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History and importance of guinea pig production for the indigenous people of the Peruvian Andes

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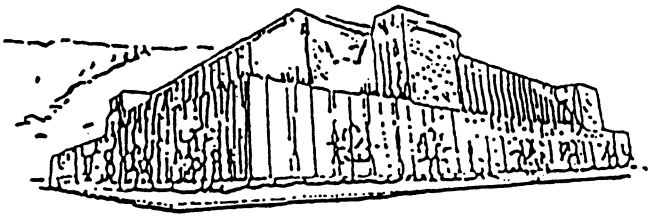

THE HISTORY AND IMPORTANCE OF GUINEA PIG PRODUCTION FOR THE INDIGENOUS PEOPLE OF THE PERUVIAN ANDES

By

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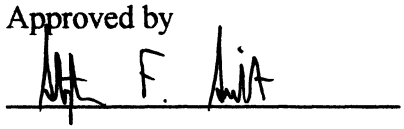

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The Peruvian Andes is a remote region inhabited primarily by impoverished indigenous people whose economy is based on subsistence agriculture. Guinea pigs (cuy) have traditionally been raised by some Andean peoples as a source of food and cash income. Cuy are attractive as a potential means of enhancing the nutritional and economic well-being of Andean households for a number of reasons, including: high fecundity, rapid growth rates, simple and inexpensive maintenance requirements, and meat that is high in protein. This study compiled a comprehensive guide to cuy production for use by extension workers, evaluated the effectiveness of current cuy extension education training in one case study area, and suggests potentially more effective cuy production and rearing methods. The study was undertaken by reviewing published literature on cuy and completing a survey of indigenous families who raise cuy and had received extension training in one region of northern Peru. At present, few cuy are raised for commercial or subsistence purposes in remote Peruvian villages. In fact, survey results indicate that cuy are primarily eaten only on special occasions. Improved cuy production methods, specifically raising cuy in pens rather than allowing them to roam freely in kitchens, as is the traditional practice, could increase the quality and quantity of cuy production, and thereby potentially improve the diets and income of rural people.

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Finally there are no words to express my thankfulness to my Lord who continually protected me and opened doors of opportunities. I hold on to His promise in Jeremiah 29:11 "For I know the plans I have for you plans to give you a future and a hope."

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INTRODUCTION

My first experience with cuy (guinea pig) production on a large scale was in Lima, Peru where I worked with Ing. Lilia Chauca, an animal scientist, and head of cuy research at INIA the National Institute of Agricultural Investigation. For many years Ing. Chauca had worked as a team with her husband, Ing. Marco Zaldivar, author of much of the literature cited in this paper. He was murdered in 1991 by the terrorist group Shining Path. The suspected motive for the killing was the guerrillas anti-American feeling (Morales, 1995). Ing. Zaldivar had received grants from the U.S. Agency for International Development (AID).

I worked with a technician recording production data on 3000 cuyes during my first four months in 1996. At the suggestion of Ing. Chauca I decided to do field research in an area of northern Peru where INIA staff had little information. The first area was the cooperative of Atahaulpa Jerusalem, where I went after meeting with an extensionist who worked with cuyes at INIA in Cajamarca. During this interview I was informed about the cooporative and brought up to date on their cuy production.

When I arrived at the cooperative I was introduced to Mr. Quispe, the indigenous Quechua man in charge of cuy production. For two weeks we worked together during which time I documented the methods of production and problems encountered. Unfortunately one of the cooperative members suspected that I was a terrorist, and I chose to travel to an other area for my own safety.

Chota, which is located 6 hours northeast of Cajamarca, was my second choice for undertaking a cuy study, where I worked with a veterinarian from Jorge Basadre, an NGO.

I traveled for 3 months and interviewed 100% of the indigenous Quechua farmers who had used loans from the NGO to change their cuy production to the technical method. The survey was developed with the assistance of Ing. Chauca at INIA in Lima. It was hoped with the information gathered we would be better able to plan extension work in cuy production for areas not yet reached.

The comprehensive background material on cuy was compiled after recognizing the need for information for use by professionals not familiar with cuy production. Several times in my travels I was asked to send literature to health professionals who had seen a need to assist in cuy production along with their other assigned duties. Videos and pamphlets were available, but a comprehensive guide was not.

BACKGROUND ON PERU

The country of Peru is divided into three areas: the coast, the Sierra (Andes) and lowland Amazon rainforest. Peru is 21% meadows and pasture, 55% forest and woodlands, 3% arable and 1% irrigated (Tenebaum, 1995). Peru has a population of 24 million with 8 million living in the capital of Lima, of these 52% live in squatter areas around the city known as Pueblo Jovenes (Tenebaum, 1995). Portable water and sewage are lacking in 25% of urban and 80% of rural residences (Tenebaum, 1995).

The population of Peru is 52.% indigenous and approximately 1,200 children were dying weekly from malnutrition in 1991 (Castillo, 1992). The principal products of Peru include sugar, potatoes, rice, cotton, corn and coffee, with fish meal being the largest export product (Tenebaum, 1995). In 1989 illegal exports of coca leaf and cocain totaled 5.6 billion dollars.

All over the world women struggle to keep their families alive, many without help, They have no hope for the future, working only to survive. Luck (1996) reported that this is the case for two-thirds of the world's women. Although they produce 80% of the developing world's food and have most of the responsibility for their families' animals and crops, these women own less than 1% of the world's land and make up 70% of the poor (Luck, 1996). Many, out of despair, flee to the cities where they become victims of crime and often resort to prostitution for money to feed their children.

Peru has a female rural population of approximately 35% (Chauca, 1995). In poor rural areas peasant women have always contributed to the development of their families and communities. Their dual role at home and in production through agricultural tasks is not always recognized, nor monetarily rewarded (Chauca, 1994). The peasant women

themselves consider their own work of little importance. With economic improvement in the economy and material and human resources necessary for production, peasant woman tend to decrease participation in agricultural activities (Chauca, 1995).

In Peru peasant women are involved primarily in sowing crops, irrigation, weed-killing and harvesting (Chauca, 1994). Woman are also responsible for breeding small domestic animals such as cuyes and poultry and selling handicrafts. In this way peasant women have the opportunity to earn money and establish social relationships. As they establish social links, these women play an important role in the community and are placed in a good position to organize and present project proposals for their community (Chauca, 1995).

Rural Peruvian families tend to have small plots of land which they work with traditional technology. Family labor is used and the plots are usually far from important markets. A high proportion of families depend on agriculture and production is directed towards family subsistence consumption (Chauca, 1994). Risk aversion inhibits changes in traditional agricultural or animal breeding practices among small farmers (Chauca, 1995). In rural homes, for example, cuyes are still bred through an inefficient household system that does not consider productivity rate (Chauca, 1995). In order to increase production, an improved method of raising cuyes in cages separate from the household using improved bred males has been introduced. The transfer of technology directed towards women living in rural areas could contribute to their development and independence.

HISTORY AND IMPORTANCE OF THE CUY

The guinea pig, Cavia porcellus L. is a small rodent of South American origin. The Quechua speaking people in the Peruvian Andes refer to it as the cuy. Other names used for the cuy are cobayo, conejillo de Indias, huanco in Bolivia, curi in Colombia and acurito in Venezuela. In the Andean countries the cuy population is estimated to be 36 million. (Chauca, 1994).

The cuy belongs to the family Cavididae and is more closely related to the chinchilla and capybara than a rat or mouse (Chauca, 1995). The genus Cavia includes seventeen wild species, all restricted to South America and most are diurnal, live in burrows, and are hunted by local people (Ellerman, 1940).

Domestication of the cuy dates from 2000 B.C. when small houses with corrals were built (Gade, 1967). Ceramic cuyes from the Mochica culture (A.D. 500-1000) give evidence of its' existence on the northern Peruvian coast (Gade, 1967). Breeds of cuyes were believed to have been developed for different purposes during the Incaic era and these differed in terms of color and flavor. The cuy was eaten by the Incas on ceremonial occasions much as it is today (Gade, 1967). Garcilazo de la Vega (1960) reported that "the Indians have many of them and eat them at fiestas." Religious sacrifices were common in Cusco during the Inca reign, when as many as one hundred black llamas and one thousand white cuyes were sacrificed to placate the gods and to prevent damage to the crops (Guaman Poma de Ayala, 1956). Selective breeding was probably practiced as white is a recessive characteristic in guinea pigs (Aliaga, 1993).

The cuy has four positive factors for production that would make it a good possibility to improve nutritional and economical levels of the people in developing

countries. These factors are its fast rate of growth, prolificacy, the many alternatives available for its nutrients and the small area required to raise them (pers. obs.).

Today in rural Peru, the cuy still is a cultural symbol of the indigenous family. It is a source of protein in the diet and is used in gift exchange, to reinforce social relations, as a sign of prestige and a part of medicinal folklore (Gade, 1967). The cuy is a prolific animal with up to eight young per birth, and a short gestation period of 68 days with 4-5 litters a year (Aliaga, 1993). The young are born with hair, eyes open and walk within minutes of birth to eat forage (Chauca, 1995). When the females are fed a concentrate, such as pellets, the young can be weaned at 10 days, the time at which lactation drops off (Chauca, etal., 1984).

Table 1. Chemical composition of cuy meat in comparison with other species

SPECIES	% MOISTURE	% PROTEIN	% FAT	%MINERALS
guinea pig	70.6	20.3	7.8	0.8
poultry	70.2	18.3	9.3	1.0
swine	46.8	14.5	37.3	0.7
sheep	50.6	16.3	31.1	1.0
cattle	58.9	17.5	21.8	1.0

Source: Chauca 1995

Peru maintains a population of approximately 22 million cuyes as breeding stock. These provide an annual crop of about 68 million cuyes for slaughter, yielding about 17,000 metric tons of meat (Conestcar, 1978). The meat is dark and rich, having a

protein content of 20.3% and a fat content of 7.8% (Table 1), with a taste similar to rabbit (Chauca, 1995).

When they are slaughtered the neck is broken or cut with a knife. The entire animal is then dipped into boiling water to loosen the hair which is plucked the same way feathers are removed from a chicken. The abdomen is then opened and the viscera removed. The carcass yield for the indigenous cuy is 54.4%, 450-600 grams, while the improved cuy yield increases to 67.4% (Chauca, 1995) The animal is usually served roasted or fried. Restaurants serve fried cuy with boiled potatoes, rice, and sweet potatoes. Another dish served is corina, a stew made with fried pieces of cuy, potatoes, onions and capsicum peppers (Morales, 1995).

The amount of protein available from a 1,000 gram improved bred cuy is approximately 136 grams, assuming a carcass yield of 67% and 20.3 % protein. Luna and Moreno (1969) estimate that, of the total weight of the cuy, hair and blood is 8.5%, viscera 26.5%, carcass 65%, and bones 13.5%.

The diet of the indigenous people of Peru is low in protein, the only sources being the grains of quinua, kiwichi and eggs (pers. obs.). Beans are not consumed on a daily basis. Generally, livestock is sold to buy staples such as rice, macaroni, sugar, kerosene and cooking oil, rather than slaughtering them. Peruvian women traditionally have managed cuys and often prefer to sell them to buy other food items (generally carbohydrates) that will fill the stomach (personal observation).

Cuy production could potentially improve the diet of Peruvian people and supplement their income. Under ideal conditions at the Agrarian University in Peru, 0.5

cuy is weaned per female per month, however, in the Sierra this drops to 0.25 (Chauca, 1994). An example of cuy production would be for a family of six members who desired to eat two cuyes a week, or 8 a month. A breeding population of 32 females and 4 males would be required to produce cuy at this rate. If improved male cuyes were utilized this would require an initial investment of $20 per family, or only one improved male could be purchased, using the income from the offspring to purchase others. Unfortunately in the Peruvian Andes much of the family income is spent on alcohol consumption, and a change must start at the social level.

BREEDS

Cuyes are classified according to their conformation and hair type. When classifying by hair four types are described.

The ENGLISH, TYPE I , (Lacio) has short straight hair that is smooth and lies close to the body. This type is the most commonly used for meat (Aliaga, 1993). It may or may not have a cowlick or swirled hair on the top of the head. These come in a variety of colors from white, cream, yellow, to black (Fig. 1, Appendix 4).

The ABYSSINIAN, TYPE 2, (Abisinio) has short hair that is rough-coated with rosettes and ridges over the body formed by the unusual way in which the hair grows. This type is found in the criollo populations and exists in various colors. When crossed with other types (Fig. 2, Appendix 4) these traits are recessive (Aliaga, 1993).

The PERUVIAN, TYPE 3, (Landoso or Hippie) genetically is a long haired Abbyssinian. The rosettes on the top of the body make the hair lie towards the head and fall over the face. The hair may grow up to 50cm. These are show animals and must be

groomed daily to keep the hair from matting. Generally wrappers made of paper and balsam wood are tied around the hair to keep it clean (Henwood, 1985). This type is not to be confused with the Improved Line Peru which was bred from Type I English (Fig. 3, Appendix 4).

The MERINO, TYPE 4, (Erizado) is more common in the northern Peruvian Highlands. The hair of the newborns is as tightly curled as a lambs wool becoming bristled as the animal grows. The head and body are round shaped and Merinos have a higher percentage of muscle fat and the meat is more flavorful (Aliaga, 1993).

The English and Abyssinian types are most common in Peru (Chauca, 1995).

Two types are recognized when description is based on body conformation . TYPE A has a short small head. The body is compact and rounded. These animals are tranquil and easy to manage. They are characterized by high rates of growth with animals reaching 2.5 kilograms (Aliaga, 1993).

TYPE B cuyes are nervous animals that have a longer body than Type A's with angular heads. The outer ear is smaller and may be absent. Feed efficiency and growth rates are inferior to type A. Type B was shown to have a higher resistance to stress caused by improper management or feeding (Zaldivar and Rojas, 1990).

In the Andean countries there are two genotypes of cuyes: the criollo and the improved. The indigenous criollo is a smaller animal weighing less than one kilogram. It has developed under harsh conditions and poor nutrition (Chauca, 1995). These cuyes are generally raised in family kitchens where they can be close to the heat of the cooking fire. Their productivity is low due to disease, internal parasites and poor management (Chauca,

1995).

