.94
916-2	W	11.72	1740.68	6.0	57.07	3.17	155.52	270	25.77
916-3	W	10.50	1207.81	3.2	194.92	4.32	128.09	255	10.53
916-4	W	9.70	1249.54	3.2	160.58	4.19	145.53		9.70

Appendix G1: Goats -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	(HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	(HAIR) (ppm)	>>> SERUM VITAMINS << VIT - A (ug/dl)	VIT - E (ug/dl)
907-1		0.87		90		21.8	34.1
908-1		0.42		175		21.2	51.3
908-2		0.16		180		22.7	17.0
909-1		0.40		140		29.1	32.5
909-2		0.27		110		27.6	30.3
910-1		0.06				36.2	25.4
910-2		0.08		110		19.2	37.7
911-1		0.24				31.1	
912-1		0.15		180		22.5	184.7
913-1		0.35		125		34.2	30.4
913-2		0.61		65		28.3	26.1
914-1		0.01		175		26.3	34.1
914-2		0.31		125		29.3	18.0
915-1	W	0.27	0.08	145	83.00	36.0	40.7
915-2	W	0.68	1.15	140	110.10	28.2	65.0
915-3	W		0.06	115	52.93	32.2	23.6
915-4	W	0.17	0.32	110	44.97	18.1	26.0
916-1	W	0.13	0.06	120	71.27	30.4	42.2
916-2	W	0.30	0.80	95	109.06	32.2	14.8
916-3	W	0.50	0.39	110	53.51	16.1	66.7
916-4	W	0.07	0.47		66.18	37.9	62.6

Appendix G1: Goats — Mineral and Vitamin Levels in Serum and Hair

ID-PERIOD	HAIR COLOR	>>> CALCIUM <<< (SERUM) (mg/dl)	>>> CALCIUM <<< (HAIR) (ppm)	>>> PHOSPHORUS <<< (SERUM) (mg/dl)	>>> PHOSPHORUS <<< (HAIR) (ppm)	>>> MAGNESIUM <<< (SERUM) (mg/dl)	>>> MAGNESIUM <<< (HAIR) (ppm)	>>> IRON <<< (SERUM) (ug/dl)	>>> IRON <<< (HAIR) (ppm)
15-1		12.42		6.8		4.01		330	
15-2		7.98		10.2		3.84		290	
901-1	M	9.39	713.53	7.8	91.86	3.26	20.01	320	7.16
901-2	M	10.71	1545.10	9.4	94.79	2.97	34.36	265	5.18
901-3	M	12.73	1073.77	0.2	111.74	4.79	20.78	170	8.80
901-4	M	12.22	1498.47	0.4	84.52	4.70	32.75	215	2.96
902-1	M		1447.70		127.55		27.74		17.68
902-2	M	9.90	2053.45	7.0	109.40	3.08	34.41	245	14.93
902-3	B	10.91	1674.65	4.2	92.18	4.55	21.51	400	34.84
902-4	B	10.71	1620.74	7.2	42.17	4.28	28.73	280	7.08
903-1	M	11.92	1199.68	6.8	255.93	4.16	252.73		24.19
903-2	M	10.81	783.07	9.2	43.06	4.28	180.03	280	2.71
903-3	BR	9.29	807.02	4.0	52.49	4.35	226.36	225	33.62
903-4	BR	9.90	1248.10	2.6	80.52	3.09	225.46	230	34.66
904-1	W	12.02	578.22	6.4	96.88	4.77	86.88	375	4.07
904-2	W	11.82	807.81	8.0	50.00	3.69	88.44	145	4.86
904-3	W	4.95	581.28	3.4	12.40		52.24	305	5.08
904-4	W	8.48	12037.49	2.0		3.66		225	
905-1	M	22.32	819.99	5.2	72.89	5.09	142.68	240	68.88
905-2	M	12.83	748.41	6.0	127.39	3.64	84.20	205	2.68
905-3	M	9.60	1394.81	3.2	503.68	4.40	186.46	370	12.61
905-4	M	8.79	785.33	1.8	70.43	4.43	98.61	245	6.36
906-1	B	14.24	1631.88	4.0	14.27	4.64	24.61	470	5.24
906-2	B		1181.08		13.07		18.79		5.49
906-3	B	12.12	1085.34	3.0	14.03	4.67	18.94	280	10.75
906-4	B	11.01	908.14	3.2	70.42	4.72	17.75	240	0.49

B11 X

Appendix G: Cattle -- Mineral and Vitamin levels in Hair and Serum

ID-PERIOD	HAIR COLOR	>>> CALCIUM <<< (SERUM) (mg/dl)	>>> CALCIUM <<< (HAIR) (ppm)	>>> PHOSPHORUS <<< (SERUM) (mg/dl)	>>> PHOSPHORUS <<< (HAIR) (ppm)	>>> MAGNESIUM <<< (SERUM) (mg/dl)	>>> MAGNESIUM <<< (HAIR) (ppm)	>>> IRON <<< (SERUM) (ug/dl)	>>> IRON <<< (HAIR) (ppm)
49-1	B		502.77	7.8	58.01	3.57	95.96	480	3.25
49-2	B	13.53	287.52	6.2	40.35	2.44	96.17	225	11.86
49-3	B	20.10	720.19	3.4	70.51	2.72	68.75	200	6.77
49-4	B	11.72	471.40	3.2	112.91	3.69	104.44	165	8.54
63-1				4.4		5.40		215	
63-2		11.31		5.6		2.32			
185-1	B	22.32		7.2	14.39	3.99	26.26	215	15.41
185-2	B	7.68		7.2	30.52	2.58	15.26	185	27.56
185-3	B	11.41	1634.03	1.8	14.70	3.37	19.30	160	20.38
185-4	B	10.71	1222.39	2.4	135.07	3.16	14.18	135	20.14
245-1	W	23.53	378.99	7.2	52.27	4.32	64.04	200	7.14
245-2	W	11.92	379.89	4.0	14.90	2.23	36.69	170	6.10
245-3	W	10.91	306.19	4.4	18.14	3.13	44.45	130	5.14
245-4	BR	10.20	723.37	2.2	21.76	2.83	85.93	115	23.99
552-1	B	19.49	578.45	5.6	17.14	4.52	19.71	230	12.78
552-2	B	7.37	664.14	4.0	18.32	2.27	22.21	135	9.81
552-3	B	12.63		2.6	13.79	3.50	16.38	185	13.76
552-4	B	12.52	1395.94	0.6	16.07	3.01	19.68	150	20.25
553-1	W	12.12	746.76	2.6	35.21	2.98	58.68	240	5.18
553-2	W	12.12	508.10			3.85	104.73		17.77
553-3	W	13.64	661.17	1.0	56.87	3.30	120.62	220	34.64
553-4	W	12.12	528.13	1.6	61.45	3.71	79.51	200	26.62
554-1	W	12.83	139.63	3.6	75.47	3.11	47.74	150	3.33
554-2	W	11.31	263.99	3.8	14.77	3.20	30.64	160	2.64
554-3	W	10.50	244.61	1.8	21.99	3.83	56.34	220	10.39
554-4	W	9.19	127.55	2.4	14.58	3.32	10.20	370	3.67

Appendix G: Cattle -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	>>> SELENIUM <<< (HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	>>> ZINC <<< (HAIR) (ppm)	>>> SERUM VITAMINS <<< VIT - A (ug/dl)	>>> SERUM VITAMINS <<< VIT - E (ug/dl)
555-1	B	0.46	0.66	125	522.03	32.0	2325
555-2	B	0.23	0.23	105	573.64	25.6	1223
555-3	B	0.53	0.01	160	371.44	35.7	463
555-4	M		0.48	110	479.99	41.9	558
556-1	W	0.07	0.01	115		22.3	1160
556-1		0.18		105	415.03	22.3	1334
556-2	W	0.78	0.13	110	419.98	22.1	316
556-3	W	0.58	0.04	140	507.07	36.9	601
556-4	BR	0.28	0.54	230	728.86	40.4	528
557-1	W	0.60	0.14	150	561.16	22.5	2153
557-2	W	0.81	0.46	105	863.20	29.3	
557-3	W	0.40	0.14	120		41.3	544
557-4	W	0.11	0.55	155	635.85		627
558-1	W	0.62	0.42	90	430.50	30.0	2342
558-2	W	0.31	0.28	190	884.71	25.2	2032
558-3	B	0.72	0.07	135	701.95		730
558-4	W	0.60	0.11	130	791.40		718
559-1		0.30		195		22.3	2761
559-2		0.03		80		28.9	1426
560-2		0.27		120		22.1	340
562-2						28.2	2578
563-2		0.24		90		22.5	2210
564-2		0.72		200		19.0	2696

