Nunoa Project Alpaca Project

A compilation and analysis of data collected by the Nunoa Project

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ABSTRACT

Nunoa Project is a nonprofit collaboration between individuals associated with the American alpaca industry and the district of Nunoa, Peru. Over the course of three years teams of veterinarians, students, and other volunteers have collected data on alpaca herds in four communities located in the Nunoa District of Peru. This data includes records of intestinal parasitism, ectoparasite infections, pregnancy rates, neonatal mortality, and breeding male evaluations. This paper serves to assimilate and analyze this data in order to direct future projects and locate areas where more data in needed. The main focus of the Nunoa Project is improving the quality of the herds in Nunoa District in the southern Peruvian highlands. The data suggests that intestinal and dermatological parasites have a minimal impact on the overall and reproductive herd health. Instead the data indicates that low conception rates stem from the use of poor quality and too few males. Accordingly, a male improvement program is in progress. The males were chosen from the herd at Mamaniri, the community with the highest quality animals, and distributed in pairs among the other three communities. Another major concern among the communities is the high neonatal mortality due to pneumonia and an infectious bacterial disease called enterotoxemia. The government of the Nunoa District plans to distribute a vaccine against this disease, but little work has been done to combat deaths due to pneumonia. Future plans of the Nunoa Project include sending a team to collect data on neonatal pneumonia and the performance of the breeding males. Pregnancy rates will continue to be monitored and efforts to provide training seminars for the alpaca herders will continue.

INTRODUCTION

Once prized by Incan cultures for many reasons, especially for its unique fiber, the alpaca still plays a central role in the economy of many South American countries, including Peru. Slowly, appreciation of the alpaca's value spread to other countries. In the middle of the nineteenth century, an Englishman, Sir Titus Salt, introduced alpaca fiber to Europe's textile industry. However, it was not until 1984 that South America's northern neighbor discovered the animal's value and the United States imported its first alpacas. The American alpaca industry is centered on raising and selling breeding stock (http://www.alpacainfo.com/about/index.asp). Showing is also a vital aspect of the industry since winning ribbons increases an animal's value and gains recognition for the farm. Comparatively, in Peru the survival of those who raise alpacas is utterly dependent upon the wool crop provided by their animals. Limited shelter, nutritional sources, and medical attention are problematic for animal and owner alike. Instituted in 2009, the Nunoa Project is a nonprofit collaboration between individuals associated with the American alpaca industry and the district of Nunoa, Peru. Finding practical solutions to the issues previously outlined is the epitome of the Nunoa Project's raison d'être. High up in the Andes Mountains in a region called the altiplano, the Nunoa district is home to 14,000 inhabitants and the most alpacas per capita in Peru. This makes it an ideal place for the Nunoa Project to concentrate its efforts. Per its website, the mission of the Nunoa Project is:

- To give back to the country of Peru for their gift of alpacas to the U.S. and other countries in the world
- To make a positive difference in the lives of herders and townspeople of Nunoa, Peru.

- To address immediate needs through humanitarian aid for the people and veterinary support for the animals in the region.
- To exchange information and preserve the rural traditions of herding for future generations in Nunoa.
- To establish self-sustaining programs in the areas of: support for underprivileged children and herding families, veterinary assistance for livestock, and medical assistance to the people of the district (http://www.nunoaproject.org/).

METHODS AND MATERIALS

Description of the Communities

Over the course of three years, teams of volunteers have collected data from four communities within the Nunoa District: Diego Tampara, Mamaniri, Salcaccancha, and Orcoropampa. A common problem confronts these communities. While they are dependent upon the crop of wool gathered from their alpaca herds, many of these alpacas exhibit stunted growth patterns and poor quality fleece. In Diego Tampara, 110 people subsist on income garnered from their six hundred alpacas. Each of the 20 families owns its own animals, in addition to a community managed herd. 300 of these animals are breeding females. At Mamaniri only 3 families reside, but their exemplary management practices and private financial support from an American owner have resulted in the highest quality animals of all the communities. These families care for 1000 alpacas, approximately 30 Brown Swiss cows, 200 llamas, and many sheep. They use 10 males to breed their 350 reproductively mature females. The next community, Salcaccancha, is home to 130 people. Although it has fewer alpacas, about 400 in