In 1966 work began at the Experimental Station in Lima Peru (INIA) to improve the genetic potential of cuyes for meat production. Animals were selected for their prolificacy and rate of growth from Type I English (Peruano cuyes) (Zaldivar and Chauca, 1988). This work was necessary as the indigenous cuy had decreased its size through inbreeding to the point at which a 3 month old weighed only 400 grams (Zaldivar and Chauca, 1989). With the 1st generation of cross breeding using an improved male the weight of the offspring increased 60% (Chauca, 1994). There are presently three improved lines of cuyes at INIA as follows:

The LINE PERU was selected for their rate of growth. At nine weeks they reach the harvest weight of a kilogram. The feed conversion index is 3.81 with a diet of concentrate and forage. Average litter size is 2.8 young (Chauca, 1995). Table 2 shows the weight gains from birth to 13 weeks of a 3/4 Peru (INIA) and an indigenous (Sierra) cuy on a family-commercial farm (Fig 4, Appendix 4).

Table 2. Weights of 3/4 Peru crossbreds and indigenous cuyes in a traditional system

	Average weight (g)	
Age of Young	3/4 Peru	Indigenous
Birth	151.25	131.60
1 Week	257.77	186.12
4 week	412.66	307.75
8 week	689.42	519.71
12 week	835.47	665.00
13 week	896.31	723.00

Source: Chauca 1995

LINE ANDINA was selected for prolificacy. They have 3.9 young per litter and have an increased number of litters per year due to an 84% postpartum heat (Chauca, 1995) (Fig. 5, Appendix 4).

LINE INTI was selected for increased weight at 10 weeks and increased litter of size. This line has the highest survival rate (Chauca, 1995) (Fig. 6, Appendix 4).

The results of crossing the criollo with the improved breeds have been successful as can be seen in Table 3 with an increase in weight at 8 and 13 weeks over the criollo.

Table 3. Weights at birth, weaning, 8 and 13 weeks

Crossbreeding	Weight in grams			
	Birth	Weaning	8 weeks	13 weeks
INIA X INIA	148.4	458.9	860.8	1091.3
INIA X COAST	123.6	393.4	582.6	795.4
INIA X SIERRA	146.5	260.4	429.6	626.2
COAST X COAST	117.6	268.4	383.3	483.7
SIERRA X SIERRA	87.4	263.6	356.7	458.9

Source: Chauca 1995

Avila and Bautista (1984) reported that in the warm weather of Colombia the crossbred cuyes have an average weight gain of 5.52 grams per day and typical carcass yields of 49.9%, as compared to criollos with an average carcass yield of 46.2% and 4.6 grams weight gain per day. Where the Line Peru INIA cuy was crossed with the criollo of

the Sierra the results were 167.3 grams more weight at 13 weeks of age (Avila and Bautista, 1984).

SYSTEMS OF CUY PRODUCTION

In Peru three cuy breeding systems based on the method of production are recognized: family system, family-commercial, and commercial or industrial. Ninety-three percent of the cuyes in Peru are produced under the family system in which the animals are raised in a room in the house, usually the kitchen (Chauca,1995). The heat from the fire keeps them warm as they have thin fur and little subcutaneous fat (Lane- Petter and Porter, 1963). Indoors the cuyes are also protected from natural enemies such as weasles. The adobe homes in the Sierra have no other source of heat, and with the drastic temperature changes from day to night the cuyes would not survive at the higher elevations. Bolton (1979) reported that a common belief is that smoke is required for cuy survival as water is not provided and it is believed that they "drink smoke". Smoke in Quechua (k'osni) also includes vapor or steam. "By having cuyes live near fire, villagers provide them with high humidity (a source of water), and also some protection against disease carrying fleas and lice" (Bolton 1979).

The cuyes run loose in the houses and are provided with cubbyholes (cuyeros) of rock or adobe (Gade, 1967). Under this system, there is little management or controlled mating. The animals are cared for by children and women, and are fed scraps from cooking, grasses, alfalfa, or crop residues (pers. obs.).

All animals are kept together regardless of sex, age or class. There is a high degree of in-breeding and mortality of the young due to suffocation and competition for

food (pers. obs.). Many newborns are killed at breeding during the post partum heat (Aliaga, 1993). With this system it is common to sell or consume the larger animals that bring a higher price leaving small breeding stock. As the investment is small this system does have its advantages as it provides a low cost protein source for the family and extra income when sold or traded (trueque) for other products. The average number of animals raised is 20 determined primarily by the amount of feed available (pers. obs.).

The second system is the family-commercial (semi-industrial) system which has a population of under 500 cuyes with 150 breeding females (Chauca, 1995). The animals are separated according to sex, age, and class (reproducers, weaned, market) and are kept in small cages (jaulas) or in larger pens (pozas). The nutrition is agricultural by-products, cultivated forage, or a commercial concentrate such as rabbit pellets. Sanitary control is more strict to prevent disease (Zaldivar and Chauca, 1988). The males from improved lines of INIA, Peru and Inti, have been introduced to be crossbred with the female indigenous criollo to produce offspring that can be marketed at nine weeks of age compared to twenty weeks for criollo x criollo (Chauca, 1995). With migration from the sierra to the coast that has occurred in Peru during the years of terrorism 1970's-90's, there is now a far greater demand in cities for cuy (Chauca, 1995). Traditionally cuy is eaten at baptisms, marriages, religious celebrations and national festivals, at which time the price for cuy can triple (personal observation).

The commercial system of production has been developed in the valleys near urban areas where there is a market for cuy meat. Advanced technology is employed using genetically improved animals that will reach market weight at 9 weeks. Of the total

population 32% will be reproducers , a percentage that reflects the efficiency of the management of breeding stock and the health of the young (Chauca, 1994). The population in commercial operations ranges from 500 to 3000 cuyes (Zaldivar and Chauca, 1988).

INSTALLATIONS FOR RAISING CUYES

The cages for breeding cuyes at a family-commercial level are best made out of local construction materials such as adobe, bamboo, bricks, wood or reed grass to lower costs. It generally is recommended that these be constructed away from the main living quarters of the family to prevent the spread of disease. Light and ventilation are important to control the inside temperature and to prevent high humidity which can cause respiratory disease through the buildup of ammonia. When the temperature surpasses 30^0 C the pregnant animals die and water must be provided at all times or cannibalism may result (personal observation).

Raising cuyes in a pasture setting is possible with portable cages (jaulas) utilizing 1" wire bottoms. The cage can be placed in a pasture after the forage has been cut for other animals. The cuy will eat through the wire on the bottom, while still being protected from predators. The need to cut forage each day is eliminated, thus saving labor. The cage should be moved at 6 am and 6 pm to take advantage of the nocturnal grazing habits which can increase ingestion by 40% (Aliaga, 1993).

A Morant hutch is also constructed to be portable. It is a triangle, two thirds of which is covered with wire netting, the remaining third being covered by a wooden house. The dimensions are 300 cms x 80cms high. A raised shelf inside keeps the animals dry

(Henwood,1985).

Wood casetas (houses) are used in warmer climates. These are divided into four sections of 1.25 x 1.25 x .30 meters. Pen #1 is for reproducers, six females and one male. Pen #2 is for weaned males. Pen #3 for weaned females, and pen #4 for future breeding animals, only females. With a nucleus of 6 females there will be 3 cuyes a month available as food for the family (Saravia, 1993).

Galpones are used in commercial production of cuyes. These are large covered buildings that hold over 1000 animals. The shape of each poza (pen) is usually rectangular or square with measurements of 1.5 x 1 x 0.45 meters or 1 x 1 x 0.45 meters. The floor is dirt or concrete to facilitate cleaning (Aliaga, 1993). Ventilation is important to facilitate drying and to remove the ammonia order. The temperature is best between 15^0 C and 18^0 C, with humidity above 60%. It is recommended that one length of the galpon face east so the rising sun will warm the galpon. The wind direction should also be considered. In a poza measuring 1m sq. there is space to raise 10 females and one male or 12 to 15 weaned animals up to three months of age (Zaldivar and Chauca, 1988).

NUTRITION

The cuy is a herbivore with a monogastric stomach. It has two types of digestion: enzymatic at the level of the stomach and small intestine and microbial at the cecum (Chauca, 1994). It can live on a diet of only grasses or concentrates. In the Puna at 4000 m they are fed fibrous grasses which are difficult for other animals to eat and the algae from lakes. In the lowlands they eat weeds and crop undergrowth (Chauca 1995). In all areas they are fed crop aftermath and kitchen scraps. For these reasons the cuy is versatile

and inexpensive to raise. The common plants fed in Peru are: "Cardo santo" (Argemone mexicana), "cerra jera" (Sonchus oleraceus), "lengua de vaca" (Rumex crispus), "nudillo" (Leptochloa tiliformis, Paspalum haenkesnum), "retama" (Spartium junceum), "grama china" (Sorghum halepence), "alfalfa" (Medicago sativa), and "treboles" (Trifolium sp.) (Chauca and Zaldivar, 1994).

There are three types of feeding methods: forage, forage with concentrates, and only concentrates with water and Vitamin C (Zaldivar and Chauca, 1989). The nutritional requirements of cuyes vary according to stage of growth, lactation and reproduction (Aliaga, 1993). The basic nutritional requirements for growth are shown in Table 4.

Protein

Ration protein is important for maintenance and muscle formation (Zaldivar and Rojas, 1990). The following points should be kept in mind. The total protein content of the ration should be 20-30% and derived from two or more sources. A concentrate ration of 10% protein or more is recommended as an increased % protein means less concentrate consumed. At the growing stage of the cuy the % protein in the diet is increased (Aliaga, 1993).

Table 4. Basic nutritional requirements for the cuy

NUTRIENT	PER KILOGRAM OF FEED
Protein (%)	20-30
Energy TDN (%)	65-70
Fiber (%)	6-18
Minerals	
Calcium (%)	1.2
Phosphorous (%)	0.6
Magnesium (%)	0.35
Potassium (%)	1.4
Cobalt mg.	0.002
Vitamins (mg.)	
A	12
D	-
E	60
K	10
C ascorbic acid	200
Thiamin	16
Riboflavin	16
B6	16
Niacin	50
Pantothenic acid	20
Biotin	-
Folic acid	10
Choline (g)	1

Source: Aliaga 1993

Energy

Energy in the diet, expressed as total digestible nutrients (TDN), should be 65-75%, since increased energy content in the feed means decreased feed consumption (Zaldivar and Rojas, 1990). Carbohydrates, which are found in larger proportion in cereal grains and by-products, and fats are the main sources of heat and energy (Aliaga, 1993).

Fiber

Fiber is important in the cuy diet due to the physiology and anatomy of it's cecum

(blind gut) that is large and allows for a diet high in cellulose. Through microbial action there is better utilization of the fiber (Zaldivar and Rojas, 1990). Fiber content in the diet should be 6-18% (Aliaga, 1993). A higher fiber diet slows down the passage of nutrients in digestion to allow greater utilization by microbial action at the level of the cecum and colon (Zaldivar and Rojas, 1990). There volatile fatty acids are produced that contribute significantly to satisfy energy requirements of the cuy (Zaldivar and Rojas, 1990).

Minerals

Mineral requirements for the cuy are shown in the Table 4. Of importance is a 2:1 ratio for calcium to phosphorous (Aliaga, 1993).

Vitamins

The cuy cannot synthesize vitamin C, however if fed a good quality green forage the requirement of 4 mg per 100 g live weight is met. When forage is restricted 20 mg. of vitamin C per animal per day is sufficient (Aliaga, 1993). Vitamin C deficiencies result in loss of weight, red inflamed ulcerated gums, loose teeth and sore joints, to the point that the animal will drag its hind legs (Fraser, 1986).

Water

Water has traditionally been limited in family breeding systems. The fresh forage and vegetable scraps satisfy this need (Chauca and Zaldivar, 1994). In confinement a fungus growth from the watering dishes is a problem and the best method is a drip system as is used for rabbits (pers. obs.).

Water consumption during the reproductive stage has these advantages: increases the number of cuyes born (Table 5), reduces death in nursing animals 3.2%, increases live

birth weight 125 grams and weight at weaning 34 grams, increases pregnant female weight 125 grams and decreases weight loss during lactation (Chauca, 1995).

Table 5. Production of female cuyes with water in the diet fed ad libitum

SIZE OF LITTER	WITHOUT WATER	WITH WATER
At Birth	2.73	2.78
At Weaning	2.42	2.53
Mortality of Weaning %	12.22	9.00
Weight in grams		
Birth	118.03	135.84
Weaning	176.97	213.70
Total Weight of litter in grams		
Birth	321.90	377.33
Weaning	423.66	540.19
Weight of Sows		
Parturition	1032.5+ -162.4	1157.6+-154.4
Weaning	934.0 + -203.1	1123.8+-172.0
Fertility % of sows	82.5	90.0

Source: Chauca 1994

An adult cuy requires ½ cup of water a day which can be given in the form of 437 grams of fresh forage per adult animal (Chauca, 1995). The benefits of additional water can be greatly observed in temperatures over 18^0 C (pers. obs.). A young cuy requires between 50 and 100 ml of water a day (Chauca, 1994). This requirement increases with temperatures over 27^0 C. Research at INIA on the central Peruvian coast in the summer

months has shown that cuyes that were seven weeks old drank 51 ml of water while those at 13 weeks increased water consumption to 89 ml daily (Chauca, 1994)

TYPES OF RATIONS

A high quality ration during the reproductive stage increases production, including the number of young weaned per month. Whole grains such as oats, barley, wheat and corn can be used as a less expensive alternative for reproducers and market cuyes as these are easily accessible (Chauca, 1994). In the northern Sierra oats and barley that has been soaked for added moisture in the diet is fed with the forage (pers. obs.).

A fresh forage ration in the diet of the cuy is desirable for the following reasons. The cuy has a large capacity per pound of weight due to its' nocturnal habits of eating which increase ingestion by 40% (Aliaga, 1993). For its body weight the cuy consumes 2.5 times more than a sheep and 3 times more than a cow (Aliaga, 1993) (Tables 6 & 7). The cecum is developed and metabolizes high fiber content feeds through microbial action. Through coprophagy the feces are recycled to further utilize feed. Water and vitamin C requirements are generally met .

Table 6. Average amount of forage consumed (gr./cuy/day) at various growth stages (weeks of age)

1	2	3	4	5	6	7	8	9	10	11	12	13
167g	172g	188g	201g	211g	227g	236g	248g	263g	271g	278g	284g	290g

Source: Chauca 1994

Table 7. Average amount of concentrate consumed (gr./cuy/day) at various growth stages (weeks of age)

1	2	3	4	5	6	7	8	9	10	11	12	13
10.5g	12.2g	13.5g	14g	18g	19g	24.7g	26.5g	27g	27.2g	27.5g	27.7g	28g

Source: Chauca 1994

All forage should be cut later in the morning or allowed to dry for an hour before feeding to prevent colic and diarrhea (Chauca and Zaldivar, 1994). Concentrates made from nontraditional products such as feather meal are more economical. The amounts consumed per day according to cuy age are listed in the Table 7.