Appendix 6: Cattle — Mineral and Vitamin levels in Hair and Serum

		>>> CALCIUM <<<		>>> PHOSPHORUS <<<		>>> MAGNESIUM <<<		>>> IRON <<<	
		(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)
ID-PERIOD	HAIR COLOR	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(ug/dl)	(ppm)
555-1	B	12.32	208.67	2.2	54.43	3.14	33.79	215	7.24
555-2	B	12.02	267.14	6.0		4.20	74.52		7.42
555-3	B	12.32	269.93	2.2	71.04	3.64	26.64	185	3.88
555-4	M	11.21	167.45		16.74	3.94	25.75	130	9.67
556-1	W	8.99	859.95	3.2	13.68	2.58	28.38	225	11.35
556-1				3.2				215	
556-2	W	12.83	716.72	8.0	10.64	3.79	59.04	260	3.57
556-3	W	11.72	611.04	1.0	14.77	3.00	29.91		8.06
556-4	BR	12.32	528.25	0.8	16.07	3.30	51.22	245	19.91
557-1	W	10.00	526.12		11.47	2.83	42.86	120	9.87
557-2	W	11.41	534.68	3.0	20.87	3.43	42.77	200	18.62
557-3	W	10.71	961.21	0.4	32.31	3.84	101.37	190	12.21
557-4	W	10.71	1180.03	1.6	16.59	4.06	64.91	240	18.12
558-1	W	8.89	262.75	2.6	10.41	3.41	23.41	135	23.38
558-2	W	11.82	505.96	4.4	20.65	3.62	64.28	240	18.87
558-3	B	11.21	1279.18	1.2	30.46	3.57	17.32	190	35.18
558-4	W	12.22	293.48	1.2	13.34	2.50	24.51	175	4.62
559-1		11.62		4.4		3.00		205	
559-2		12.42		6.2		3.68		195	
560-2		13.03		6.0		4.16		490	
562-2		12.32		4.6		2.47		250	
563-2		9.09		6.0		2.65		280	
564-2		13.64		5.2		4.91		265	

Appendix G: Cattle -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	(HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	(HAIR) (ppm)	>>> SERUM VITAMINS <<< VIT - A (ug/dl)	VIT - E (ug/dl)
566-2		0.09		120		32.2	2579
567-2		0.52		170		15.9	498
568-2				90		17.6	1108
569-2		0.46		120		36.4	
570-2		0.49		125		22.3	1976
571-2		0.47		125		42.4	1600
595-2		0.58		95			2817
601-1	M		0.57	145	811.77	30.0	786
601-2	B		0.30		786.14		
601-3	M	0.06	0.09	130	59.16	38.4	1089
601-4	M	0.78	0.33	95	80.03	26.0	991
603-1		0.61		160		13.9	564
603-2		0.15		150		29.4	617
604-2				105		29.3	1424
605-1		0.37		145		22.1	2108
605-2		0.13		100		25.8	2338
606-1		0.37		115		22.3	886
606-1		0.45		165		15.2	781
606-2		0.47		175		29.6	404
606-3		0.63		155		29.3	534
606-4		0.71		95		27.4	718

Appendix G: Cattle -- Mineral and Vitamin levels in Hair and Serum

ID-PERIOD	HAIR COLOR	>>> CALCIUM <<< (SERUM) (mg/dl)	>>> CALCIUM <<< (HAIR) (ppm)	>>> PHOSPHORUS <<< (SERUM) (mg/dl)	>>> PHOSPHORUS <<< (HAIR) (ppm)	>>> MAGNESIUM <<< (SERUM) (mg/dl)	>>> MAGNESIUM <<< (HAIR) (ppm)	>>> IRON <<< (SERUM) (ug/dl)	>>> IRON <<< (HAIR) (ppm)
566-2		12.02		7.4		4.60		310	
567-2		15.55		5.6		3.65			
568-2		9.90		6.6		5.31		210	
569-2		15.66				4.40		280	
570-2		11.82		7.0		4.33		465	
571-2		9.09				4.01		340	
595-2		17.78		6.4		4.10		345	
601-1	M	19.49	703.51	6.0	20.03	5.59	79.36	360	16.61
601-2	B		330.20		90.57		72.08		10.14
601-3	M	11.82	621.07	6.0	12.81	4.23	41.62	415	3.36
601-4	M	10.10		8.2	111.11	4.05		230	23.57
603-1		15.55		6.4		4.71		235	
603-2		13.64		6.0		3.80			
604-2		9.80		4.2		3.69		370	
605-1		13.23		6.6		3.03		240	
605-2		9.49		5.6		3.69		335	
606-1		20.10		5.0		3.47		165	
606-1		19.09		4.2				390	
606-2		10.61		7.6		3.37		470	
606-3		8.48		4.0		3.74		430	
606-4		8.99		3.4		3.98		235	

Appendix G: Cattle -

		>>> SELENIUM <<<		>>> ZINC <<<		>>> SERUM VITAMINS <<<	
		(SERUM)	(HAIR)	(SERUM)	(HAIR)	VIT - A	VIT - E
ID-PERIOD	HAIR COLOR	(ug/ml)	(ppm)	(ug/dl)	(ppm)	(ug/dl)	(ug/dl)
607-1	B	0.20	0.24	235	96.78	21.0	1504
607-2	B	0.22	0.49	120	44.75	22.5	2335
607-3	B	0.49	0.31	165	66.24		545
607-4	B	0.47		145	69.11		640
608-1		0.43		210		24.7	2148
608-2		0.46		195		33.1	998
609-1		0.27		150		34.2	1872
610-1		0.59				36.4	2346
610-2		0.19		95		19.2	964
611-1		0.28		175		32.2	2389
612-1		0.40		200		19.4	2528
614-1		0.29		180		38.4	2623
615-1		0.50		235		19.2	2246
615-2		0.22		125		22.3	
616-1	W	0.40	0.09		45.27	22.5	1568
616-2	W	0.15	0.51	125	50.42	25.2	1657
616-3	BR	0.17	0.41	135	64.81	29.4	771
616-4	W	0.22	0.42		82.56	22.7	774
617-1	BR	0.02	0.03	95	56.15	15.2	2240
617-2	BR	0.28	0.33	105	44.45	15.4	1792
617-3	BR	0.26	0.22	95	29.11	33.5	861
617-4	BR		0.05	150	46.82	34.4	839
618-1	W	0.16	0.39	135	35.20	16.8	962

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Appendix G: Cattle — Mineral and Vitamin levels in Hair and Serum