total, the community keeps 3 riding horses,50 llamas used for meat, hides, and wool, 150 cows for milk and meat, and 500 sheep for wool and meat. According to the community, there is a need for more breeding males, as they have only 4 males for their 260 breeding females. The last community, Orcoropampa is the most disadvantaged. The herdspeople are unable to read or write. Thus they have not kept production records. This makes the strenuous task of managing their 1800 alpacas, even more difficult. However, officials from the town of Nunoa are working to establish a record keeping system for them. They also report that there are only 8 males available to breed their 800 mature females and their lack of fencing greatly inhibits efforts to increase the quality of the herd's genetics. The Nunoa town government is aiding area communities by providing vaccines against an infectious bacterial disease called enterotoxemia, a major factor in cria mortality, and by supplying color coded ear tags to identify animals and facilitate record keeping.

Intestinal Parasites

Initially 2 of the communities hypothesized that the alpacas' small size and poor fleece stemmed from a problem with intestinal parasites. In January 2010, a team collected 30 fecal samples from the animals at Mamaniri. The samples were mixed with 10mL of a concentrated sugar solution. Using a centrifugation or flotation technique, the team processed the fecal samples and analyzed them microscopically. The following January another team sampled 10 animals from Mamaniri in addition to 20 animals from the community herd at Diego Tampara. These samples were taken from mature alpacas and also younger stock of both sexes. All of these animals were also assigned a body condition score (BCS) of 1 to 5: 1 being emaciated, 3 being optimal, and 5 being obese.

Ectoparasites

Alpacas in the region also suffer from ectoparasite infections. In August 2010 veterinarians noted that mange affected an unusually high percentage of the alpacas at Mamaniri farm as compared to data collected on American herds. Additionally, infections were determined to be from sarcoptic mange, as opposed to the chorioptic mange that is prevalent in the United States. This type has become resistant to treatment with injectable ivermectin in Peru within a few years of use, but application of a topical petrolatum product has proved to be a successful treatment for these infections. Upon return in August 2011, 275 females were inspected during reproductive ultrasounds; 28 (10.2%) presented with signs of mange.

Pregnancy Ultrasound of Breeding Females

Since the Peruvian breeding season runs from December until March, teams from the Nunoa Project performed all pregnancy checks during their semiannual visit in August. Using portable ultrasound equipment, the veterinarians and students efficiently completed hundreds of transabdominal ultrasounds in the field at Mamaniri. In August 2009, 186 females were examined for pregnancy, while in August 2010, 330 were checked. In 2010 the farm manager reported 350 females bred. These pregnancies resulted in 250 surviving neonates. Compared to most of Peru, where the birthing rate is reported to be within the 40%- 50% range, Mamaniri's success rate of about 70% appears to be due to more effective management practices and better quality breeding stock. In August 2011, the veterinary team ultrasounded 253 females from the commercial herd and 22 females from what was designated as the "plantelle" group. This was only a portion of the herd according to the farm's manager. Chosen for the quality of their fleece, the plantelle females are the best of the herd. Those that subsequently do not perform well

reproductively are removed from the group. The teams also recorded the BCS for each of the selected females.

Figure 1: Determining pregnancy using the portable ultrasound. *(Purdy, SR., Lessons Learned in the Peruvian Highlands)*

Cria Mortality

Because the gestation length of the alpaca is between eleven and twelve months, the birthing period in Peru overlaps with the breeding season. For Peruvians, this time also correlates with the wet season. New growth in the pastures provides increased nutrition for the mothers at a time when they need it most. Unfortunately, in 2011 the weather was extremely wet and cold, which increased the incidence of pneumonia among the crias at Mamaniri and the 3 other communities. At Mamaniri, they lost 30 of their 250 crias, while Diego Tampara reported losing 10%. Salcaccancha reported losing 50% of their young stock due to pneumonia and entertoxemia infections. Enterotoxemia is the other major threat to crias in Peru, but a vaccine produced by San Marcos University Veterinary School in Lima has proved to be very effective at reducing its effects.

Male Alpaca Breeding Trials.