Some other plants utilized for cuyes are: trebol carretilla (Medicago halepense), Poas, potatoes, leaves and trunk of banana, apple, lemon, and banana peels, peas, habas, carrots, cauliflower, broccoli, beets, and corn husks (Aliaga, 1993). Lettuce should be fed sparingly as excess can cause liver damage. Cabbage also can cause colic and is best avoided (Aliaga, 1993).

It might be mentioned that feces of poultry and cuyes have been also used although the risk of salmonellosis is high due to contamination (pers. obs.).

There are several recommendations for fattening cuyes for market. By making use of nocturnal feeding habits ingestion can be increased by 40% (Aliaga, 1993). Use expensive nontraditional products as blood or bone meal, feather meal, fish meal, cotton shell, cotton paste, or retama flour (Aliaga, 1993). The fastest growth occurs up to 13 weeks slowing to 20 weeks so the cuyes should be sold at the optimum time before their daily gains levels off (Zaldivar and Chauca, 1988). To avoid over crowding it is recommended to have 12 to 15 animals per square meter up to 3 months of age (Luna and

Moreno, 1969). Best results have been obtained when forage is fed in the morning and concentrate in the evening (Chauca and Zaldivar, 1994).

REPRODUCTION

The weight of the female more correctly determines breeding time rather than age. A heavier weight of the sow will influence her weight at delivery and weaning, the size of the litter and the weight of the young at birth and weaning (Chauca, etal.). The majority of the literature states 3 months of age or a weight of 542 grams to begin breeding The puberty of the female cuy under normal management is between 55 to 70 days, and is greatly influenced by the nutritional condition of the animal (Aliaga, 1993). It is not advisable to delay breeding age past five months for females. They risk having the articulations of the ileo sacral pelvis soldered resulting in dystocia, the death of the sow or young (Aliaga, 1993). Table 8 illustrates results of breeding cuyes ages two months to five months.

Table 8. Results from breeding females ages two- five months of age

Age at first breeding	2 months	3 months	4 months	5 months
Weight before breeding	385 grams	589 grams	775 grams	798 grams
Weight after parturition	773 grams	867 grams	986 grams	965 grams
Size of litter	1 cuy	2.6 cuyes	2.4 cuyes	2.5 cuyes
% Mortality of young at weaning	100 %	27 %	21 %	22 %
Average weight of young at weaning	_	220 grams	238 grams	213 grams

Source: Aliaga 1993

Estrus occurs every 15-17 days with spontaneous ovulation 10 hours after sexual receptivity. The ovum have a 15 hour life and the spermatazoids 30 hours (Lane-Petter and Porter, 1963). After copulation a "vaginal plug" is excreted, 2.5 cm long and 1 cm wide. This is difficult to find as it is eaten. This plug prevents the backflow of semen left in the vagina (Aliaga, 1993). In one study within the first two hours after parturition 64% of the females present an estrus with a duration of only 3-5 hours (Asdell, 1964). In research at INIAA, after evaluating the first two deliveries of cuyes, 68.3% were covered in the postpartum heat and 31.7% after the weaning (Chauca, 1994). In the improved lines of Peru and Inti, which are selected for growth rate, post partum breeding was 54.6% and 57.9% respectively. The Andina line, which is selected for prolificacy, rated 74.7% pregnancies per postpartum heat. The interval between parturition was 68 days for postpartum heat breedings and 112 days for post weaning impregnations (Chauca, 1995). Gestation is 67 days with variations of 58 to 72 days with a half day longer for litters with more males (McKeown and MacMahon, 1956). Gestation also varies with the size of the litter, a large litter having a shorter gestation period. For example: for a litter with one young, gestation is 70.5 days, while for six young gestation is 66.8 days (Aliaga, 1993). It is important that the female receives quality nutrition and water during gestation or she may abort (Chauca, 1995). Sexual maturity of male cuyes occurs at four months and in improved breeds their weight will be over 1.1 kg. (Chauca, etal., 1984).

Fifteen days prior to breeding the females a concentrate can be offered to increase the size of the litter and improve fertility (Chauca, etal., 1984).

There are four breeding systems for raising cuyes. In the intensive or continuous

system one male should remain with seven females continually to take advantage of the postpartum heat. There will be 4-5 litters born a year per female. The weaned animals are removed at 10-21 days (Aliaga, 1993).

The semi-intensive system has the pregnant females separated from the male in a pen. They remain here until the litter is weaned and are then put with the male (Aliaga, 1993).

The mixed system differs in that after breeding the pregnant females remain with the male until one day after parturition. On this day they are removed to the maternity pen. They remain here until the young are weaned then are put again with the male (Aliaga, 1993).

Under the controlled system four breedings are planned a year. A male is placed with the females for 34 days every trimester and the postpartum heat is not utilized. After 34 days the males are removed to a separate pen. A concentrate is fed to the males 15 days before breeding and during the 34 days they are with the females to increase fertility (Aliaga, 1993).

The results of the intensive (continuous) system compared to the other 3 systems are: the size of the litter was larger, mortality of young was less from birth to weaning, total weight of young was greater and there was a savings of 50% on concentrate. However, one less litter a year was obtained with the continuous system (Aliaga, 1993).

It should be noted that utilizing the postpartum heat has not changed the number of births per litter. However, the weight of the young was 121 grams compared to 135 grams with females bred after weaning (Chauca, 1995). Prolificness depends on genetic factors

and nutrition. To calculate the percent fertility use this formula: number of females giving birth/number of females bred - number died during pregnancy x 100 (Aliaga, 1993).

PARTURITION, LACTATION AND WEANING

Dystocia (difficult births) seldom occur in cuyes . The main causes are breeding a female for the first time at 5 months of age or older and breeding low weight females to large males (Chauca, etal., 1984). The female usually delivers at night. They have only two teats but can easily nurse 4-6 young due to the quality of the milk and the fact that a female will nurse young not her own (pers. obs.). The milk of a cuy has three times more protein and 15 times more fat than cow's milk (Aliaga, 1993) (Table 9).

Table 9. Composition of cuyes milk compared to other species

Species	Water (%)	Albumin (%)	Fat (%)	Sodium (%)
Cuy	41.11	11.9	45.8	0.57
Cow	86.0	3.8	3.7	0.65
Mare	89.0	2.7	1.6	0.51
Woman	87.0	1.1	4.5	0.20

Source: Aliaga 1993

At birth, the eyes of cuyes are open and the young are fully developed and they begin eating forage after 3-4 hours (pers. obs.). There is a positive correlation between weight at birth and weaning weight (Chauca, etal., 1984). It is recommended that weaning of the improved breeds occur at 11 days when lactation decreases. Weaning before this time can result in mastitis (Chauca and Muscari, 1984).

Due to poor nutrition and decreased weight gains in cold climates the criollo cuy raised in the family system should be weaned at 21 days (Chauca, 1995). The highest

number of deaths occur before weaning (pers. obs.). Creep feeders have been used with positive results. This enables the young to eat undisturbed and prevents trampling by adults (pers. obs.). When the temperature is below 12^0 C it is necessary to use a heat source during lactation continuing to one week after weaning (Chauca and Zaldivar, 1994). On the coast a light bulb hanging in the pen is sufficient (pers. obs.).

In the Andes, if raising cuyes by the technical method, a wood burning stove is needed between the hours of 9pm and 6am. This can cheaply be made from a 5 gallon vegetable oil can.

It is important to separate weaned animals according to sex, age and size with 10 males and 15 females per pen (Chauca, etal., 1984). Given a ration of 17%-20% protein they will have weight gains of 15 grams per animal per day (Aliaga, 1993). After four weeks of age a diet of 14% protein and high energy is desirable to reach harvest weight (Aliaga, 1993). The market accepts cuyes with a carcass weight of 460 grams equivalent to 750 grams live weight (Aliaga, 1993).

When choosing reproducers the criteria are size and weight at weaning and rate of gain per day during the growing stage (Zaldivar and Rojas, 1990). The time of culling for market animals depends on the following: the ages at which the cuy reaches minimum market weight, cost of the ration consumed, and market price of the cuy.

Castration is not a common practice with the animals observed, however castration can prevent fighting among males, increase the quality and flavor of the meat and slightly increase carcass weight (Aliaga, 1993). The recommended age is 30 days (Aliaga, 1993). The procedure is to disinfect and make a small cut (0.5cm) at the base of the scrotal sac

and apply pressure until the testicle is seen. Cut the testicle using the fingernail, stitch and again disinfect (Aliaga, 1993).

BREED IMPROVEMENT

The following goals are desirable for breed improvement: a rapid rate of growth to reach market weight in the shortest time, prolificacy - number of young per birth and number of parturitions per year, conversion- amount of feed required to produce 100 grams, the % of carcass to live weight and conformation and quality of carcass (Aliaga, 1993).

When selecting for live weight and litter size the bottom line is profit and the goal of the producer should be to have the minimum amount of reproducers with optimal production. To accomplish this: at weaning select animals for live weight and size of litter and at 6 weeks begin a 30 day test for rate of growth (Zaldivar and Rojas, 1990). Fifty percent of the males can be culled at 10 to 12 weeks depending on the market price (Zaldivar and Rojas, 1990). The females and males can be selected for production and weight of young per pen (Aliaga, 1993).

To select for rate of growth, male cuyes are weighed at two months of age. The control group should all receive the same ration, and be weighed again in 30 days . The rate of growth = final weight - initial weight/30 days (Aliaga, 1993).

With studies using improved lines of cuyes it was found that genetics, not nutrition, was the determining factor (Guzman, 1968). The lines Peru and Inti reached market weight or 760 grams between the eighth and tenth week while Andina delayed until the twelfth to thirteenth week, as can be seen in Table 10. The fastest weight gain occurred

between the 1st and 3rd week of age (Zaldivar and Chauca, 1989).

Other characteristics that can be selected for in cuyes are eye color, coat color, and number of toes. Eye color is normally dark, however when pink does occur it can easily be eliminated by selection (Aliaga, 1993). Cuyes with pink eyes weigh less as they have less vision and cannot compete for food (Aliaga, 1993). Coat color affects skin color and market price, black and grey animals are less desirable due to a dark skin (pers. obs.). As cuyes are served fried or roasted a light skin is desirable, however, white is recessive. Black cuyes do have a demand by curanderos (healers) (Morales, 1995). The number of toes has no effect on production (pers. obs.).

Points to remember when selecting cuyes for market are: proper nutrition is the best tool for fast weight gain in crossbred animals (pers. obs.). Improved males, that have records showing they are above average gainers, should be purchased to be crossbreed with females. To prevent spread of disease, keep new animals quarantined for at least 20 days (Chauca and Zaldivar 1994).

Research has shown that litter size has a low heredity rate (McKeown and MacMahon, 1956). Improved nutrition and management are the key. In Table 10 it can be observed that for males rate of growth accelerates until the 10th week and for females until the 13th week. Market age is approximately the 9th week. In Table 10 the relationship between food consumption and age is shown. As can be seen, after 9 weeks consumption increases and after 12 weeks greatly increases. Thus the recommendation is to cull at 9-10 weeks in the improved lines of cuyes.

Table 10. Growth curve of cuyes from birth to 15 weeks

AGE	MALES (gms)	FEMALES (gms)
Birth	148	147
1 week	202	206
2 weeks	297	299
3 weeks	349	380
4 weeks	459	449
5 weeks	578	543
6 weeks	686	632
7 weeks	779	713
8 weeks	861	780
9 weeks	928	848
10 weeks	985	899
11 weeks	1028	944
12 weeks	1063	980
13 weeks	1091	1005
14 weeks	1104	1033
15 weeks	1114	1041

Source: Zaldivar and Chauca 1988

The best method for a family commercial business is to use metal ear tags for the identification of reproducers. A right tag for females and left for males. These are expensive for the family-traditional system. A small colored wire or yarn will suffice. Record keeping is time-consuming, however, it can improve production.

HEALTH

Disease prevention is the greatest problem in raising cuyes (Chauca, etal., 1990). Many diseases cannot be cured or are costly to cure. Cleanliness and hygiene are of top importance. The following rules should be observed:

1. The cages must be kept clean and dry. The area should be well ventilated with sunlight. If possible the floors should be concrete to facilitate cleaning and disinfection. The walls of the cages also are best made of a material that can be cleaned easily.
2. Weeds should be kept clear of the area at 10-15 meters circumference. Always keep the floors free of garbage and excess feed.
3. Insects and other animals should be kept out of the area, a major problem in the sierra where the cuyes are housed with rabbits or poultry and the dogs have free entrance. These host animals spread disease and parasites such as liver fluke and hidatidosis, fleas, and mites. These external parasites are transmitted to humans by the cuyes.

Rat fleas, carriers of bubonic plague, can be transferred to cuyes. In this century the highest incidence of bubonic plague in the Americas occurred in Peru (Gade, 1967). Peru also has the largest number of cuyes. Gade (1967) reported that it is possible that the

"unknown plagues" that caused high mortality during the Inca empire were bubonic plague spread by cuyes. The chief vector of murim typhus is the rat flea (Xenopsylla cheopis) that also lives on cuyes." The cuy has contributed to the spread of tuberculosis among the indigenous people (Gade, 1967).

Points to remember in disease prevention are:

1. When a pen is cleaned, disinfect and keep vacant for two weeks.
2. Cuyes brought from outside should be dipped then isolated for 20 days minimum before being introduced to the group (Aliaga, 1993).
3. Do not overcrowd the cages. This spreads disease, decreases productivity and growth.
4. Avoid air current, excessive humidity, high temperatures, or quick changes in temperature. A fan can be used in summer months and a wood stove during cold nights (pers. obs.).
5. All feed and forage must be clean and dry. Never change rations abruptly, 25% increments over 3 days is best (Aliaga, 1993).
6. Change the bedding often before it becomes humid and has a strong ammonia odor.
7. Never interchange dishes between cages.
8. Eliminate rodents, they are disease carriers.
9. Cremation is the best method to dispose of dead animals (pers. obs.).

The limiting factor in breeding cuyes at the family level is the amount of ectoparasites and the high cost of medications an immersion bath is the best treatment

although costly. In one study, more than 400 parasites were counted per animal (Chauca, etal., 1990). In Peru the most common ectoparasites are fleas (Echidnophaga gallinacea), lice (Menacanthus stramineus) and mites (Dermanyssus gallinae) (Zaldivar and Chauca, 1989).