		>>> CALCIUM <<<		>>> PHOSPHORUS <<<		>>> MAGNESIUM <<<		>>> IRON <<<	
		(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)
ID-PERIOD	HAIR COLOR	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(ug/dl)	(ppm)
607-1	B		724.01	5.6	15.57	5.37	19.66	310	14.88
607-2	B	11.51	790.03	6.0	18.06	4.16	84.42	195	5.69
607-3	B	12.32	1664.98	2.8	111.00	4.41	92.96	255	10.49
607-4	B	11.31	1093.96	4.4	54.70	4.26	121.47	325	10.15
608-1				2.8		4.51		205	
608-2		11.01		5.2		4.10		235	
609-1		22.12		5.4				155	
610-1		23.23		4.6		3.02		240	
610-2		9.49		5.8		4.10		250	
611-1		23.63		3.8				325	
612-1		23.53		8.0		3.47		180	
614-1		23.13		7.0		5.12		280	
615-1		23.53		6.4				345	
615-2		12.63		4.0		4.27		245	
616-1	W	14.85	453.46	2.0	12.91	4.60	65.36	255	0.95
616-2	W	8.69	257.27	6.2	11.83	4.88	30.90	465	2.36
616-3	BR	11.31	991.63	4.8	24.11	4.89	91.93	270	21.27
616-4	W	12.93	723.20	1.6	105.96	4.73	18.54	280	8.46
617-1	BR	17.27	344.90	7.0	15.50	6.07	37.01	215	16.60
617-2	BR	22.02	391.69	3.2	16.67		31.46	315	26.60
617-3	BR	11.41	275.64	2.0	12.60	4.19	88.83	225	15.61
617-4	BR	10.10	402.55	5.2	16.51	3.83	71.43	320	17.69
618-1	W	19.80	860.34	5.6	14.90	3.59	59.03	250	6.57

Appendix 6: Cattle -

ID-PERIOD	HAIR COLOR	>>> SELENIUM << (SERUM) (ug/ml)	>>> SELENIUM << (HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	>>> ZINC <<< (HAIR) (ppm)	>>> SERUM VITAMINS <<< VIT - A (ug/dl)	>>> SERUM VITAMINS <<< VIT - E (ug/dl)
618-2	W	0.22	0.19	185	30.69	26.9	1309
618-3	W	0.46	0.44	140	31.76	29.8	1155
613-4	W	0.88	0.48	165	33.43	34.4	1613
619-1		0.03		135		22.5	855
619-2		0.46		125		21.9	2249
619-3		0.37		190		29.3	862
619-4		0.18		200		30.2	864
620-1	B	0.44	0.49	165	138.62	29.3	1805
620-2	B	0.03	0.46	155	51.65	29.6	2065
620-3	B	0.12	0.37	160	94.75	29.3	657
620-4	B	0.68	0.24	195	62.44	15.9	758
621-1		0.23		210		28.3	1171
621-2		0.44		120		29.1	1825
621-3		0.56		125		19.0	1486
621-4		0.28		155		36.8	705
622-1	W	0.32	0.30	170	96.79	15.4	1302
622-2	W	0.12	0.07		63.25	29.1	1221
622-3	W	0.54	0.24	145	51.03	36.4	943
622-4	W	0.32	0.27	175	55.88	22.1	975
623-1		0.43		140		36.2	1316
624-1	W	0.06	0.01	120	59.59	29.6	2063
624-2	W	0.46	0.15	230	83.24	29.3	2602
624-3	W	0.06	0.50	145	114.50	29.6	975
624-4	W	0.36	0.38	175	71.77	23.0	1007
625-1	B	0.19	0.16	160	25.07	29.4	2585
625-2	B	0.52	0.74	115	31.13	29.3	2487

Appendix G: Cattle — Mineral and Vitamin levels in Hair and Serum

		>>> CALCIUM <<<		>>> PHOSPHORUS <<<		>>> MAGNESIUM <<<		>>> IRON <<<	
		(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)
ID-PERIOD	HAIR COLOR	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(ug/dl)	(ppm)
618-2	W	20.71	631.82	3.6	11.65	3.47	39.89	290	6.24
618-3	W	10.81	609.95	3.0	14.27	4.08	50.65	190	8.69
618-4	W	10.71	781.81	2.2	14.09	4.12	48.42	255	0.30
619-1		22.73		4.2				485	
619-2		11.11		4.0		4.73		415	
619-3		13.53		1.4		4.50		265	
619-4		11.72		3.6		4.55		380	
620-1	B		684.46	5.0	33.59			145	
620-2	B	11.72	647.01	4.0	34.28	4.89		350	9.90
620-3	B	8.08	1431.09	1.4		3.73	107.51	490	17.17
620-4	B	8.79	494.35	7.2	28.66	4.40	90.99	330	8.43
621-1		20.91		5.2		4.48			
621-2		13.53		6.0		4.27		380	
621-3		12.63		2.6		4.15		250	
621-4		13.94		4.2		4.36		250	
622-1	W		635.63	3.2			89.40	470	19.42
622-2	W	20.00	772.79	5.2	95.11	3.01	45.57	430	10.65
622-3	W	11.21	594.84	3.0	142.36	4.64	66.09	380	23.49
622-4	W	12.02	565.15	1.8	17.80	5.28	61.86	380	11.40
623-1		12.83		6.4				290	
624-1	W	13.33	585.77	5.0	16.22	3.11	68.51	410	25.20
624-2	W	20.60	1128.89	5.2	25.66	5.01	134.38	375	25.05
624-3	W	7.58	749.68	3.0	28.70	4.02		200	
624-4	W	9.09	756.96	7.6	33.18	5.02	99.75	330	
625-1	B	14.34	395.36	2.8	12.70	3.52	59.07	95	3.20
625-2	B	12.63	810.39	3.2	32.58	5.44	83.69	375	4.45

Appendix G: Cattle -

ID-PERIOD	HAIR COLOR	>>> SELENIUM << (SERUM) (ug/ml)	>>> SELENIUM << (HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	>>> ZINC <<< (HAIR) (ppm)	>>> SERUM VITAMINS <<< VIT - A (ug/dl)	>>> SERUM VITAMINS <<< VIT - E (ug/dl)
625-3	B	0.25	0.24	155	39.06	28.5	1236
625-4	B	0.06	0.25	170	35.36	36.4	895
676-1		0.15		145		22.3	947
676-2		0.16		120		36.4	474
677-1	W	0.39	0.17		30.53	43.5	652
677-2	W	0.00	0.26		45.82		
677-3	W	0.20	0.47	130	40.62	37.7	1410
677-4	W	0.28	0.34	145	40.13	18.1	922
678-1	M	0.33	0.42	160	43.32	29.1	1214
678-2	M	0.15	0.30	155	38.83	21.2	1142
678-3	M	0.51	0.29	170	28.09	28.9	1152
678-4	M	0.07	0.70	125	34.13	20.7	895
679-1		0.09		130		22.5	2337
680-1	M		0.74	150	43.22	20.7	1095
680-2	W	0.78	0.35	140	39.85	23.0	1021
680-3	W	0.41	0.26	145	27.60	28.2	237
680-4	W	0.68	0.53	155	3.42	25.4	1074
681-1		0.31		150		36.4	2161
682-1	BR	0.02	0.54	165	41.11	30.2	2168
682-2	BR	0.65	0.21	150	42.55	15.2	336
682-3	BR		0.31		24.91		
682-4	BR				35.88		
683-1	B	0.46	0.46	150	42.54	29.6	155
683-2	B	0.22	0.25	145	51.10	29.3	2384
683-3	B	0.79	0.03	110	45.37	41.0	1021

Appendix G: Cattle -- Mineral and Vitamin levels in Hair and Serum

		>>> CALCIUM <<<		>>> PHOSPHORUS <<<		>>> MAGNESIUM<<<		>>> IRON <<<	
		(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)
ID-PERIOD	HAIR COLOR	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(ug/dl)	(ppm)
625-3	B	13.03	992.91	2.2	107.83	5.01	102.44	340	21.89
625-4	B	12.93	750.74	1.4	33.18	4.72	116.97	320	11.67
676-1		16.06				3.31		450	
676-2		12.93		6.6		4.39		535	
677-1	W	20.81	220.00	6.4	38.26	3.30	33.96	410	1.61
677-2	W		192.87		49.77		21.36		1.05
677-3	W	10.50	331.66	1.6	74.39	4.15	21.08	205	6.51
677-4	W	10.30	160.68	2.4	51.42	5.03	29.57	215	1.44
678-1	M	13.94	176.17	3.6	16.98	4.29	32.69	335	23.71
678-2	M	18.89	152.90	4.8	14.39	4.37	33.64	260	2.27
678-3	M	9.49	367.45	4.6	16.51	4.64	37.36	260	2.25
678-4	M	9.09	351.69	1.4	131.20	4.85	51.57	205	8.11
679-1		21.72		7.0		5.15		185	
680-1	M	20.60	296.50	4.8	12.55	4.76	54.44	180	10.41
680-2	W	11.72	408.42	5.6	14.27	3.98	48.33	270	39.55
680-3	W	11.72	384.23	2.4	27.82	4.66	44.16	325	29.79
680-4	W	12.02	646.19	2.8	57.44	4.83	61.75	370	7.04
681-1		21.11		6.4		4.66		250	
682-1	BR	16.97	616.25	8.0	47.56	6.07	78.86	290	7.66
682-2	BR	12.32	739.82	8.0	29.16	5.33	57.04	365	2.60
682-3	BR		868.85		12.75		49.90		4.02
682-4	BR		344.80		12.21		30.51		2.31
683-1	B	10.40	336.95	3.4	112.99	3.34	56.90	205	0.34
683-2	B	8.69	541.70	6.2	16.67	3.39	73.34	155	1.23
683-3	B	10.71	587.50	0.4	30.32	4.40	55.34	265	0.32