In January 2010 evaluation of quality breeding males commenced with six males. It continued through January 2011 and 2012. Inserting a speculum into the female's vagina immediately after breeding enabled the team to collect a semen sample. Sperm activity and estimated sperm concentration were evaluated on site. Secondary evaluations were later performed using an eosin-nigrosin stain to evaluate percent live sperm and sperm morphology. In cases where enough of the sample was available, an actual concentration was assessed using a Neubauer hemocytometer. In January 2012, a group of six superior males at Mamaniri was selected to be dispersed in pairs among the other three communities. This was the beginning of a breeding improvement program for these communities in conjunction with Nunoa officials. Initially males were chosen for quality of fleece and conformation. Select males were further evaluated through breeding evaluations and semen analysis. For each of the males the team recorded BCS, identification tag number, and fleece color. The length and thickness of the testes were also measured using calipers. To appraise breeding potential, the males were turned out at Mamaniri with a group of maiden females and allowed to breed at will. The team recorded which females were bred by the males and quantified breeding duration. During the breeding they also noted any unusual observations. This procedure was repeated at Diego Tampara with two of the males. Semen analysis was performed on all successful breedings.

RESULTS

Intestinal Parasites

Before the teams collected data on the alpacas' parasite loads, yearly ivermectin injections were a major expense for the community at Mamaniri. Considering the life cycle of the parasites found in this region this system was not effective, nor, as the data revealed, was it necessary. Infection rates were similar between males and females, approximately 65% and 69% respectively. The majority of the samples revealed less than 12 eggs per gram (EPG) of feces, indicative of a very low level of infestation. It might seem logical that an animal infected by a parasite might exhibit a low BCS, but data evidenced that this was not the case. Of the 11 animals with a low BCS of 1 or 2, 64% showed positive for parasites, while of the 14 animals with an optimum BCS of 3, 50% were positive and 80% of the animals with a BCS of 4 had fecal samples containing parasite eggs. Thus, data seems to suggest that there is no direct correlation of BCS with parasite infestation at the low levels identified. However, a definite relationship between age and parasite infestation becomes apparent from the data. 83% of the 12 alpacas aged 1 year or younger were positive for parasites, while only 45% of the 18 adult alpacas were positive. Levels and number of different infecting species were also higher in the young alpacas. None of the adults displayed more than 8 EPG (eggs per gram) of any one species and only 2 had multiple species present. Comparatively, the heaviest infestations belonged to the younger alpacas and some were infected by up to 3 different parasite species. Interestingly, the only parasite species that seemed to equally infect each age group were the strongyles, which were seen in low levels in 5 adults and 5 young alpaca, and whipworms, which affected one animal in each age group. Figure 2 shows the number of alpacas in both age groups divided according to the results of their fecal slide readings.