Ectoparasites are found on the skin all over the cuyes body, and death often results from secondary causes (Zaldivar and Chauca, 1989). The bite keeps the animal scratching and nervous causing weight and hair loss. Mortality is greatest in young cuyes and those suffering from malnutrition. Adult lice lay eggs that attach to the hair and then hatch in 21 days (Fraser, 1986).

Fleas (pulgas) are the most difficult to control as they jump from one animal to the other. Fleas can survive without a blood meal off the host for up to two months (Fraser, 1986). The females, after sucking the blood of the host, lay their eggs which fall off the host animal to contaminate the bedding or walls of the cuyes (pers. obs.). The larvae receive nourishment from the debris (filth) or dry blood feces of adult fleas (Fraser, 1986). The larvae pupate and adult fleas emerge from cocoons. During summer months the cycle is 21 days, extending to 2-4 months in winter, 500 eggs can be produced in a life cycle (Fraser, 1986).

Mites (acaros, chuchuy) are easy to detect on the cuys body as they look like small red spiders after they have sucked the blood (Chauca, etal., 1990). If the cages receive sunlight, mites live on the animals at night and during the day hide on the cage. Eggs are laid in debris from which small white spiders emerge that mature to return to the cuy body for nutrition (Fraser, 1986). The life cycle is six days. Mites, lice and fleas can pass from

infected animals to the cuy breeder (pers. obs.).

For the treatment of ectoparacites powders and immersion baths are effective (Aliaga, 1993). For fleas treat every 18 days for heavy infestations and for mites every seven days until eliminated. The following products were recommenced: Malathion, Sevin, Negubon, Butox, Diazil and Aldrin 2.5% (Aliaga, 1993). The cages should be emptied and all the material burned. Clean the floor and sides carefully with Lindoane 0.5%, Dieldrin 0.5%, Malathion 2%, Butox .0005%, or 5 spoonfuls Kreso per liter of water (Aliaga, 1993).

In a study done by Zaldivar and Chauca (1989) to determine the infestation of internal parasites it was found that 100% of the cuyes were infected with gastrointestinal worms in the following degree: Paraspinodera uncicata 80% in the cecum or colon, Trichuris sp. 78% in the small intestines, Passalurus ambiguas 30%, Heterakis gallinae 28%, and trichostrongylus axei in the stomach.

Coccidiosis is a protozoal infection which localizes in the small intestine and liver to produce hemorages (Fraser, 1986). This usually occurs 10-15 days after weaning with symptoms of diarrhea, weight loss, fever and death (Aliaga, 1993). Transmission from rabbits is possible. Treat with sulfaquinoxaline in the water (0.04%) for 30 days. Discontinue 10 days before marketing (Chauca, etal., 1990).

Hepatic distomiasis is also known as alicuya, liver fluke and gusanero del higado. The female can lay up to 20,000 eggs which are eliminated in the feces of the host (Fraser, 1986). To control, do not feed cuyes forage that has been cut where cows or sheep have grazed, also cut grasses well above ground level, where the larvae or snails live, and allow

to dry before feeding to the cuyes (Chauca, etal., 1990).

Hidatidosis and Cisticercosis are parasites found in the liver, brain, kidneys, lungs or intestines of cuyes (Aliaga, 1993). They appear as small bags of water which contain hundreds of heads of parasites called tenias (Fraser, 1986). These are carried by dogs and spread through feces deposited on pasture fed to cuyes. Dogs can be treated with Droncit or Lopatol. There is not a treatment for cuyes. Hidatidosis can be transmitted to humans causing death (Aliaga 1993).

Dermatitis micotica (hongos, caracha) does not produce mortalities, but is contagious to humans (pers. obs.). In cuyes there is loss of hair around the nose and mouth progressing over the body if not treated. This is prevalent when cuyes are watered out of dishes instead of using a drip system. Treat with a 5% solution of copper sulfate in lanolin or tincture of iodine. The scab must first be rubbed lose with a cloth so treatment can reach the raw skin. The use of gloves is recommended (pers. obs.).

Salmonellosis (peste) is the most common infectious disease of cuyes and causes the greatest number of deaths, affecting up to 95% of the group (Chauca, 1994). Causes are high air temperature and humidity in the pens, moving animals between pens and new animals introduced without a quarantine period which can be clinically normal, but carriers (pers. obs.). Animals may die without showing the symptoms of diarrhea with mucous, loss of appetite, vomiting and paralysis of posterior limbs (pers. obs.). The treatment is clorofenical, streptomycin, oxomid, or nitrofurazan (Aliaga 1993). All animals that survive should be eliminated as they can be carriers (Fraser, 1986). The entire area must be carefully disinfected and cadavers burned. Rodents, wild birds and feces of infected

animals spread the disease (Fraser, 1986). When an outbreak occurs manure should not be used as fertilizer. The organism can survive for months in humid wet warm areas such as cages and dirt kitchen floors. The incidence of salmonellosis in man has increased in recent years. Transmission to man occurs via contaminated drinking water, milk, meat, eggs, pigs and poultry (Fraser, 1986).

Scurvy is caused by a deficiency of Vitamin C in the diet. Cuyes require a dietary supplement of ascorbic acid because they lack the enzymes necessary for conversion of L-gulonolactone to L-ascorbic acid (Fraser, 1986). One to three mg. of ascorbic acid per 100 grams body weight daily is required. Commercial diets contain Vitamin C that is stable for only three months after millings (Chauca, 1995). Vitamin C supplement can also be added to the drinking water or foods rich in C such as parsley, cabbage (in small amounts only), green pepper and kale (Henwood, 1985). Signs of deficiency are unsteady gait, painful locomotion, emanciation and hemorrhage of gums (Fraser, 1986).

Antibiotic toxicity can be caused in cuyes by penicillin, lincomycin, erythromycin and tylosin (Fraser, 1986). The result is anaphylactic shock, enterocolitis with diarrhea and death in 3 to 7 days. To avoid antibiotic toxicity, broad spectrum antibiotics should not be used orally. However, tetracycline or chloroampheric ol are tolerated (Fraser, 1986).

FOLKMEDICINE

Traditionally cuyes remain an important part of cultural ritual and medicine in the Andes (Morales, 1995). The cuy is used in both predictions, diagnosis and therapy or curing of diseases (Morales, 1995). Curanderos (folkdoctors) and brujos (witches) are common in Peru (pers. obs.). Cuyes have been referred to as the "x-rays" of the Andean Indians as they are used to detect illness (Frisancho, 1970). During diagnosis a live cuy is rubbed over the ill persons body and then killed. The organ that shows discoloration in the cuy will correspond to the diseased organ in the person (Morales, 1995), as can be seen in the diagnostic signs shown in Table 11.

Table 11. Use of the cuy in folk medicine

Illness in the Patient	Signs in the Cuy
Cold	A white, thin film covers the back
Bronchitis	A white, thin film covers the back and there are fine lines of blood, like broken veins
Sore throat	Clotted blood in the neck
Diarrhea caused by cold and colic	Intestines have air bubbles and feces are sparse
Diarrhea caused by irritation	Intestines dark red or purple
Intestinal fever	Red, bloody intestines
Susto (fright)	The carcass put in fresh water trembles
	Shiny, whitish and glassy bowels
Witchery	Yellowish eruptions in the neck that look like pus

Source: Morales 1995

Rather than being killed after passing the cuy on the patient's body, the cuy may also be released believing to carry the disease away with it (Morales, 1995). The cuy fat is used as a salve, the warm viscera rubbed on the body to ease abdominal pain (Gade, 1967). When the cuy cries in a high pitched voice it is thought to be an omen of death or illness, actually it is the cuyes death that results (Gade, 1967). Black cuyes are valued by the curanderos and bring a higher price in the market, however their meat is less desirable due to the dark skin (pers. obs.). In the northern Peruvian Andes district of Cajamarca, more than 50% of survey respondents stated that their first option for treating an ill person would be the curandero, followed by the village health promoters (25%), the health clinic (20%) and lastly the hospital (5%) (Castillo, 1992). "Traditional medicine is connected to rituals, metaphors and symbols familiar to the Andean people. Therefore, incorporation of modern, scientific methods of diagnosis, prognosis and treatment of illnesses leads to confrontations with practices that have deep cultural roots. In many communities where health officials refuse to live, curanderos are the hope for the indigenous people" (Bastier, 1987).

FIELD RESEARCH IN ATAHAULPA JERUSALEM

Objectives

The objectives of the field research in Peru were : 1) to gather information about the possibility of increasing cuy production in a family-commercial operation, using the improved line Peru from INIA, 2) to determine if sufficient numbers of cuyes could be produced to be sold to restaurants in Cajamarca and 3) research methods of controlling the outbreaks of salmonellosis that had drastically reduced numbers of cuyes at the cooperative.

Research Site and Methods

The research was conducted at the evangelical cooperative of Atahaulpa Jerusalem, located 30 kilometers from Cajamarca in the Andean region of northern Peru. The cooperative consists of 600 persons of indigenous Quechua blood. Atahaulpa Jerusalem has 10,000 hectares of pasture and reforested mountains of pine and cedar. The elevation is 3,500 meters where temperatures range from 10^0 C to 25^0 C. Temperature varies considerably between day and night in the summer months and humidity is low. Precipitation occurs as rain, mostly during the months of November through March. All families have their own homes which are scattered over the area. Dwellings are constructed of adobe; some have tin roofs to protect against torrential winter rains. There is a 100-cow dairy herd, and the milk is trucked to Cajamarca for cheese production. Butter is presently made at the cooperative, while plans are being developed for Swiss cheese production soon. Three large greenhouses contain potato seed stock.

I worked for 2 weeks in 1997 with the manager of cuy production and also interviewed a random sample of cooperative members about their methods of raising cuyes. I was limited in my work due to the peoples' shyness and lack of trust of outsiders. The language was not a problem as Spanish was spoken with me, although Quechua is spoken among the people.

Research and Observations

The cooperative has a building which contains 100 cuy pens made from bamboo (carrrizo). Each measures 1x1x.5 meters and has a dirt floor. The building has windows above the pens that open along both lengths, allowing ventilation in summer. In winter a fire is lit in the two aisles for warmth; however, this is inefficient, as many animals die of pneumonia and salmonellosis. At the time of my work there were less than 50 cuyes being housed in an area sufficient for 500 animals. An outbreak of salmonellosis had killed the majority of the animals (pers. obs.). There were cages for 560 females, leaving 30 pens for weaning and fattening. At 0.25 cuyes weaned per female per month, approximately 140 weanlings could have been available per month. Cuy production was managed by the men of the cooperative.

The women had their cuyes in their homes and one woman, who managed the small restaurant, raised her cuyes in the kitchen. Woman daily worked in the fields, along with having their household chores. The director of the cooperative had told me that field work had been given to the women after he had observed it being practiced at another cooperative. The men did not assist women in their domestic work or with child care. Men sat apart from the women during church services. While I was there I often observed

women carrying cast iron cooking pots, over three feet in diameter, used to feed the youth who were there at the time for a retreat. The men would watch, but not offer to help. Wood was used for cooking and the women also cut and carried this to their homes.

Although computers were used in the office, the homes had no electricity or running water, with the exception of the guest house and main house where the director's family lived.

Recommendations

Based on my observations, interviews with leaders of the cooperative and an extension agent from INIA, the following recommendations could improve the vigor and productivity of cuy production.

It would be advisable to sell or harvest the remaining 50 cuyes that have survived from the salmonellosis outbreak to remove all carriers that could spread diseases. The pens should then be left empty for at least 40 days. Each week a different treatment should be used to disinfect the enclosures, such as fumigation using wood smoke and application of a liquid disinfectant and lime. Pens should to be completely cleaned and the material burned. Any new animals that are bought in the future should be kept in quarantine in a separate building for three weeks before being introduced to the main group of animals. During this time they should be dusted or dipped for parasites.

A new type of stove should be used in the aisles to provide more heat. For example, a 5-gallon vegetable oil can could be converted into a wood-burning stove. Heat produced by this stove can last for 6-7 hours and if lit at 9 pm during the winter months should keep the animals warm and reduce humidity. This will help decrease the stress that animals

incur during early morning hours due to cold. No other animals should be allowed in the building and only those workers directly involved should be allowed access. Rabbits should be moved to another building to decrease spread of disease. At the present time visitors are allowed to enter the building. However, to prevent contamination in the production area, a small cage could be added to the zoo to enable visitors to see the cuyes.

To improve production, animals should be classified and grouped according to age, sex and class (reproducers, market, weaners, replacement). Eight females should be used for each male cuy. The females will begin production at the age of three months and the males at four months. Weaning will occur at two weeks of age at which time animals should be separated according to sex. For the first year, only improved cuyes type I Peru should be used to simplify record keeping. To optimize economic return animals for market should be sold between their 10^{th} and 12^{th} week (depending on weight). Records should be kept on females according to number of young weaned and average weight.

Production records for females should be kept which chart the following information to determine which animals to cull, as is the procedure in INIA: female number, litter number, sire number, date born, number born, number weaned, weaning weight, cause of death, and disease prevention methods used.

Cages should be cleaned every two days to prevent spread of diseases and to keep floors dry. A recycling program to use cuy manure in a feed mixture for fattening the young bulls (castration is not practiced) could be implemented. At a cuy operation near Lima this has been tried with positive results. However, for this to be successful it is very important that the manure be dry to prevent respiratory problems and parasites.

At the present time, rye grass is used almost exclusively as feed. Corn stalks and alfalfa could be added along with a concentrate feed for the evening ration. It is important that during the rainy season the grass is cut later in the day and not at the ground level to help prevent health problems. The area for raising alfalfa should not be pastured by other animals or have manure from cuyes used as a fertilizer. This precaution will help prevent the reinfestation of internal parasites.

Conclusions

The above recommendations were discussed with Mr. Quispe along with a drawing showing the wood-burning stove. Due to the fact that one of the members had thought I was a terrorist, I was not comfortable staying at the cooperative and decided to go to another area for my safety. The cooperative of Atahaulpa Jerusalem is in an isolated area, not served by bus, and during the many years of intense terrorism it was not uncommon for them to have terrorist activity in the area.

PARTICIPATION OF THE FAMILY IN THE PRODUCTION OF CUYES IN CHOTA

Objectives

The objectives were to evaluate the effectiveness of current cuy extension education training and suggest more effective cuy production methods.