Appendix G: Cattle -

ID-PERIOD	HAIR COLOR	>>> SELENIUM << (SERUM) (ug/ml)	>>> SELENIUM << (HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	>>> ZINC <<< (HAIR) (ppm)	>>> SERUM VITAMINS <<< VIT - A (ug/dl)	>>> SERUM VITAMINS <<< VIT - E (ug/dl)
683-4	B	0.39	0.28	150	28.85	42.2	878
684-1	W	0.65	0.19	95	56.34	28.3	136
684-2	W	0.59	0.07	80	57.26	43.7	1449
684-3	W	0.23	0.03	175	106.43	20.7	
684-3		0.66		125		38.8	661
684-4	W		0.19	155	50.42	29.1	384
685-1		0.17		110		28.9	188
686-1		0.25		180		29.4	422
687-1		0.24		85		29.3	1428
688-1		0.37		110		26.9	1876
689-1	M	0.22	0.48	125	39.63	36.4	1781
689-2			0.36		36.28		
689-3	B		0.12		55.09		
689-4	M		0.36		42.13		
690-1	B	0.65	0.14	135	31.38	20.5	996
690-2	B	0.46	0.14	135	66.05	19.0	1080
690-3	B	0.54	0.04	150	41.40	29.3	1518
690-4	B	0.25	0.05	180	37.74	32.0	1476
691-1		0.31		120		36.6	2470
692-1		0.18		155		15.4	1522
693-1		0.16		140		15.4	1953
694-1		0.36		160		29.6	1845

Appendix G: Cattle -- Mineral and Vitamin levels in Hair and Serum

		>>> CALCIUM <<<		>>> PHOSPHORUS <<<		>>> MAGNESIUM<<<		>>> IRON <<<	
		(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)	(SERUM)	(HAIR)
ID-PERIOD	HAIR COLOR	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(mg/dl)	(ppm)	(ug/dl)	(ppm)
683-4	B	10.71	571.42	2.8	23.38	4.62	88.71	160	0.25
684-1	W	14.54	561.81	4.4	12.45	3.13	32.21	170	17.39
684-2	W	7.88	351.72	6.8	12.45	3.62	44.51	265	23.40
684-3	W	12.32	274.69	4.6	13.73	5.41	38.28	345	
684-3		15.96		4.8					
684-4	W	13.84	581.05	1.8	12.81	5.08	36.66		11.03
685-1		14.04		4.0		3.29		190	
686-1		16.16		3.6		3.84		265	
687-1		11.41		8.0		2.94		195	
688-1		9.29		5.6		4.90		195	
689-1	M	13.43	842.44	4.8	24.51	2.84	70.61	225	5.15
689-2			737.53		58.56		98.46		
689-3	B		1243.07		61.01		119.48		0.64
689-4	M		1159.34		46.30		115.93		2.59
690-1	B	8.69	415.21	4.4	53.36	3.36	71.70	220	0.98
690-2	B	8.48		5.2		4.86	89.33	155	0.98
690-3	B	8.69	852.06	4.0		4.48	91.50	275	0.88
690-4	B	9.39	411.17	1.8		4.39	60.91	325	0.96
691-1		11.21		3.2		3.62		225	
692-1		12.22		5.4		2.89		185	
693-1		14.44		4.4		3.85		75	
694-1		8.28		4.2		3.33		115	

Appendix G: Cattle -

ID-PERIOD	HAIR COLOR	>>> SELENIUM <<< (SERUM) (ug/ml)	(HAIR) (ppm)	>>> ZINC <<< (SERUM) (ug/dl)	(HAIR) (ppm)	>>> SERUM VITAMINS <<< VIT - A (ug/dl)	VIT - E (ug/dl)
694-2		0.12		130		15.4	1974
695-1		0.02		125		27.1	2064
695-2		0.44		130		29.3	
696-1		0.57				21.6	1426
696-2		0.25		130		22.3	1055
697-1		0.81		180		22.1	1078
698-1	W	0.55	0.45	130	52.51	29.3	1374
698-2	W	0.65	0.67	195	47.47	22.3	1488
698-3	W	0.68	0.50	180	53.88	28.2	744
698-4	W	0.19		140	40.98	30.4	867
699-1	B		0.41	210	55.75	36.4	1361
699-2	B	0.40	0.62	150	73.97	29.4	1138
699-3	B	0.86	0.31	110	45.24	19.0	673
699-4	B	0.17	0.06	160	52.80	29.3	622
COUNT:		164	112	166	111	163	167
MAXIMUM:		0.88	0.74	235.00	884.71	43.71	2817.00
MINIMUM:		0.00	0.01	80.00	3.42	13.90	136.00
AVERAGE:		0.36	0.31	144.61	219.40	27.74	1318.13

Appendix G: Cattle -- Mineral and Vitamin levels in Hair and Serum

ID-PERIOD	HAIR COLOR	>>> CALCIUM <<< (SERUM) (mg/dl)	>>> CALCIUM <<< (HAIR) (ppm)	>>> PHOSPHORUS <<< (SERUM) (mg/dl)	>>> PHOSPHORUS <<< (HAIR) (ppm)	>>> MAGNESIUM <<< (SERUM) (mg/dl)	>>> MAGNESIUM <<< (HAIR) (ppm)	>>> IRON <<< (SERUM) (ug/dl)	>>> IRON <<< (HAIR) (ppm)
694-2		9.09		6.6		3.05		160	
695-1		8.38		3.8		3.20		170	
695-2		10.50		6.8		4.18		370	
696-1		8.38		4.2					
696-2		10.71		6.6		2.74		170	
697-1		9.39		7.4		2.68		170	
698-1	W		750.58	6.6	18.59	5.38	102.94	350	31.43
698-2	W	9.29	257.45	8.0	16.74	2.66	64.68	270	8.62
698-3	W	10.81	700.44	3.8	16.29	3.47	119.12	315	15.56
698-4	W	11.21	503.98	5.4	18.41	3.90	81.69	270	13.34
699-1	B		184.94	6.6	82.20	5.65	50.14	240	6.21
699-2	B	8.18	250.00	8.0	88.89	2.66	85.83	230	1.87
699-3	B	16.16	450.80	5.4	148.58	5.06	80.54	335	4.40
699-4	B	12.52	373.64	4.0		5.24	69.32	365	1.76
COUNT:		164	111	167	108	161	112	163	111
MAXIMUM:		23.63	1664.98	8.20	148.58	6.07	134.38	535.00	39.55
MINIMUM:		7.37	127.55	0.40	10.41	2.23	10.20	75.00	0.25
AVERAGE:		13.04	590.12	4.47	38.00	3.96	60.04	264.26	11.23

Appendix H: Cattle forage analysis results and translations
(accessibility: 3 is highest, 1 is lowest)