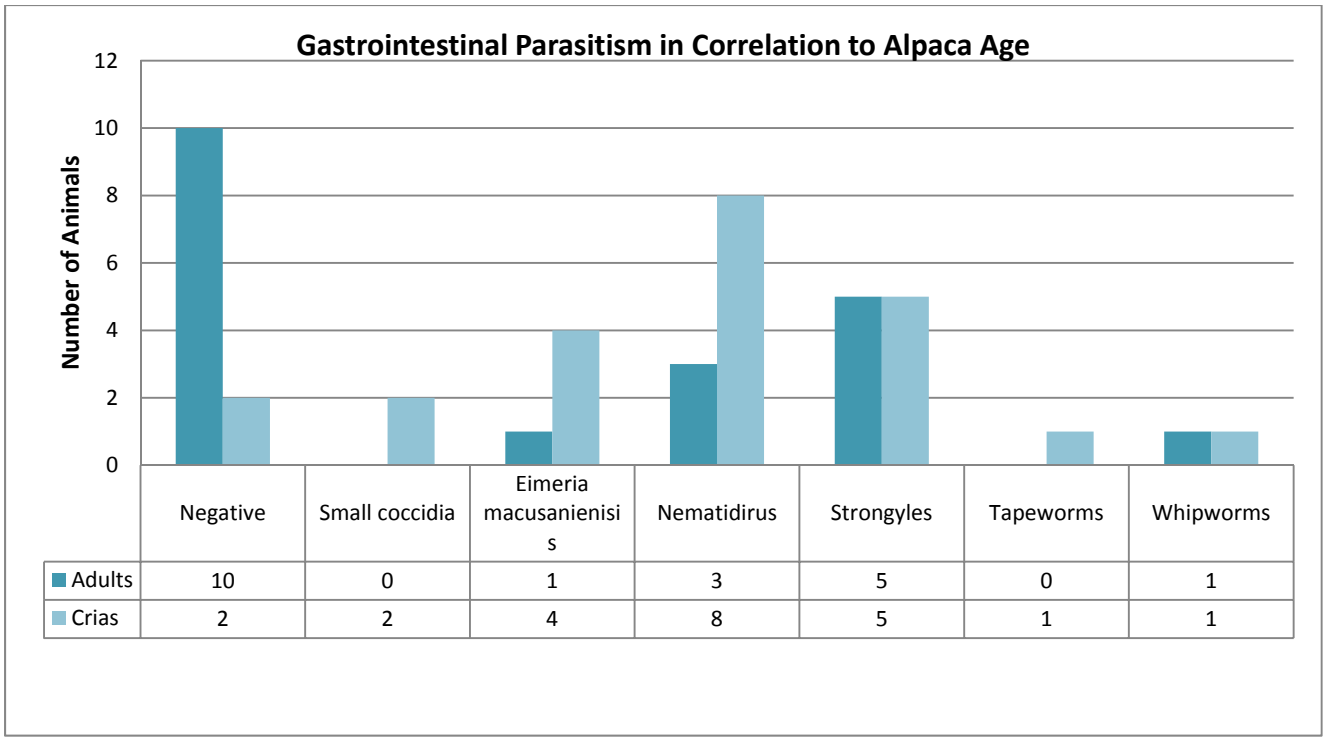

Figure 2: Gastrointestinal Parasitism versus Alpaca Age

Incidence of Mange

In August 2010, the teams examined 82 mature females and 95 alpacas under the age of two from Mamaniri and found that 22% and 8.4% respectively suffered from an ectoparasite. This data suggests that older animals are more affected by mange than younger animals. The reason for this is unknown at this point. Initially the majority of the cases presented as sarcoptic mange, while a smaller portion of infections were visually classified as trombiculosis (red mange). However the next year trombiculosis was the major etiological agent. During pregnancy ultrasounds in August 2011, the team found that 28 of 253 females (11.1%) in Mamaniri's commercial herd were affected by an ectoparasite infection, 23 (82.1%) of which were the result of trombiculosis. 3 of the 22 females (13.6%) in the plantelle group were also affected, 2 by trombiculosis and 1 by sarcoptic mange. Moreover, eight of the nine crias (aged 4 to 12 months)

(88.9%) evaluated were positive for trombiculosis. As infections had no correlation to pregnancy status or BCS score, these parasites seem to be more of a nuisance than a serious condition. A one time application of a topical petrolatum ointment is a very effective treatment against the mites.

Figure 3: Sarcoptic Mange (Sarna) in Peru

(Purdy, SR, Lessons Learned in the Peruvian Highlands).

Ultrasound Pregnancy Examination of Breeding Females

Most of the communities have an issue with low birthing rates. In 2011 Orcoropampa and Salcaccancha reported rates of approximately 50% and 60% respectively. Even the 70% achieved at Mamaniri is low when compared to American statistics where birthing rate estimates range between a conservative 80% and greater than 90%. In 2011 data collected on the females ultrasounded at Mamaniri suggested that pregnancy rates correlate with BCS scores. In the commercial herd, of the 61 females with a BCS of 1 or 2, 29 (50%) were confirmed pregnant, while 123 (73%) of 169 females with an optimum BCS of 3 were found to be pregnant. Of the 23 females with a higher BCS of 4, 15 (65%) were found pregnant. However, in 2012 the superior Huacaya females of the plantelle group had a very low pregnancy rate. Of the 17 examined, 25% were confirmed pregnant, while 100% of the five Suri females were. Pregnancy status did

not seem to have any relation to BCS score in that group. The discrepancy between data of the supposed superior females and commercial grade females was due to two unproven Huacaya males being used to breed with the plantelle group. These males were not tested, but were suspected to be subpar breeding animals, based on the pregnancy rates. The Suris in the plantelle group were not affected since cross breeding between Huacayas and Suris is not allowed. This indicates that the lower pregnancy/birthing rates are due to male breeding issues rather than reduced female fertility relative to low BCS. This seems to hold true across the other three communities. The low birthing rates are due to too few quality breeding males. This revelation was the basis of the male selection program that added quality breeding males to the herds of these communities in January 2012 and will continue to add more in the future.