Research Site and Methods

My second area of study was in the area surrounding Chota, approximately 6 hours by bus from Cajamarca in northern Peru. The road to Chota is dirt, much of it unpassable during the rainy season from October to April. Chota is at 1,000 meters elevation and is located approximately two hours from the Amazon rain forest. The surveys were conducted within 2-3 hours walking distance from Chota. As stated in the introduction, this area was chosen after meeting with Ing. Chauca of INIA in Lima as a location where surveys had not yet been done and improved cuyes were being produced. I traveled with a veterinarian, Ing. Clavo. He was from Jorge Basadre, an NGO funded by Germany, and had been working for four years with the indigenous farmers whom are bilingual, speaking Spanish and Quechua. The NGO had provided loans to improve or begin cuy production to all interested people in the community. I surveyed 100% (63) of those families who had received loans, were raising cuyes and repaying their loans.

The weather, which had changed after a long drought, presented a problem. We had heavy rains in the mornings which made traveling by motorcycle impossible. Walking was the only alternative. Aalthough horses were numerous, none were available to rent. Due to the continuous threat of terrorist activity, I was unable to travel alone. The Tables and Figures which follow are the results of the survey unless stated otherwise.

After completing each survey, I used posters printed by INIA to provide information on cuy production (see appendix). This was a valuable visual aid to answer questions that families had on cuy production. I gave each family a booklet with the same information as a gift for their cooperation and hospitality. All survey respondents eagerly, answered the questions and offered additional information. The humility and honesty encountered were encouraging.

Observations and Discussion

All of the families who had adopted pens or cages continued to raise cuyes in the kitchen due to custom and practicality of having animals near the heat. The reason for using pens, which were built inside or next to the house, was for ease of cleaning and animal security. The same reasons were given for use of cages (Fig. 1). The preferred method of production was still the traditional of having all animals loose in a room.

In the families interviewed, the average age of the husband was 46 and of the wife 42. Of the population in Cajamarca, 46% to 47% are aged 0-14 years. During the almost 20 years of terrorist activity, there was a large migration of people from the Sierra to urban areas, which explains the large percentage of young people. Extended families lived in the same area, generally had their own homes, and did not live with their children as is common in Lima. Of the families surveyed, 61% had completed primary school, 9% had finished high school and 22% had no formal education at all (Table 12). It has been noted that in segments of the juvenile population the benefits of education are discredited, as they have become conscious of the limitations of an education in their lives. In one evaluative session with those responsible for working with "ninos de la calle" (street

Fig. 1 Methods of raising Cuyes in the Family System

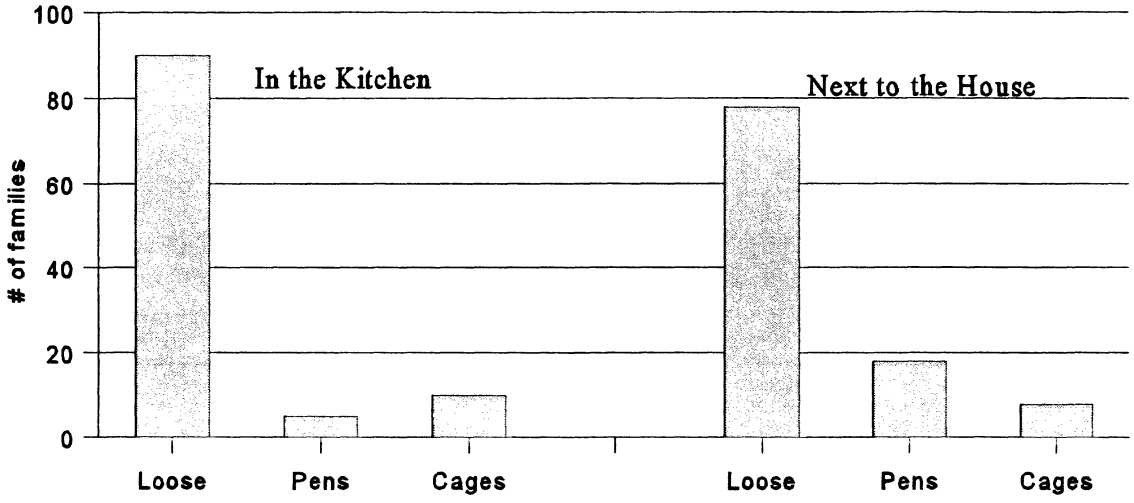
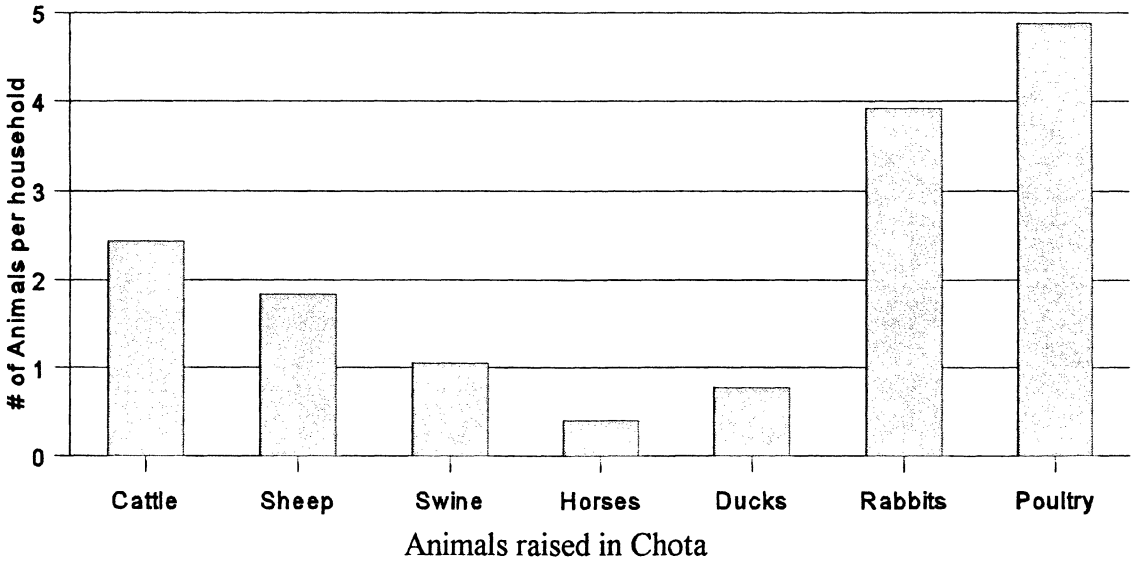


Fig. 2 Animal Populations in the Area



children), it was found that many working children, both boys and girls, do not see the benefits of an education when they are simply trying to earn money. With available resources and street knowledge they have the possibility to have work and money without an education (Chiroque, 1990).

Table 12. Education of the families

Level of Instruction	Man	Woman	Children
Grade school incomplete (%)	39	31	18
Grade school completed (%)	27	42	36
Secondary incomplete (%)	8	2	10

Source: Castillo 1992

Land distribution in the district of Cajamarca may explain the precarious crop production that campesinos face and their reluctance to take risks. There is a small number of large landowners and unequal land distribution. An estimated 63.7% of the agricultural units are made up of less than five hectors and campesinos own only 12.6% of the land suitable for farming. Within this same group 20% have less than one hector of agricultural land (Castillo, 1992).

At the other extreme, 0.1% of the farmers control 46% of the arable land and the majority of fertile land (Castillo, 1992). With land reform the tradition of collectives diminished in the campesino communities of the Sierra, which had collectives of land, but retained the family unit of production (Castillo, 1992). Abandoned to their own luck without technical help or loans, the cooperatives quickly degenerated and were sold cheaply to wealthy landowners or were parceled and sold to individuals (Castillo, 1992).

The unequal distribution of land constitutes one of the main obstacles for the development of the small rural producer. Parcel size has been reduced with almost no possibility to enlarge them due to the increase in land prices. This has intensified the use of available agricultural land, resulting in overuse and marked drops in production and productivity (Castillo, 1995). Campesinos cannot subsist on their small farms and as a consequence have migrated in large numbers to cities (Castillo, 1995).

The majority of survey respondents stated that the principal occupation of the man was agriculture and of the woman was housewife (Table 13). Women also care for the gardens and small animals, and are responsible for taking produce to market along with an occasional cuy.

Table 13. Principal occupations of the family members

OCCUPATION	HUSBAND	WIFE	CHILDREN
Homemaker	10	71	12
Agriculture	46	4	6
Employee	6	2	2
Businessman	9	7	1
Artesania	2	1	0.7
Professional	3	0.5	1
Student	-.-	1	65
Animal Husbandry	9	2	0.4

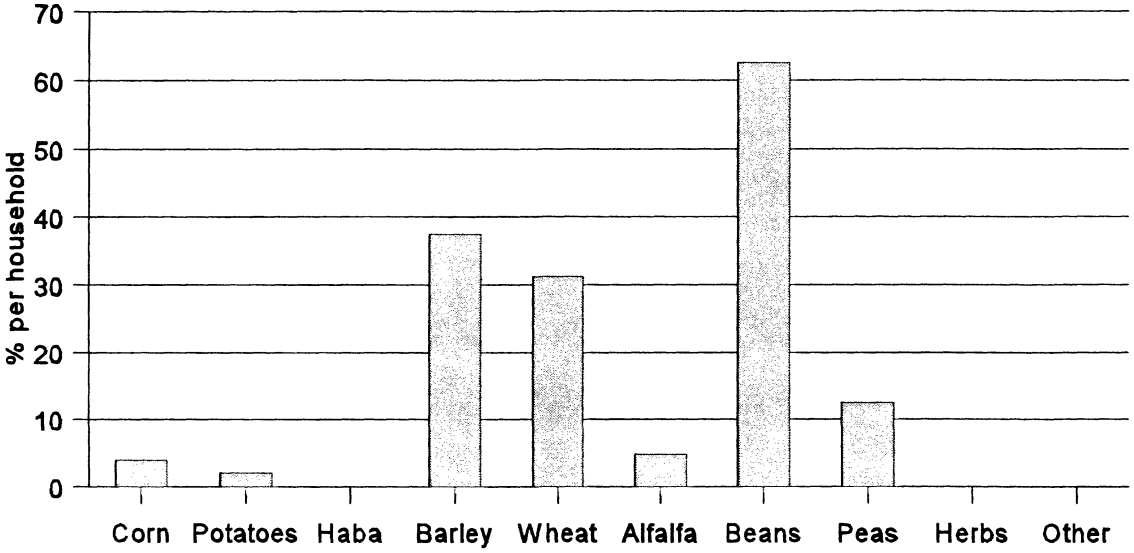
Raising cuyes by the traditional method is not considered a part of animal husbandry, but rather a part of domestic household labor. This may explain why less than 2% of the women surveyed stated that animal husbandry was their occupation. This also demonstrates the lack of importance given to cuy production by the family, which may

only be considered one of many expected female responsibilities. The wife, grandmother or children are in charge of their care. In those homes which still raise cuyes using the family system, the average number of cuyes was 15. While those that have adopted cages and improved lines of males averaged 50 cuyes during the winter months, the number dropped to less than 10 in the summer months when feed is scarce due to lack of rain and irrigation.

Figure 2 lists the average number of other animals raised on farms, with rabbits and poultry being the most common. Chota was an area with high cheese production; however, with the government program of Tasa de Leche (Cup of Milk) for school children, milk is sold rather than processed for cheese. The ownership of cattle is important for their use in the fields as work animals as well as milk production. The predominant crops raised are shown in Fig. 3 with corn, barley, beans and different potato varieties most common. Potatoes are grown by all the families, but the distance from markets limits profits. Potatoes were sold for 12 cents a kilo in Chota while in Lima the price was 50 cents.

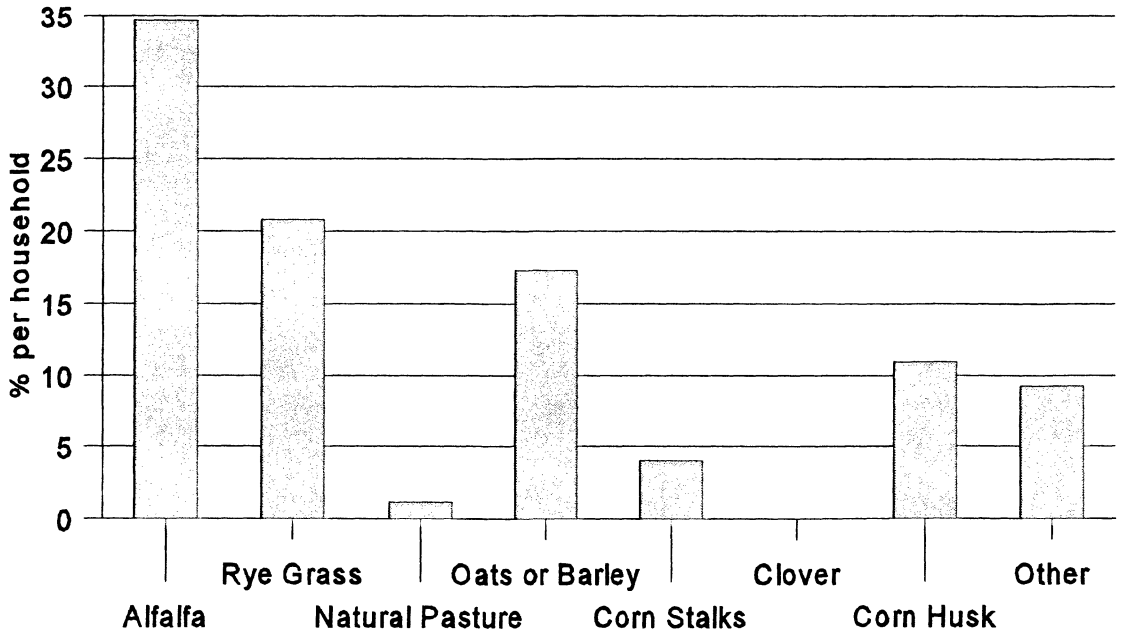
Survey respondents indicated that alfalfa was raised in small ungrazed plots for use as a forage for cuyes, rabbits and livestock. Fig. 4 shows the nutrition available for cuyes. Alfalfa, ryegrass and oats or barley were the most common forages. One owner was raising alfalfa in a separate area strictly for feeding the cuyes. In addition to alfalfa, corn stalks and husks, kitchen scraps, and herbs were also fed. None of the survey respondents were feeding concentrates to cuyes due to the high cost. One of the limiting factors in all of the families surveyed was the lack of pasture available to cut for the animals in the dry period

Fig. 3 Primary Crops Cultivated by Small Producers



Crops cultivated in Chota

Fig. 4 Nutrients Used for Cuy Production



Feeds used for Cuy

from June to November. Fortunately, the annual fair in Chota is held in June and producers can sell the majority of their animals for $2.60 to $3.75 (5-7 soles), leaving only the breeding stock to feed when grass supply is low.