1st Sampling Period

SAMPLE NO.	ANIMAL NO.	NAME OF FORAGE KREOLE	ACCESSI-BILITY	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
616-2	616	PAY PITIMI (GRAP)	3	0.43	0.03	0.04	0.35	99.60	255.23
682	682	PAY PITIMI	3	0.50	0.08	0.06	0.16	37.28	313.74
624	624	FEY BWADOMM	3	1.93	0.06	0.23	0.38	43.40	334.82
616-1	616	PAY MAI (HUSKS)	3	1.18	0.01	0.03	0.34	36.84	245.58
604-2	604	ZEB TIPALTO	3	1.03	0.07	0.15	0.02	128.71	371.29
558-1	558	PAY PITIMI (GRAP)	3	0.50	0.05	0.09	0.11	132.33	298.21
100		ZEB TIPALTO	3	1.16	0.09	0.10	0.40	106.24	347.91
245-2	245	ZEB KOD-A GRINN	2	0.43	0.07	0.08	0.28	80.45	309.41
604-1	604	PAY PITIMI (FEY)	2	0.48	0.12	0.48	0.12	93.01	49.60
615	615	PAY DIRI (FEY)	2	0.48	0.10	0.06	0.12	98.04	318.63
913-1	913	ABSINT	2	1.64	0.11	0.19	0.01	107.69	317.48
250	250	ZEB KOD-A GRINN	2	0.49	0.11	0.12	0.01	118.51	293.16
245-1	245	FEY PAY PITIMI	2	0.28	0.12	0.06	0.04	43.32	99.01
103		ZEB KOD-A GRINN	2	0.73	0.02	0.14	0.33	87.50	237.50
COUNT:				14.00	14.00	14.00	14.00	14.00	14.00
MAXIMUM:				1.93	0.12	0.48	0.40	132.33	371.29
MINIMUM:				0.28	0.01	0.03	0.01	36.84	49.60
AVERAGE:				0.81	0.07	0.13	0.19	86.64	270.83
STD DEV:				0.49	0.04	0.11	0.14	32.45	88.49
VARIENCE:				0.24	0.00	0.01	0.02	1053.01	7830.18

SAMPLE NO.	ANIMAL NO.	NAME OF FORAGE KREOLE	CATTLE ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
932-2	932	FEY PWA KONGO	1	1.06	0.07	0.07	0.12	62.25	280.13
104		FEY GOMIER	1	0.77	0.04	0.19	0.01	43.66	268.21
559	559	FEY LECENA	1	1.14	0.06	0.20	0.17	43.66	249.50
105		FEY TIA-TIA	1	1.74	0.05	0.13	0.28	93.56	280.69
936	936	PWA ROUJ (FEY & BWA)	1	1.27	0.05	0.18	0.07	30.52	48.83
558-2	558	FEY MASKETI	1	2.38	0.05	0.12	0.02	56.03	267.68
101		CROSS COASTAL - 1	1	0.81	0.12	0.11	0.14	186.26	334.16
932-1	932	ZEB BALE	1	0.76	0.07	0.13	0.12	35.63	318.75
913-2	913	PIE BALE	1	1.46	0.11	0.22	0.08	93.01	99.21
COUNT:				9.00	9.00	9.00	9.00	9.00	9.00
MAXIMUM:				2.38	0.12	0.22	0.28	186.26	334.16
MINIMUM:				0.76	0.04	0.07	0.01	30.52	48.83
AVERAGE:				1.26	0.07	0.15	0.11	71.62	238.57
STD DEV:				0.50	0.03	0.05	0.08	45.90	92.10
VARIENCE:				0.25	0.00	0.00	0.01	2106.77	8481.88

Appendix H: Cattle forage analysis results and translations
(accessibility: 3 is highest, 1 is lowest)

2nd Sampling Period

SAMPLE NO.	ANIMAL NO.	CATTLE ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
2617-A	617 FEY VENSAN	3	1.05	0.05	0.15	0.04	62.25	292.58
2245-C	245 ZEB KOD-A GRINN	2	0.27	0.09	0.08	0.25	103.56	268.03
2617-B	617 FEY KANN	2	0.64	0.05	0.07	0.21	87.33	249.50
2604-A	604 ABSINT	2	1.33	0.06	0.20	0.06	16.25	250.00
2245-B	245 BWA PATAT	2	1.06	0.11	0.22	0.13	31.13	1288.60
2604-B	604 FEY PITIMI	2	0.76	0.03	0.13	0.11	45.53	212.08
COUNT:			6.00	6.00	6.00	6.00	6.00	6.00
MAXIMUM:			1.33	0.11	0.22	0.25	103.56	1288.60
MINIMUM:			0.27	0.03	0.07	0.04	16.25	212.08
AVERAGE:			0.85	0.07	0.14	0.13	57.67	426.80
STD DEV:			0.34	0.03	0.05	0.07	30.48	386.16
VARIENCE:			0.12	0.00	0.00	0.01	928.93	149119

SAMPLE NO.	ANIMAL NO.	CATTLE ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
2604-C	604 ZEB PATTE KRAB	1	0.75	0.16	0.23	0.34	99.01	266.09
22000-B	FEY GOMIER	1	0.98	0.09	0.15	0.15	87.47	268.64
2558	558 FEY KALALOU	1	1.49	0.20	0.45	0.20	68.20	620.04
22000-A	FEY MOMBIN	1	1.46	0.05	0.18	0.04	47.03	173.27
2935-A	935 BALE	1	1.19	0.14	0.16	0.04	49.70	304.42
2935-B	935 ABSINT	1	1.84	0.14	0.10	0.09	105.83	298.80
2245-A	245 DEKOS	1	0.88	0.13	0.27	0.36	31.13	516.68
COUNT:			7.00	7.00	7.00	7.00	7.00	7.00
MAXIMUM:			1.84	0.20	0.45	0.36	105.83	620.04
MINIMUM:			0.75	0.05	0.10	0.04	31.13	173.27
AVERAGE:			1.23	0.13	0.22	0.17	69.77	349.71
STD DEV:			0.36	0.04	0.11	0.12	26.41	146.53
VARIENCE:			0.13	0.00	0.01	0.02	697.70	21470.97

Appendix H: Cattle forage analysis results and translations
(accessibility: 3 is highest, 1 is lowest)

3rd Sampling Period

SAMPLE NO.	ANIMAL NO.	CATTLE ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
3952-A	952 FEY BWADOMM	3	0.83	0.06	0.17	0.10	18.75	125.00
3931	931 PAY MAI (HUSKS)	3	0.12	0.00	0.12	0.23	22.94	148.81
3185-B	185 ZEB TIPALTO	3	0.21	0.07	0.12	0.23	19.96	349.30
3623	623 PAY PITIMI (GRAP)	3	0.38	0.02	0.12	0.28	52.40	330.59
3568	568 ABSINT	2	0.94	0.11	0.18	0.50	79.52	173.96
3950-B	950 BALE	2	0.81	0.11	0.22	0.23	24.70	179.10
3400	BWA & FEY DIRI	2	0.19	0.01	0.13	0.35	29.20	161.53
3185-A	185 ZEB KODAGRINN	2	0.76	0.07	0.56	0.25	21.08	254.22
COUNT:			8.00	8.00	8.00	8.00	8.00	8.00
MAXIMUM:			0.94	0.11	0.56	0.50	79.52	349.30
MINIMUM:			0.12	0.00	0.12	0.10	18.75	125.00
AVERAGE:			0.53	0.06	0.20	0.27	33.57	215.31
STD DEV:			0.32	0.04	0.14	0.11	20.12	80.04
VARIENCE:			0.10	0.00	0.02	0.01	404.70	6406.03

SAMPLE NO.	ANIMAL NO.	CATTLE ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
3960-A	960 ZEB PAT KRABB	1	0.66	0.04	0.15	0.25	180.79	242.30
3683	683 FEY MOMBIN	1	0.37	0.09	0.13	0.09	11.85	143.46
3960-B	960 DIMOV	1	0.59	0.04	0.18	0.07	29.70	266.09
3950-A	950 BERYIN	1	0.44	0.10	0.22	0.31	35.20	271.74
3952-B	952 FEY GOMIER	1	1.14	0.08	0.21	0.29	50.02	203.80
3300	CROSS COASTAL - 1	1	1.62	0.09	0.13	0.10	54.67	155.32
COUNT:			6.00	6.00	6.00	6.00	6.00	6.00
MAXIMUM:			1.62	0.10	0.22	0.31	180.79	271.74
MINIMUM:			0.37	0.04	0.13	0.07	11.85	143.46
AVERAGE:			0.80	0.07	0.17	0.19	60.37	213.78
STD DEV:			0.44	.02	0.04	0.10	55.63	50.61
VARIENCE:			0.19	0.00	0.00	0.01	3094.74	2561.74