Cria Mortality

Decreased cria production from low birthing rates is reduced even further by neonatal mortality. The two biggest threats to newborn alpacas are pneumonia and enterotoxemia. In an earlier study, Dr. Raul Rosadio of San Marcos University Veterinary School discovered that *Clostridium perfringens* A was the primary causative agent of enterotoxemia deaths in Peru. Although a vaccine is available and inexpensive by US standards, the cost prohibits most of the communities from using it. The Nunoa Project ran a two year vaccine efficacy trial at Mamaniri and enterotoxemia was eliminated from that farm. Nunoa District plans to distribute vaccine among the other communities in the future. In contrast, other than collecting some preliminary information, the teams sent by the Nunoa Project have not investigated the incidences of pneumonia in the four communities. Because the cria deaths due to pneumonia increased with the abnormally cold and wet weather, it is surmised that the cause is environmental. Nuflor® (florfenicol) injectable, long-acting antibiotic administered to older crias suffering from

pneumonia comprised the entirety of treatment as the farmers were reluctant to move sick crias to shelter or provide special care. This stems from their philosophy that only the alpacas which are strong enough to survive are desirable breeding animals. The Nunoa Project is in the process of locating portable cria shelters which may be used to help prevent this disease in the neonates.

Male Selection Trials.

Better genetics are the key to the future success of Peru's alpaca herds. As Figure 4a below shows, the team rejected as breeding prospects any males suffering from dental abnormalities, stunted growth, or poor quality fleece, including those infected with ectoparasites or those with a mixed color fleece. In Peru animals are only allowed to breed if they have the same colored fleece. The six males that were chosen had good conformation, excellent body condition, and superior fleece. Their testes were of normal size and consistency and all were mature, experienced breeding males. The old ear tag numbers of the selected males were recorded and replaced with new identification tags labeled NP (Nunoa Project) 001-006.

Selection of Nunoa Project Huacaya Males at Mamaniri (January 7, 2012)

Ear Tag	Age (yrs.)	BCS	Teeth	Right Testis (cm)	Left Testis (cm)	Notes	Result
No Tag	~	2	No fighting teeth	small 3.7	3.8	Shorn	Rejected
No Tag	5	3	good	4.5x2.8	4.8x2.5	Split ear	**NP#005**
R0481	5	3	good	4.0x2.8	4.0x2.6	Curled toe nails	**NP#004**
R0482	Adult	3	good	3.8x2.8	4.1x2.6	Trombiculosis	Rejected
R0487	6	3	good	4.5x2.7	4.1x2.8	Superior Fiber	**NP #002**
R0489	4.5	3	good	4.1x2.5	4.0x2.4	Curled toe nails; great fleece	**NP#003**
R0503	~	3	~	~	~	Chorioptic mange	Rejected
R0506	4?	3	Under bite	4.0x2.5	4.1x2.4	Shorn	Rejected
R0508	3.5	3	good	4.2x2.5	4.1x2.8	Curled toe nails; good fiber	**NP #001**
Y033	2.5	3	~	4.1x2.6	4.5x2.7	small stature	Rejected
Y037	~	~	~	~	~	small stature	Rejected
Y038	~	3	~	small	small	small stature	Rejected

Y60593	5	4	good	4.0x2.5	4.2x2.5	~	**NP#006**

Figure 4a: Nunoa Project Male Evaluations

Figure 4b depicts the results of the subsequent breeding trials, when the 6 Nunoa Project males were turned out with a group of maiden females. Any resulting pregnancies would be the consequence of these breedings. Because NP001 or NP003 were not observed breeding any of the females, no semen samples were collected on these males. NP006 tried breeding to two females, but neither attempt resulted in a complete breeding. After being mounted, female B7 kushed, the normal alpaca breeding posture, and subsequently stood up several times. Post breeding vaginal examination showed that her hymenal area was constricted (normal for a first time bred maiden). The second female, B161, was not sexually receptive and after attempting to breed her for 13 minutes, NP006 did not produce a semen sample for evaluation. Most of the collected samples were very viscous. A study at the University of Massachusetts showed this to be normal among alpacas (Mainini, T, *Semen Evaluation and Extension in Alpacas)*. Due to the high viscosity of the semen, activity rather than motility of sperm is evaluated. Afterwards these males were dispersed in pairs to Diego Tampara, Orcoropampa, and Salcaccancha, for a one year trial period. At the end of the year the communities will rotate the males among themselves.