When asked about other health problems, I was told that salmonellosis in the animals from INIA was a concern. The families were hesitant to buy them again; however, after speaking with a veterinarian I was told that this was not the case, that unclean conditions within the homes were the cause. The campesinos also preferred to buy a mature male for $7.50 to $11.30 (20-30 soles) rather than pay $5.60 for an animal of 10 weeks.

According to survey results and personal communication with Ing. Clavo, the main problem in rearing cuyes was sanitation and health, the lack of cleanliness in cages and the stress put on animals with a change of feed, weather or management. When survey respondents were asked about the interval of cleaning the cages, all stated that the interval was 2-3 days; however, my observations suggest cages were cleaned less frequently.

The cuyes produce approximately 29 tons of manure annually (Miller, 1993). An alternative to spreading it on pastures is the use of a recycling program. The manure of cuyes contains 15 kilos of nitrogen per ton (Table 14). By incorporating a recycling program using earth worms or the BIOL method (Appendix), crop production could be increased while at the same time making use of the manure. The BIOL method results in a liquid fertilizer that has been made from manure of cuyes and other animals. The first step is to collect the manure daily and pile it in an area that is shady to conserve humidity. The materials needed to make the biodigestor are: 3 feet of plastic agricultural hose, 4" plastic

PVC pipe, strips of rubber cut from an inner tube, a plastic 11/2 liter pop bottle and PVC pipe glue. One pail of manure is mixed with one pail of water and put into the bag. After three months the mixture can be used by mixing 1 liter of BIOL to four liters of water and sprayed on the crops (Miller, 1993).

Table 14. Comparisons of manure production of farm animals

SPECIES	TONS/year	KILOS Nitrogen / ton	KILOS N / year
Cuy	29	15	437
Sheep	13	12.5	167
Swine	35	4.5	159
Poultry	10	14	142
Cow	26	5	134
Horse	18	6	110
Bull	19	5	100

Source: Aliaga 1993

All of the respondents stated that weaning takes place at 21 days. An average of 6 females to one male were used in each pen with 2-3 young being born per female. The number of cuyes per litter is low due to lack of proper nutrition. English, Abyssinian and Merino cuyes were being raised with a preference for Merinos due to increased fat content of the meat. The long haired Peruana (hippie) cuyes were not observed in either area.

Males are exchanged in the communities for breeding, without observing any quarantine, which adds in spread of diseases. Selling of large animals is still practiced,

which leaves only smaller animals for breeding stock.

Several families were raising cuyes together with rabbits, not aware of the spread of disease, especially coccidiosis, from rabbits. Other animals were also allowed to enter the area, introducing fleas and lice. When asked if they will continue to raise cuyes, 100% of survey respondents stated yes, with the main reason being the increase in income and custom. Unfortunately, animals are more often sold than consumed which results in a loss of potential protein in the family's diet. When sold, the income is used for education of the children, and to purchase rice, sugar, kerosene, pasta or lumber for a roof.

The most common health problem stated by survey respondents is liver fluke which causes dehydration and death (Fig. 5). This may result from the fact that pastures are cut early in the morning and the humid grass then fed to the cuyes. Since cuy manure is used for fertilizer on pastures, parasites can continue their cycle, entering the cuy cages with the forage.

Eighteen percent of survey respondents stated that salmonellosis was a cause of death, while 32% said that fleas or lice was a problem. This number could be closer to 100% due to the prevalence of external parasites although I did not inspect all cuyes. Water was not offered to the animals and hongos (dermatitis) were seldom observed. Since the price of medication is high, treatment of disease is not common. Fig. 6 shows the methods of treatment reported by survey respondents. Forty percent of respondents are not accustomed to treating the cuyes, due either to lack of knowledge about available treatments or the high cost of medications. However, 17% of reported illnesses were cured using folk medicine and 32% using medicines recommended by the veterinarian.

Fig. 5 Diseases Reported by Household

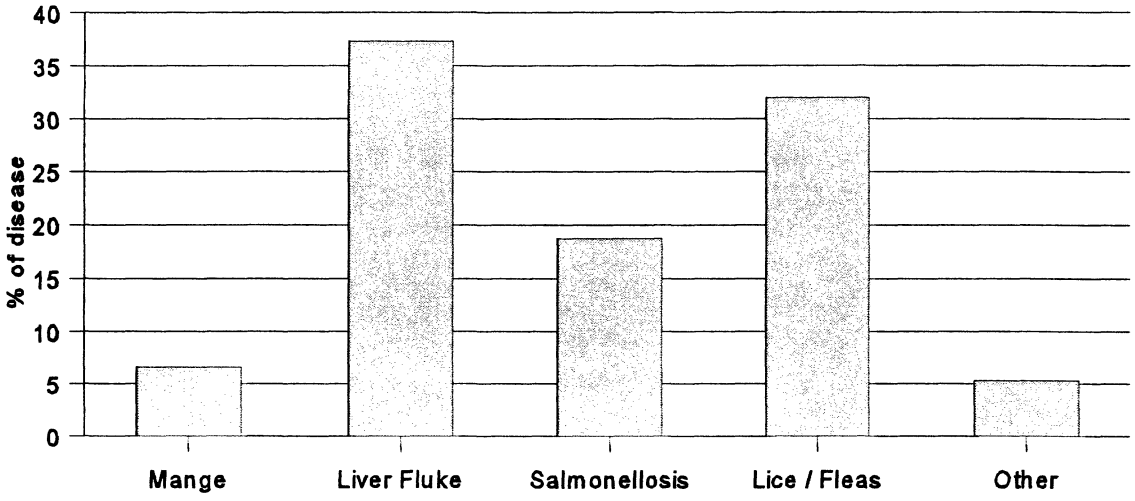
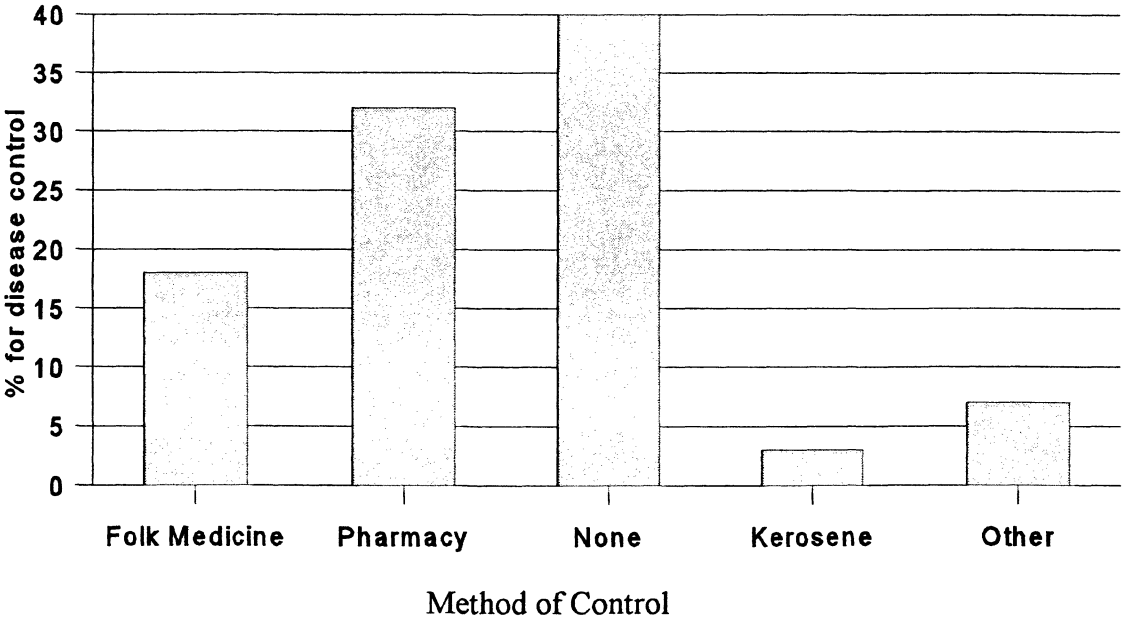


Fig. 6 Household Methods of Disease Control



Recommendations and Conclusions

There are several opportunities for further work in Chota. I would suggest introducing more Type I cuyes to families for crossbreding with criollos. These crosses will likely be better adapted to the climate and diet, and will be more disease resistant (Chauca, 1995). It was noted that litter size is small due to deaths of newborns when they are stepped on by mature animals and because of high parasite infestation. A possible solution would be to use a creep feeder for the young or feed more often to avoid aggressiveness when animals are overly hungry. At the present time no economical treatments are available for effectively treating external parasites in cuyes. Another area of importance is traditional treatments used for disease control in cuyes. Banana leaves and ground corn can be used to treat diarrhea in cuyes, the same treatment that is used for children.

Another project of potential value involves the possibility of shipping cuyes to the coastal town of Chiclayo from Chota by truck and establishment of a commercial production system in Chota. The market for cuyes has increased on the coast in Peru due to migration from the Sierra. Many coastal restaurants now serve cuy as a daily special.

Based on the information collected in the survey, four major factors appear to limit cuy production:

Health.The primary constraint to increased cuy production is poor health. Fifty percent of cuyes die due to ecto and endoparasites. Outbreaks of salmonellosis also kill a large number of cuyes that survive the parasites. Male breeding animals should not be loaned or exchanged among producers to prevent the spread of disease. Due to the high

cost of medication, research could be done to evaluate the utility of using traditional methods of disease control.

Management. Poor management and raising animals together regardless of age or sex results in cuy mortality. Before the introduction of an improved breed of cuy, the construction of at least two enclosures should be built by the family. These enclosures could be kept in kitchens. However, to limit diseases being contacted by the families, these enclosures should preferably be kept in a separate area near the house. They should be inexpensive and built of materials such as bamboo or adobe bricks that are common to the area. Female reproducers should be separated from weaned females. Young males could be turned loose as is traditionally done, since fighting occurs when mature males are penned together. However, ideally all cuyes should be separated into groups according to sex, age and class and raised in pens using eight females to one male. If a manure recycling program is implemented, crop production could improve.

Nutrition. Water can improve production of caged animals if given to breeding females during the hot months. This is not a common practice as cuyes are traditionally raised in kitchens where steam was available. Under the recommended system, cuyes would be raised in pens outside of the house. Since Chota has its rainy season from October to April, water is not required if fresh forage is fed. In the summer months breeding animals would require water .

Alfalfa does not grow well in higher elevations, although it is a major nutrient source for the cuyes. Figure 7 (appendix) shows a structure for growing alfalfa in cold regions in 90 m sq. of land. Green branches of eucalyptus are planted in the ground. Next,

stones 5-6 inch in diameter that have been painted black are placed in rows along the perimeter. These are covered with a plastic netting. At night a sheet of white plastic is used to provide total cover. The black stones absorb the heat of the sun and help to warm the plants at night (Aliaga, 1993). A possible constraint to using this structure would be the cost of the plastic.

Genetics. The practice of selling the larger animals is still followed. By teaching the importance of selection, the quality of cuyes can be increased. This could gradually improve the vigor, growth, yield and profitability of cuy production. A technical production system that breeds quality improved males is needed in this area. These animals would be climatized and more disease resistant. By selling cuyes to local NGO's and small producers a niche can be filled while providing a profitable project for the community.

Bolton (1979) stated that anthropologists have become aware of the importance of understanding relationships between nutrition and diet, on the one hand, and behavior and culture, on the other. As was stated in the introduction, the cuy has had an important role in Peruvian culture. Lanning (1967) stated that "if we had any way of estimating the number of guinea pigs eaten in ancient times, we might find that they ranked with seafood as the most important sources of protein in the ancient diet, well ahead of the camelids and the Andean deer". Rowe (1946) concluded that "almost the only regular meat supply available to Indians was provided by the swarms of guinea pigs that bred in Indian kitchens, the situation has not changed much in 400 years". From my observations this extreme dependence on cuy for protein does not exist in most Andean communities today,

yet the importance of the cuy remains. Cuy is now kept more for ritualistic purposes than as an important source of food, although cuyes are more closely associated with the Andean peasant than any other animal (Gade, 1967).

I found no taboos that restricted the eating of cuy meat by the families, but generally they were reserved for birthdays, visits by kinsmen, New Years Day and religious holidays. A major constraint to increased cuy consumption was the number of cuy available in the flock to be slaughtered routinely. Gade (1967) had reported that several animals are needed to satisfy the appetite of a hungry man. In the area of Chota and elsewhere this type of indulgence was not observed. On the average one cuy was shared by 3-4 persons.

Bolton (1979) observed that almost every Andean ethnographer, who mentions cuyes, stresses the importance of cuy meat as a special dish generally reserved for ritual occasions. From his research he concluded that the people of Santa Barbara, in southern Peru, have major fiestas at the time they do because the cuy is more abundant and there is a need for protein in the diet. There is no evidence that fiestas can regulate the cuy production cycle (Bolton, 1979).

In cuy production the environment is not degraded as with other livestock. Cuyes consume a small amount of feed and can subsist on crop aftermath; other domestic livestock does not compete with it for food. The cuy thrives in a mild to cool climate, quickly reproduces and the cost of raising them is minimal.

Since domestication of the cuy can be dated before 1,000 BC, cuyes may have first been kept to provide companionship. Gade (1967) reported that the presence of

mummified cuyes in human graves suggests a close association with man, although it was never used as a totem animal by the ancient Andean people.

The current technical approach to cuy production taken by NGO's does not consider the cultural importance of the cuy. The cuy's socio-economic place in the community is important as well as the traditional and cultural role the animal has played for centuries.

The following points are important to keep in mind in any extension work which involves cuyes:

1. Any introduced system or project should not drastically alter traditional agricultural practices because of the risk involved to the people.
2. Any introduced technical changes should not require a large investment of time or money or they will be limited only to certain socioeconomic groups (Montfort and Roncancio, 1995).
3. Materials used in the construction of cages should be available locally and cages should be separate from the family living area.
4. As women become more independent, friction may be created in the family and the men may feel threatened. In an area where abuse is common, I believe it is vital for social and economic growth that all members of the family should be involved in cuy production. Resistance may be broken down by getting the men involved in the project as was reported by Communications (1996).
5. In the families I surveyed, women were hesitant to offer an opinion. I found that the market place was an atmosphere where women could and would speak

more freely. In markets women have the confidence to express their feelings without fear of a beating by the husband (Holtmeier, 1998). I would recommend for future survey work on cuy and other issues in which the role of women is important to be conducted at least in part in market places.