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Appendix H: Cattle forage analysis results and translations
(accessibility: 3 is highest, 1 is lowest)

4th Sampling period

SAMPLE NO.	ANIMAL NO.	CATTLE ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
4245-C	245 ZEB TIPALTO	3	0.27	0.05	0.15	0.22	14.94	410.86
4693	693 ZEB KOD-A GRINN	2	0.35	0.04	0.08	0.11	23.42	258.88
4906-A	906 ABSINT	2	0.63	0.07	0.16	0.11	27.79	160.57
4245-B	245 ZEB KOD-A GRINN	2	0.28	0.05	0.14	0.36	109.93	284.09
4680-B	680 FEY MAI	2	0.75	0.08	0.17	0.20	59.52	235.62
4245-A	245 BALE	2	0.67	0.14	0.22	0.06	42.61	679.35
4680-A	680 BALE	2	0.99	0.12	0.25	0.38	216.39	148.81
COUNT:			7.00	7.00	7.00	7.00	7.00	7.00
MAXIMUM:			0.99	0.14	0.25	0.38	216.39	679.35
MINIMUM:			0.27	0.04	0.08	0.06	14.94	148.81
AVERAGE:			0.56	0.08	0.17	0.20	70.66	311.17
STD DEV:			0.25	0.03	0.05	0.12	66.40	170.59
VARIENCE:			0.06	0.00	0.00	0.01	4409.28	29101.31

SAMPLE NO.	ANIMAL NO.	CATTLE ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
4919-A	919 FEY BWA DIAK	1	1.00	0.04	0.20	0.49	57.55	167.08
4906-B	906 PITIMI PINTAD	1	0.38	0.06	0.18	0.03	43.94	148.51
4905	905 ?GRASS ON PATH	1	0.49	0.09	0.09	0.30	19.96	318.11
4919-B	919 FEY MOMBIN	1	0.85	0.07	0.17	0.38	35.41	124.25
COUNT:			4.00	4.00	4.00	4.00	4.00	4.00
MAXIMUM:			1.00	0.09	0.20	0.49	57.55	318.11
MINIMUM:			0.38	0.04	0.09	0.03	19.96	124.25
AVERAGE:			0.68	0.06	0.16	0.30	39.21	189.49
STD DEV:			0.25	0.02	0.04	0.17	13.63	75.80
VARIENCE:			0.06	0.00	0.00	0.03	185.91	5745.24

Appendix H: Goat forage analysis results and translations

1st Sampling Period

SAMPLE NO.	ANIMAL NO.	NAME OF FORAGE KREOLE	GOAT ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
604-1	604	PAY PITIMI (FEY)	3	0.48	0.12	0.48	0.12	93.01	49.60
932-1	932	ZEB BALE	3	0.76	0.07	0.13	0.12	35.63	318.75
604-2	604	ZEB TIPALTO	3	1.03	0.07	0.15	0.02	128.71	371.29
682	682	PAY PITIMI	3	0.50	0.08	0.06	0.16	37.28	313.74
616-2	616	PAY PITIMI (GRAP)	3	0.43	0.03	0.04	0.35	99.60	255.23
913-2	913	PIE BALE	3	1.46	0.11	0.22	0.08	93.01	99.21
624	624	FEY BWADOMM	3	1.93	0.06	0.23	0.38	43.40	334.82
245-1	245	FEY PAY PITIMI	3	0.28	0.12	0.06	0.04	43.32	99.01
100		ZEB TIPALTO	3	1.16	0.09	0.10	0.40	106.24	347.91
104		FEY GOMIER	3	0.77	0.04	0.19	0.01	43.66	268.21
558-1	558	PAY PITIMI (GRAP)	3	0.50	0.05	0.09	0.11	132.33	298.21
913-1	913	ABSINT	3	1.64	0.11	0.19	0.01	107.69	317.48
245-2	245	ZEB KOD-A GRINN	2	0.43	0.07	0.08	0.28	80.45	309.41
558-2	558	FEY MASKETI	2	2.38	0.05	0.12	0.02	56.03	267.68
936	936	PWA ROUJ (FEY & BWA)	2	1.27	0.05	0.18	0.07	30.52	48.83
250	250	ZEB KOD-A GRINN	2	0.49	0.11	0.12	0.01	118.51	293.16
103		ZEB KOD-A GRINN	2	0.73	0.02	0.14	0.33	87.50	237.50
932-2	932	FEY PWA KONGO	2	1.06	0.07	0.07	0.12	62.25	280.13
105		FEY TIA-TIA	2	1.74	0.05	0.13	0.28	93.56	280.69
COUNT:				19	19	19	19	19	19
MAXIMUM:				2.38	0.12	0.48	0.40	132.33	371.29
MINIMUM:				0.28	0.02	0.04	0.01	30.52	48.83
AVERAGE:				1.00	0.07	0.15	0.15	78.56	252.15
STD DEV:				0.58	0.03	0.10	0.13	32.53	97.69
VARIENCE:				0.34	0.00	0.01	0.02	1058.52	9542.48

SAMPLE NO.	ANIMAL NO.	NAME OF FORAGE KREOLE	GOAT ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
616-1	616	PAY MAI (HUSKS)	1	1.18	0.01	0.03	0.34	36.84	245.58
559	559	FEY LECENA	1	1.14	0.06	0.20	0.17	43.66	249.50
615	615	PAY DIRI (FEY)	1	0.48	0.10	0.06	0.12	98.04	318.63
101		CROSS COASTAL - 1	1	0.81	0.12	0.11	0.14	186.26	334.16
COUNT:				4	4	4	4	4	4
MAXIMUM:				1.18	0.12	0.20	0.34	186.26	334.16
MINIMUM:				0.48	0.01	0.03	0.12	36.84	245.58
AVERAGE:				0.90	0.07	0.10	0.19	91.20	286.97
STD DEV:				0.28	0.04	0.06	0.09	59.79	39.83
VARIENCE:				0.08	0.00	0.00	0.01	3574.69	1586.51

Appendix H: Goat forage analysis results and translations

2nd Sampling Period

SAMPLE NO.	ANIMAL NO.	GOAT ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
2935-A	935 BALE	3	1.19	0.14	0.16	0.04	49.70	304.42
2604-A	604 ABSINT	3	1.33	0.06	0.20	0.06	16.25	250.00
2935-B	935 ABSINT	3	1.84	0.14	0.10	0.09	105.83	298.80
22000-A	FEY MOMBIN	3	1.46	0.05	0.18	0.04	47.03	173.27
2604-B	604 FEY PITIMI	3	0.76	0.03	0.13	0.11	45.53	212.08
22000-B	FEY GOMIER	3	0.98	0.09	0.15	0.15	87.47	268.64
2245-C	245 ZEB KOD-A GRINN	2	0.27	0.09	0.08	0.25	103.56	268.03
2245-B	245 BWA PATAT	2	1.06	0.11	0.22	0.13	31.13	1288.60
COUNT:			8	8	8	8	8	8
MAXIMUM:			1.84	0.14	0.22	0.25	105.83	1288.60
MINIMUM:			0.27	0.03	0.08	0.04	16.25	173.27
AVERAGE:			1.11	0.09	0.15	0.11	60.81	382.98
STD DEV:			0.44	0.04	0.04	0.07	31.58	344.70