Breeding Trials at Mamaniri (January 7, 2012)						
Male	**Female**	**Breeding Time**	**Estimated Concentration**	**Actual Concentration**	**Activity**	**Notes:**
NP001	~	~	no sample	~	~	Not collected
NP002	B, no number	15 min.	high	~	50%	bloody, viscous; large clumps of sperm on each side, 3 clumps for a total of 16 sperm on top and 1 clump of 6 on the bottom of slide
NP003	~	~	no sample	~	~	Not collected
NP004	Y1427	3 min.	high	$25x10^6$ sperm/ml	60%	Watery- low volume; clump of approximately 60 on one side was not counted
NP005	Y16030	14 min.	high	$30x\ 10^6$ sperm/ml	30%	Very viscous; clump of approximately 200 off to side of counting, not included
NP006	B7	Male up and down	no sample	~	~	Female shifting; hymenal area not dilated

NP006	B161	~	no sample	~	~	Female not receptive

Breeding Trials at Diego Tampara (NP003 and NP004) (January 11, 2012)						
Male	**Female**	**Breeding Time**	**Estimated Concentration**	**Actual Concentration**	**Activity**	**Notes:**
NP004	008	21 mins 15 secs	Moderate	~	40%	
NP003	Did not breed any of the 25 females					

Figure 4b Data gathered on breeding trials performed at Mamaniri and Diego Tampara.

FUTURE WORK

All of the data presented in the paper has been gathered over a three year period. Teams traveled to Peru twice a year, once in January and again in August, staying for about a week each time. It is difficult to gather data when first visiting a community until a relationship is established, thus the data was not completely consistent from year to year. Over these three years it has also become apparent which data is most useful. It will be extremely helpful for future teams to have formatted data sheets so that each team collects consistent data and does not have pieces missing from year to year. In this way better information can be obtained, efforts can be more specific, and improvements made more rapidly.

More semen evaluations should be performed on all of the breeding males, as they are the key to the success of creating superior breeding programs in the communities. Additionally, the six males in the breeding program should continue to be evaluated for semen quality and production of offspring, both in number and more importantly, in quality. Improvement in the individual communities will be evaluated over time. Female pregnancy and birthing rates should continue to be monitored. If the breeding program is successful, the communities should see an increase in the percentage of live births.

There is also a need for more data on the pneumonia related neonatal deaths. These animals are the next generation and future livelihood of the farmers in Peru. It is not definitively

known whether these deaths stem from environmental or bacterial causes, although as previously stated it is strongly suspected that the environment is a major contributing factor. To test this hypothesis a team must run an experiment. They will compare a control group that will receive no treatment to three other groups of crias. One group that will have access to shelter, a second group whose mothers will be vaccinated during pregnancy, and a third group that will have both access to shelter and whose dams will be vaccinated.

Over the years, the week long trips were all that could be managed. However, an extended period of study is necessary to collect a greater range and depth of data, so that the Nunoa Project can obtain a better understanding of actual conditions in Peru and what undertakings would most benefit the Peruvian alpaca herders and their communities. Just such an expedition is in the beginning stages of planning and will hopefully be initiated in December of 2012.

Immediate endeavors to improve the herd integrity and management are already underway. An associate of the Nunoa Project has put together a training power point on management, breeding, and vaccine practices for the Peruvian farmers. Upon finishing the seminar, the attendees receive a certificate recognizing their participation. Through these efforts, the Nunoa Project seeks to improve the lives of the herdsmen, their families, and their alpacas. It strives to increase the knowledge available to all those who care for alpacas, while, as their mission states, giving back to the country that gave them the alpaca.

Figure 5: Certificate receiveced upon completion of the training seminar *(Purdy, S., Lessons Learned in the Peruvian Highlands)*

References

About Alpacas http://www.alpacainfo.com/about/index.asp Retrieved on March 16, 2012

http://www.nunoaproject.org/ Retrieved on March 16, 2012

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