APPENDIX 1. SURVEY OF CUY PRODUCTION IN PERU

1.1 DATA OF THE PRODUCERS

Name
Age Sex
Principal occupation
Area of residence Province District address

1.2 Family members

Name	Age	education	occupation

1.3 Land available for agriculture or livestock?
Acreage
Condition of the land
Use: Agricultural own rent share communal
Livestock

1.4 Crops produced
Acreage

1.5 Livestock raised

specie	male	female	total

2. CUY PRODUCTION

2.1 Origin of the cuyes

2.1.1 From what source are the cuyes?
- Buy
- Gifts
- Exchange
- Sharing

2.1.2 With how many cuyes did you begin?
How many do you now have?

2.1.3 Time of production
- All year
- Seasonal

2.1.4 Do you plan to continue raising cuyes? Yes No
Why : They produce rapidly
- Provide extra income
- Social relations in community
- Own consumption
- The feed is too expensive
- Become sick easily
- Other animals kill them
- I do not like to raise them

Appendix 1 - continued

2.2 COMPOSITION OF THE CUYES

	Males	Females	Condition
Reproducers			
Weaned			
Nursing			

2.3 NUTRITION

2.3.1 Feeds used
- only pasture
- Pasture and concentrate
- Cooking leftover (scraps)
- Corn husk
- Corn stalk and leaves

2.3.2 Who feeds them?

2.4 INSTALLATIONS

2.4.1 Cuy production is located:

In the kitchen	loose
	Pozas
	Jaulas
Next to the house	Loose
	Pozas
	Jaulas

2.4.2 Are the cuyes raised with other animals?

What animals?

2.4.3 What material is used in the construction of the pozas or jaulas?

Adobe Wood Carrizo Bricks

2.5 HEALTH

2.5.1 List in order of priority the diseases most common

2.5.2 Describe the disease most prevalent
- name
- symptoms
- treatments

2.5.3 Are the enclosures cleaned? Yes No
- With what frequency?
- Who does this work?
- What is done with the manure?

2.6 SELECTION AND BREEDING

2.6.1 Selection practiced?

2.6.2 How are reproducers selected?
- For size
- For the color of their hair
- For the color of their eyes
- For the number of toes

2.6.3 How many females are used per male?

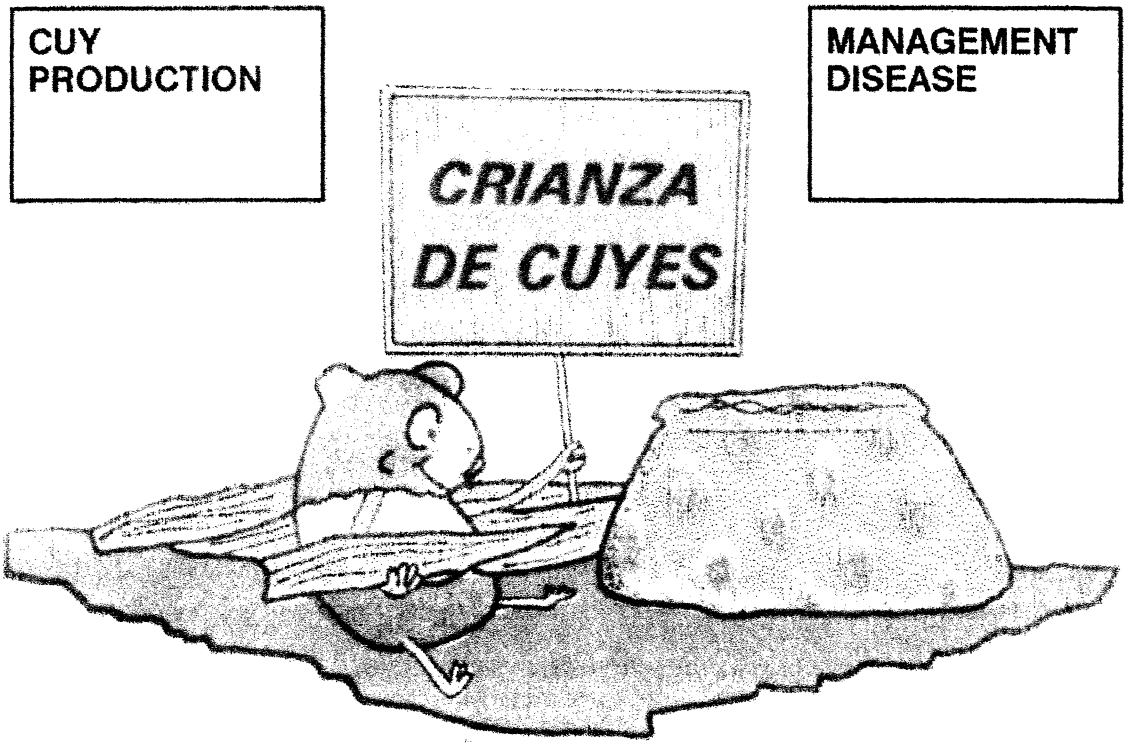
Appendix 1 - continued

2.6.4 Where do the reproducers come from?
- We raise them
- Buy
- Exchange
- Loan

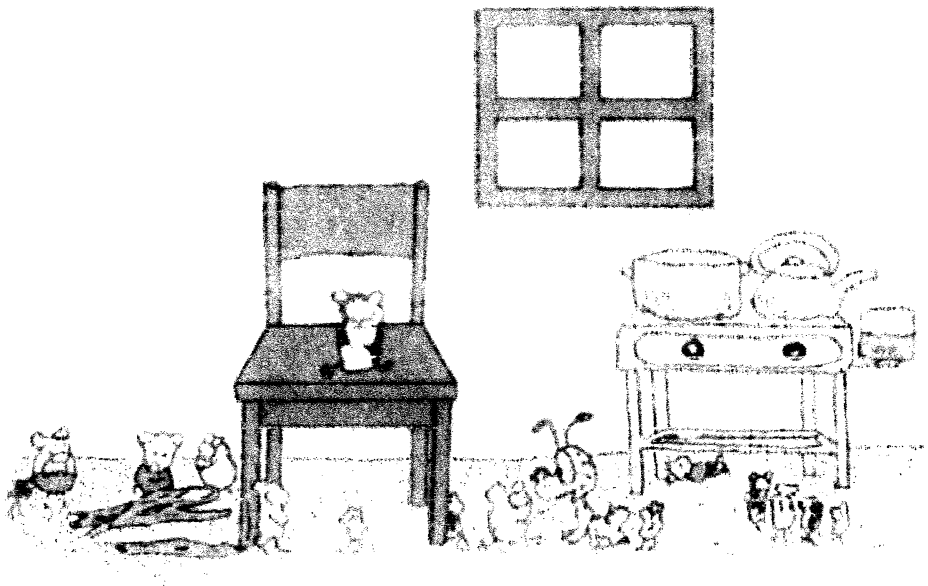
2.7 WEANING
- 2.7.1 Is weaning practiced?
- 2.7.2 How is weaning done?
  - By the size of the young
  - For the age of the young

2.8 DESTINY OF THE CUYES
- 2.8.1 Sales
  - Number of animals sold per month
  - Reproducers (replacements) or culls
  - Are they sold live or slaughtered
  - In what season are they sold
  - Where are they sold and for what price
- 2.8.2 Self-consumption
  - How many cuyes are consumed a month
  - On what occasions are they eaten
  - How are they prepared

APPENDIX 2. EXTENSION TEACHING POSTERS



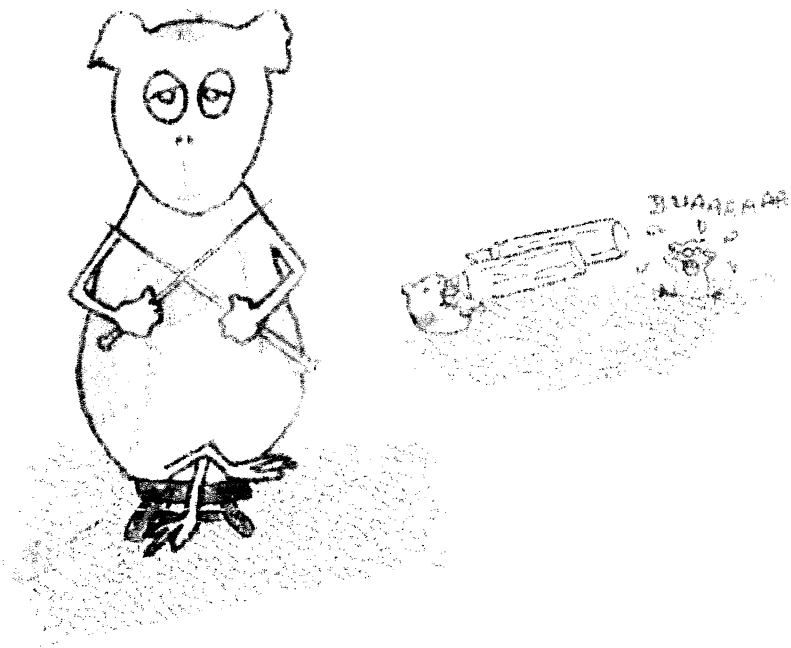
The cuy is a mammal whose meat is eaten in Peru



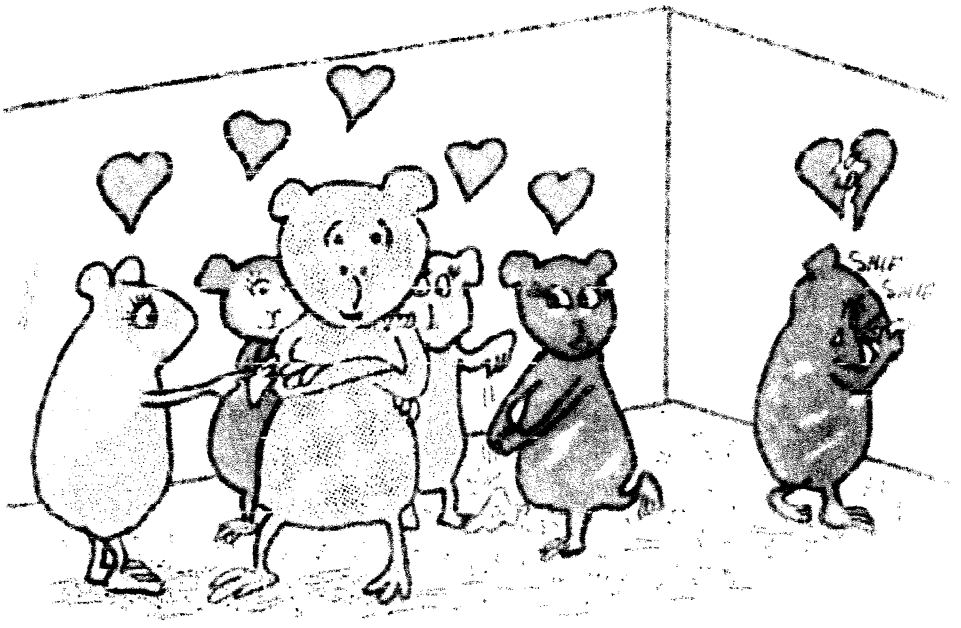
All the cuyes are raised together regardless of sex, age or class.

Animals are raised in enclosed areas or cages separating them according to age, class and sex

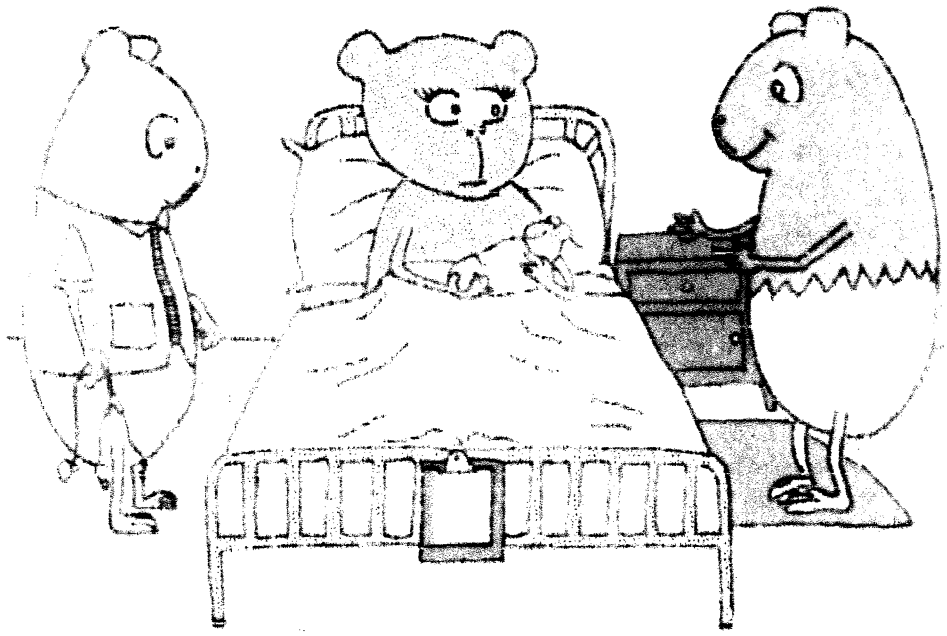
Reproduction
Breed males at 4 months of age and females at 3 months



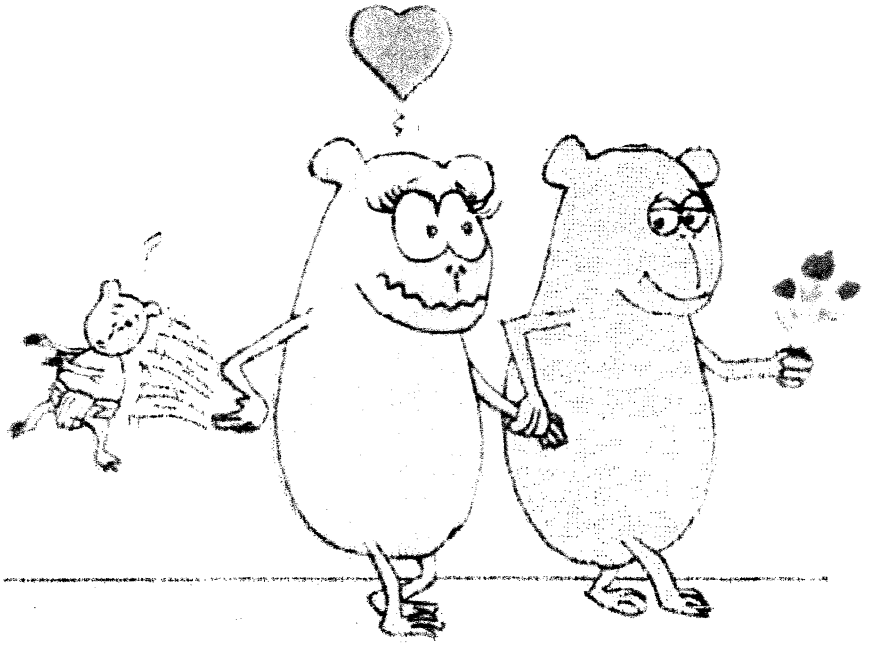
Gestation is 67 days.
Feed good quality forage and water