SAMPLE NO.	ANIMAL NO.	GOAT ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
2604-C	604 ZEB PATTE KRAB	1	0.75	0.16	0.23	0.34	99.01	266.09
2617-A	617 FEY VENSAN	1	1.05	0.05	0.15	0.04	62.25	292.58
2617-B	617 FEY KANN	1	0.64	0.05	0.07	0.21	87.33	249.50
2558	558 FEY KALALOU	1	1.49	0.20	0.45	0.20	68.20	620.04
2245-A	245 DEKOS (DROUIN)	1	0.88	0.13	0.27	0.36	31.13	516.68
COUNT:			5	5	5	5	5	5
MAXIMUM:			1.49	0.20	0.45	0.36	99.01	620.04
MINIMUM:			0.64	0.05	0.07	0.04	31.13	249.50
AVERAGE:			0.96	0.12	0.23	0.23	69.58	388.98
STD DEV:			0.30	0.06	0.13	0.11	23.30	150.70
VARIENCE:			0.09	0.00	0.02	0.01	543.07	22709.26

Appendix H: Goat forage analysis results and translations

3rd Sampling Period

SAMPLE NO.	ANIMAL NO.	NAME OF FORAGE KREOLE	GOAT ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
3952-A	952	FEY BWADOMM	3	0.83	0.06	0.17	0.10	18.75	125.00
3568	568	ABSINT	3	0.94	0.11	0.18	0.50	79.52	173.96
3952-B	952	FEY GOMIER	3	1.14	0.08	0.21	0.29	50.02	203.30
3185-B	185	ZEB TIPALTO	3	0.21	0.07	0.12	0.23	19.96	349.30
3623	623	PAY PITIMI (GRAP)	3	0.38	0.02	0.12	0.28	52.40	330.59
3683	683	FEY MOMBIN	3	0.37	0.09	0.13	0.09	11.85	143.46
3950-B	950	BALE	3	0.81	0.11	0.22	0.23	24.70	179.10
3960-B	960	DIMOV	2	0.59	0.04	0.18	0.07	29.70	266.09
3960-A	960	ZEB PAT KRABB	2	0.66	0.04	0.15	0.25	180.79	242.30
3185-A	185	ZEB KODAGRINN	2	0.76	0.07	0.56	0.25	21.08	254.22
COUNT:				7	7	7	7	7	7
MAXIMUM:				0.81	0.11	0.56	0.28	180.79	349.30
MINIMUM:				0.21	0.02	0.12	0.07	11.85	143.46
AVERAGE:				0.54	0.06	0.21	0.20	48.64	252.15
STD DEV:				0.21	0.03	0.15	0.08	55.22	68.70
VARIENCE:				0.04	0.00	0.02	0.01	3049.25	4719.39

SAMPLE NO.	ANIMAL NO.	NAME OF FORAGE KREOLE	GOAT ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
3950-A	950	BERYIN	1	0.44	0.10	0.22	0.31	35.20	271.74
3931	931	PAY MAI (HUSKS)	1	0.12	0.00	0.12	0.23	22.94	148.81
3300		CROSS COASTAL - 1	1	1.62	0.09	0.13	0.10	54.67	155.32
3400		BWA & FEY DIRI	1	0.19	0.01	0.13	0.35	29.20	161.53
COUNT:				4	4	4	4	4	4
MAXIMUM:				1.62	0.10	0.22	0.35	54.67	271.74
MINIMUM:				0.12	0.00	0.12	0.10	22.94	148.81
AVERAGE:				0.59	0.05	0.15	0.25	35.50	184.35
STD DEV:				0.60	0.04	0.04	0.10	11.89	50.65
VARIENCE:				0.36	0.00	0.00	0.01	141.27	2565.89

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Appendix H: Goat forage analysis results and translations

4th Sampling period

SAMPLE NO.	ANIMAL NO.	GOAT ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
4245-A	245 BALE	3	0.67	0.14	0.22	0.06	42.61	679.35
4680-A	680 BALE	3	0.99	0.12	0.25	0.38	216.39	148.81
4906-A	906 ABSINT	3	0.63	0.07	0.16	0.11	27.79	160.57
4919-B	919 FEY MOMBIN	3	0.85	0.07	0.17	0.38	35.41	124.25
4245-C	245 ZEB TIPALTO	3	0.27	0.05	0.15	0.22	14.94	410.86
4693	693 ZEB KOD-A GRINN	2	0.35	0.04	0.08	0.11	23.42	258.88
4680-B	680 FEY MAI	2	0.75	0.08	0.17	0.20	59.52	235.62
4245-B	245 ZEB KOD-A GRINN	2	0.28	0.05	0.14	0.36	109.93	284.09
COUNT:			5	5	5	5	5	5
MAXIMUM:			0.85	0.08	0.17	0.38	109.93	410.86
MINIMUM:			0.27	0.04	0.08	0.11	14.94	124.25
AVERAGE:			0.50	0.06	0.14	0.25	48.65	262.74
STD DEV:			0.25	0.01	0.03	0.10	34.12	92.00
VARIENCE:			0.06	0.00	0.00	0.01	1164.32	8464.66

SAMPLE NO.	ANIMAL NO.	GOAT ACCESS	Ca %	P %	Mg %	Se ppm	Zn ppm	Fe ppm
4906-B	906 PITIMI PINTAD	1	0.38	0.06	0.18	0.03	43.94	148.51
4905	905 ?GRASS ON PATH	1	0.49	0.09	0.09	0.30	19.96	318.11
4919-A	919 FEY BWA DIAK	1	1.00	0.04	0.20	0.49	57.55	167.08
COUNT:			3	3	3	3	3	3
MAXIMUM:			1.00	0.09	0.20	0.49	57.55	318.11
MINIMUM:			0.38	0.04	0.09	0.03	19.96	148.51
AVERAGE:			0.62	0.06	0.16	0.27	40.48	211.24
STD DEV:			0.27	0.02	0.04	0.19	15.54	75.95
VARIENCE:			0.07	0.00	0.00	0.04	241.46	5768.87

Appendix H cont.: Forage translations:

KREOLE	ENGLISH	LATIN
Absint	Absinthe	*Artemisia absinthium*
Balé	?	*Sida spp.*
Beryin	?	*Boerhaavia erecta* or *B. diffusa*
Bwa diak	Benzolive	*Moringa oleifera*
Bwa d'orme (Bwadomm)	W. Indian elm	*Guazuma ulmifolia*
--	Cross coastal-1	*Cynodon dactylon*
Dékos	? grass	?
Dimov	? forb	?
Diri	Rice	*Oriza sativa*
Gommier	W. Indian birch	*Bursera simaruba*
Kalalou	Okra	*Hibiscus esculentus*
Kann	Sugar cane	*Saccharum officinarum*
Kod-a grinn	Angleton bluestem	*Dichantium caricosum*
Lecéna	Leucaena	*Leucaena leucocephala*
Mai	Corn	*Zea mays*
Maskèti	Castor bean	*Ricinus communis*
Mombin	Hog plum	*Spondias mombin*
Patat	Sweet potato	*Ipomoea batatas*
Pat krabb	? grass	?
Pitimi	Sorghum	*Sorghum vulgare*
Pitimi pintad	Panicum, browntop	*Panicum fasciculatum*
Pwa kongo	Pigeon pea	*Cajanus cajan*
Pwa rouj	Red bean	*Phaseolus vulgaris*
Tia tia	Woman's tongue tree	*Albizzia lebbeck*
Ti palto	? grass	?
Vensan	Plantain variety	*Musa parasidiaca*

Words common to forage descriptions are translated here:

Zèb -- grass
Féy -- leaves
Pay -- crop residues, including:
- bwa -- stalks/vines
- féy -- leaves that sprout from stubble after harvest
- grap -- threshed grain head

Appendix I: Soils analysis results and descriptions

Soil Descriptions and Associated Forages:

Unless otherwise noted, all soils are non-irrigated and non-fertilized. All are fairly flat land on or near the valley floor.

1. Current Cropland

First sampling:

#245 Drouin: sorghum; NPK fertilized 9-85 (HAS); flat.
Forage #245-1

#558 Desarmes: sorghum & pigeon peas; person's yard.
Forage #558-2

#559 Desarmes: sorghum & leucaena trees; cattle frequently tied there.
Forage #559

#604 Hatte Bellanger: sorghum (and *ti palto* grass).
Forage #604-1; 604-2

#615 Hatte Bellanger: rice; irrigated; possibly fertilized.
Forage #615

#618 Lamoni (above Marin): sorghum; higher elevation, greater slope.

#682 Halaire: sorghum & pigeon peas.
Forage #682

#913 Hatte Bellanger; sorghum (with *absint*).
Forage #913-1; 913-2

#932 Marin: sorghum & pigeon peas; (with *balé*).
Forage #932-1; 932-2

#936 Ha..aire: red beans; slightly higher elevation; irrigated.
Forage #936

2nd sampling:

#2A245 Drouin: sugar cane (sweet potatoes before that); NPK fertilized 9-85.
Forage #2245-B

#2604 Hatte Bellanger: sorghum.
Forage #2604-A; 2604-B; 2604-C

#2935 Halaire: sorghum.
Forage #2935-A; 2935-B

#21000 above Marin: sorghum; hilly.

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Appendix I: Soils analysis results and descriptions

Soil Sample Analysis Values

Sample	P	K	Ca	Mg	Mn	Zn	Fe	Cu	pH	O.M.
	ppm									%
First sampling:										
615	5.428	120.2	265.7	129.5	24.01	1.166	159.4	15.14	7.6	4.7
559	6.038	171.7	435.6	26.82	10.80	1.103	15.75	5.108	7.7	3.4
604	9.004	134.1	454.9	36.27	15.75	.7147	6.689	3.567	7.6	3.0
558	55.79	669.4	448.7	73.49	20.74	3.335	17.05	5.810	7.5	5.8
250	5.839	181.2	360.7	118.9	13.53	.5830	70.95	6.256	7.8	2.1
245	1.399	122.6	359.0	68.59	9.245	.5203	29.60	32.82	7.9	1.7
682	20.50	466.9	445.9	26.25	26.75	3.592	5.656	3.837	7.6	3.8
618	9.178	170.1	434.1	24.16	23.70	4.573	4.408	2.878	7.6	4.1
100	9.924	98.61	422.5	32.39	16.59	3.768	50.20	45.72	7.6	4.7
103	6.131	139.0	426.3	21.20	24.79	.4451	7.728	3.445	7.6	5.1
933	89.64	856.5	492.3	89.76	29.01	8.501	4.815	3.324	7.6	4.7
936	15.72	265.4	462.0	40.22	20.73	2.404	5.255	3.621	7.9	3.2
932	8.298	216.8	466.3	20.07	16.05	1.322	7.012	4.864	7.7	5.8
913	9.715	127.1	432.0	26.90	20.02	.6865	5.711	3.797	7.5	2.8
2nd sampling:										
2A245	2.350	156.8	365.5	64.43	12.14	.6238	29.20	34.54	7.9	2.1
2B245	.6548	197.9	347.6	72.48	14.94	1.147	32.66	65.60	7.7	1.7
2558	2.395	148.7	395.1	78.08	9.913	.4576	24.23	4.445	7.7	0.9
2604	10.07	136.9	425.0	22.03	16.52	.9310	8.475	4.229	7.9	3.2
2932	9.823	326.9	489.5	25.02	39.83	1.407	8.465	5.081	7.6	10.5
2935	9.960	221.8	483.4	25.29	20.32	3.253	5.744	3.135	7.9	3.9
21000	6.476	146.1	449.3	15.64	20.58	.9717	7.328	3.040	7.8	3.4
2617	11.44	366.6	475.3	27.79	27.23	2.238	5.268	3.837	7.8	4.9
3rd sampling:										
3568	21.37	406.3	427.9	34.00	9.866	11.42	6.435	3.595	8.2	3.6
3559	7.397	149.2	413.4	42.10	14.36	.9600	20.23	3.316	8.2	5.6
3185	25.30	512.1	357.7	151.5	8.314	2.278	45.81	70.68	7.9	4.3
3683	86.81	856.1	466.5	83.46	9.970	10.15	6.931	3.418	8.5	4.1
3618	7.001	147.9	428.5	15.08	12.85	.9658	9.444	2.808	8.4	5.4
3562	61.29	562.4	444.3	87.87	11.14	14.78	13.02	3.621	8.3	3.9
3558	2.518	137.2	270.7	78.02	8.255	.8666	122.0	33.27	8.2	2.8
35000	35.21	216.4	401.1	43.41	7.087	4.730	43.09	8.157	8.2	4.7
4th sampling:										
4245	30.06	581.0	338.1	123.0	13.09	2.118	81.59	83.65	8.0	5.1
4906	12.92	158.7	409.2	31.54	9.852	12.29	25.65	5.832	8.3	4.3
4919	9.738	203.4	432.3	17.08	9.608	.8491	5.667	3.354	8.5	4.1
4607	6.901	315.5	391.1	95.92	4.212	.9483	24.17	4.650	8.3	2.8
4935	54.69	440.7	422.6	88.04	7.405	2.713	5.336	2.096	8.4	3.6
4693	6.643	92.39	404.7	14.53	5.395	.3355	9.376	3.557	8.5	2.8
4951	2.529	68.68	392.9	8.892	4.072	.5515	8.632	1.994	8.7	0.6
4952	9.440	277.2	411.0	46.01	9.793	1.931	9.149	3.837	8.4	5.4

Appendix I: Soils analysis results and descriptions

3rd sampling:

#3558 Desarmes: rice; irrigated; possibly fertilized.

#3618 Lamoni (above Marin): 12" corn and sorghum; slightly higher elevation; sloping

#3683 Halaire: corn (24") and sorghum(8").

4th sampling:

#4935 Halaire: corn & sorghum; slight slope.

#4952 Desarmes: corn; almost flat.

2. Fallow or Scrub Land

1st sampling:

#103 Lejean (?): scrub land (kodagrinn grass); slightly higher elevation.

#933 Halaire: scrub land (*balé* and *absint*).

2nd sampling:

#2558 Desarmes: directly by Artibonite River; floods in June-Aug. (sampled in April); last crop was sweet potatoes -- now empty.
Forage #2558

#2617 Marin: scrub land; almost flat.

#2932 Marin: scrub land??

3rd sampling:

#3559 Desarmes: ?? (scrub land/yard)

#3562 Desarmes: fallow field; slightly higher elevation - flattish; *pat krabb* grass.
Forage #3960-A; 3960-B

#3568 Marin: someone's yard; scrub land.
Forage #3568

#35000 Drouin: roadside; scrub land.

4th sampling:

#4807 Hatte Bellanger: canal banks; all species tethered there; scrub land.

Appendix I: Soils analysis results and descriptions

#4693 Halaire: unused patch in middle of corn and sorghum.
Forage #4693

#4906 Hatte Bellanger: roadside near main crossroad; scrub land.
Forage #4906-A; 4906-B

#4919 Marin: semi-flat; person's yard.
Forage #4919-A (at edge of goat pen, therefore manure)

#4951 Desarmes: roadside -- hard ground; semi-flat; scrub land.

3. Pasture

1st sampling:

#100 Deschapelles: grass (*ti palto*) on HAS grounds.
Forage #100; 101

#250 Drouin: grass (*kodagrinn*) - unfertilized; floods from Artibonite River in rainy season.
Forage #250

2nd sampling:

#2B245 Drouin: grass pasture (*kodagrinn*) currently grazed by HAS beef herd; NPK fertilized in 9-85 (HAS).
Forage #2245-C

3rd sampling:

#3185 Drouin: grass pasture (*kodagrinn & tipalto*) currently grazed by HAS herd; NPK fertilized in 9-85 (HAS); by Artibonite River.
Forage #3185-A; 3185-B

4th sampling:

#4245 Drouin: grass pasture (*kodagrinn & tipalto*) currently grazed by HAS beef herd; NPK fertilized in 9-85 (HAS); pasture by corral,therefore high animal traffic; manager not sure if NPK fertilized right before or right after this sampling for 1986.
Forage #4245-B; 4245-C (possibly #4245-A -- at edge of this pasture)