Breed one male with seven females in pens 1.5x1x.45m

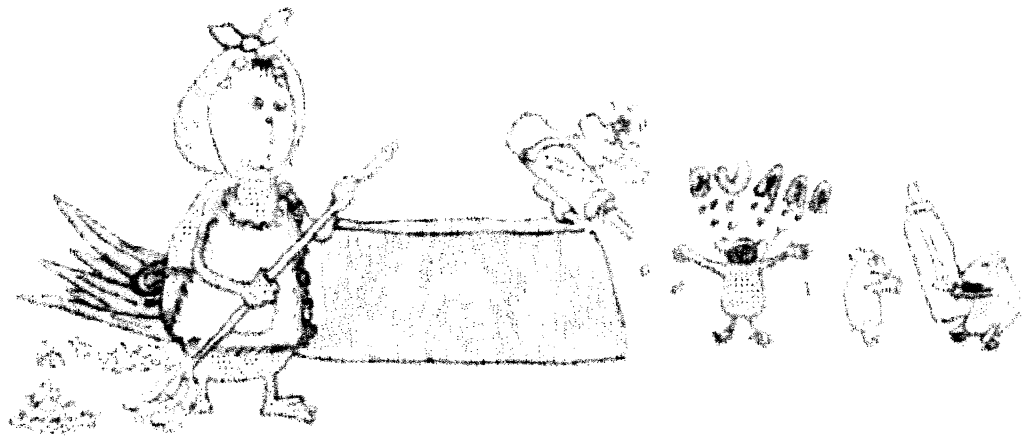


Parturition
Between 1-5 young are born per female. Newborns have hair, open eyes and eat pasture



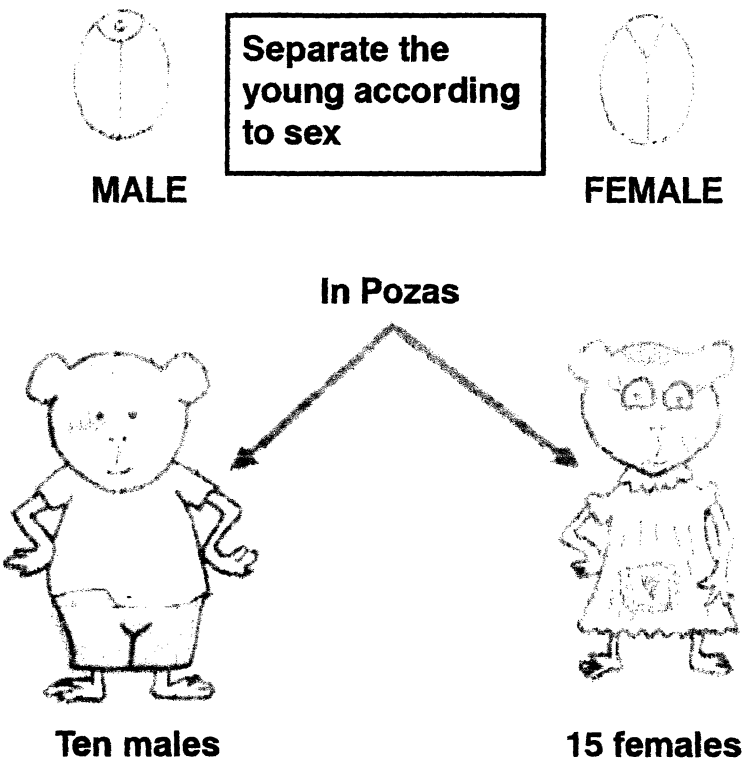
Take advantage of the post partum heat

LACTACION

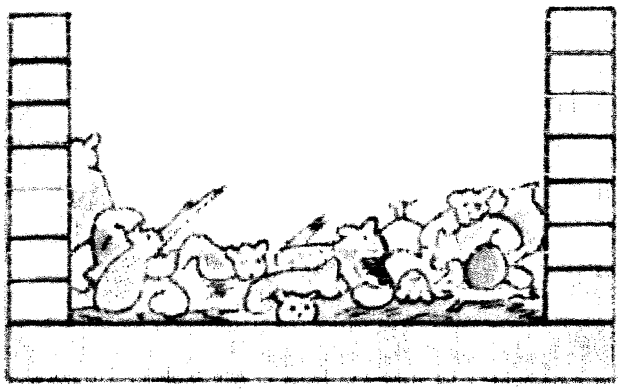


With a concentrate diet weaning is at 11-14 days compared to 21 days with a forage diet

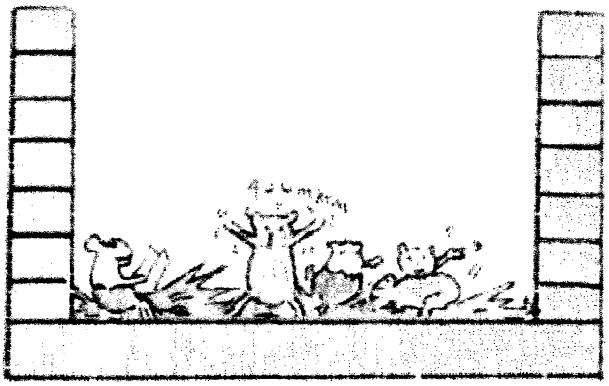
WEANING


Separate the young according to sex
MALE
FEMALE
In Pozas
Ten males
15 females

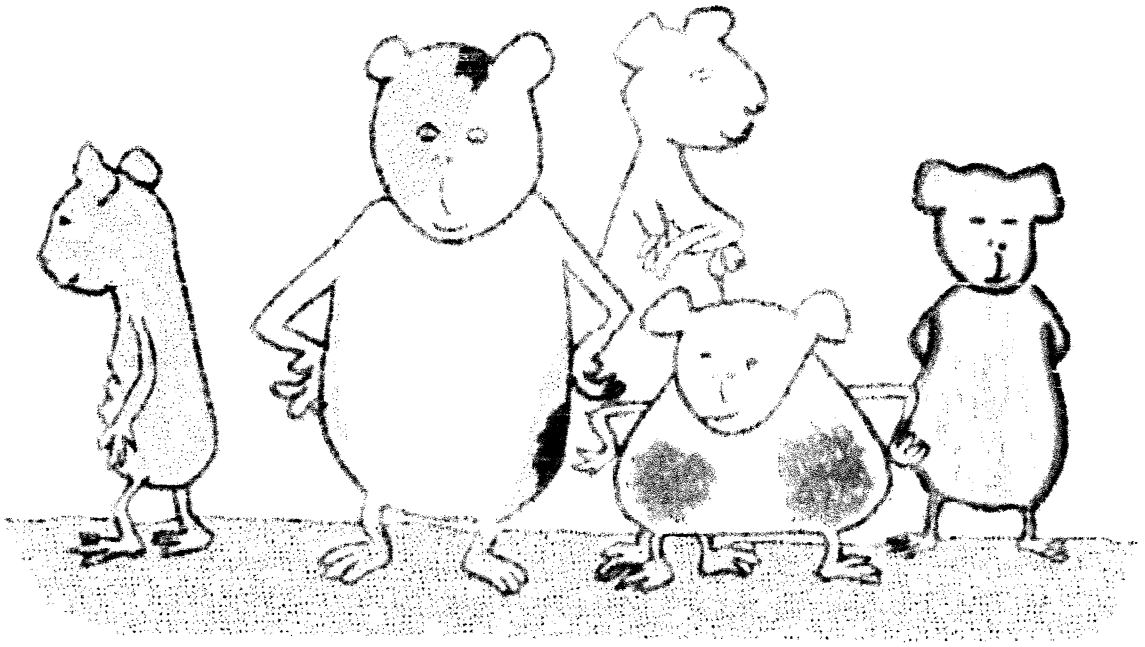
REPLACEMENTS



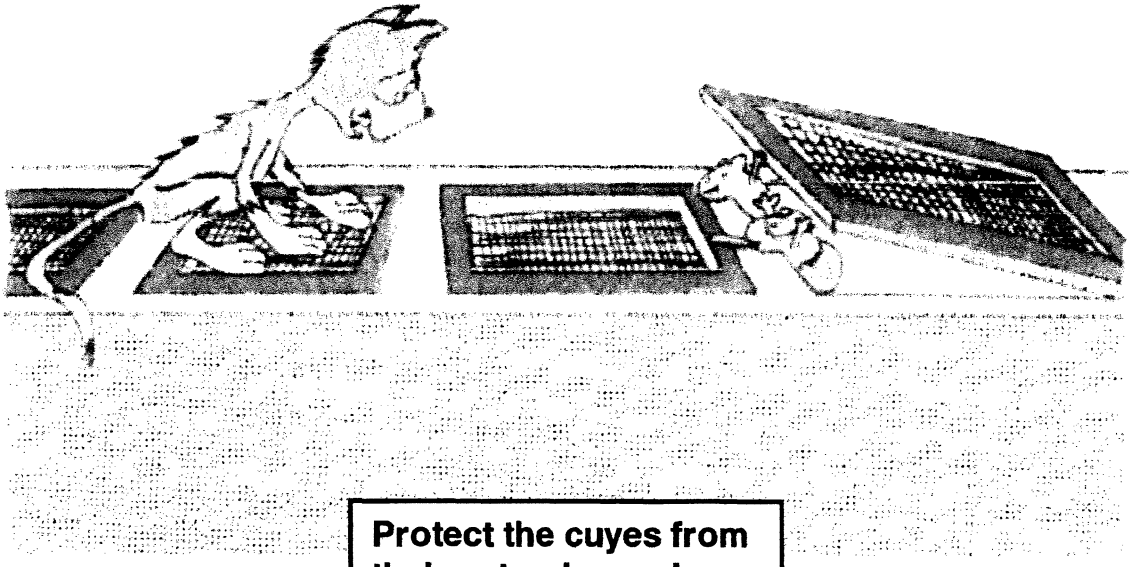
Do not raise the animals in large groups



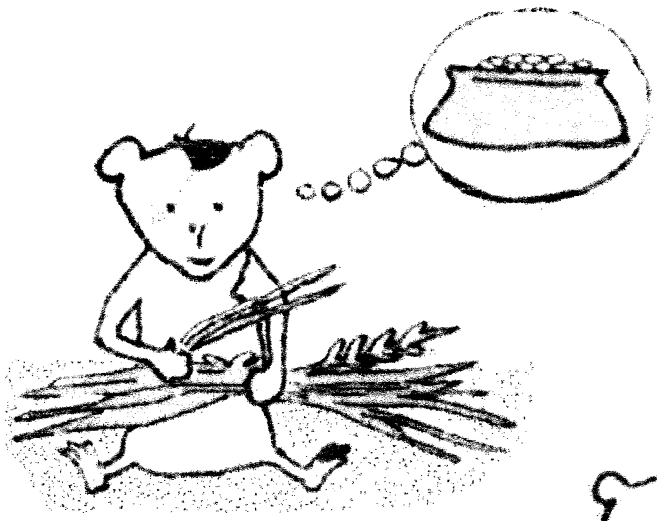
Raise in small groups according to age and sex



From one age group select the best animals for replacements



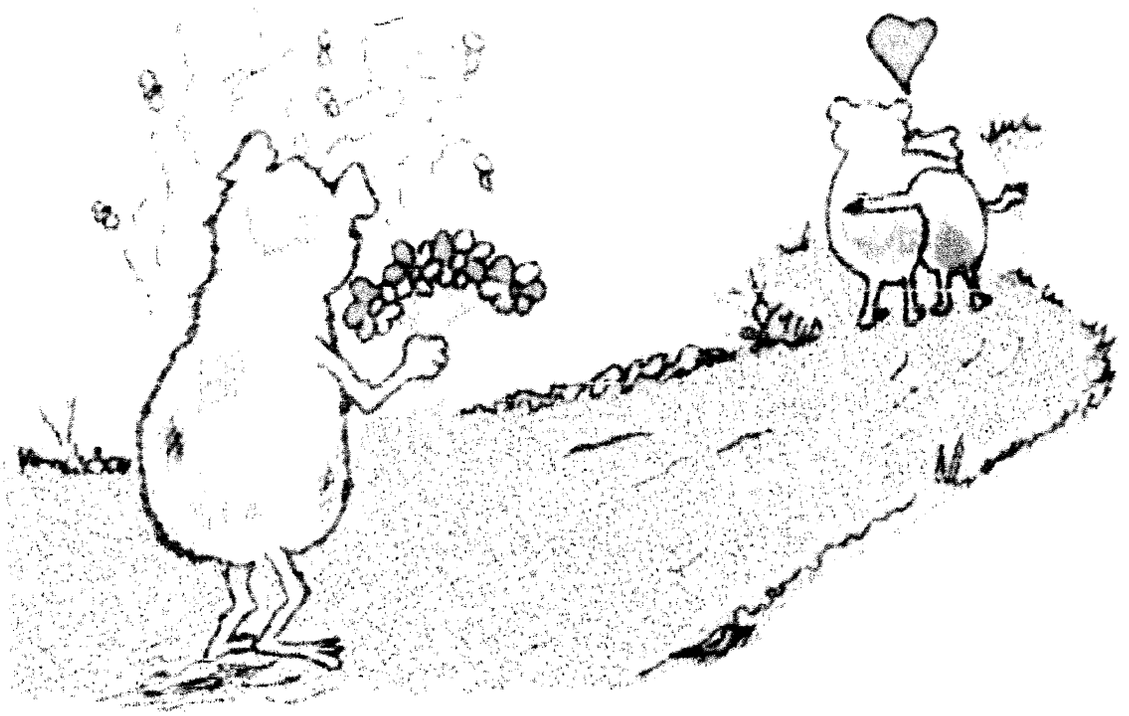
Protect the cuyes from their natural enemies



Forage only grow slowly

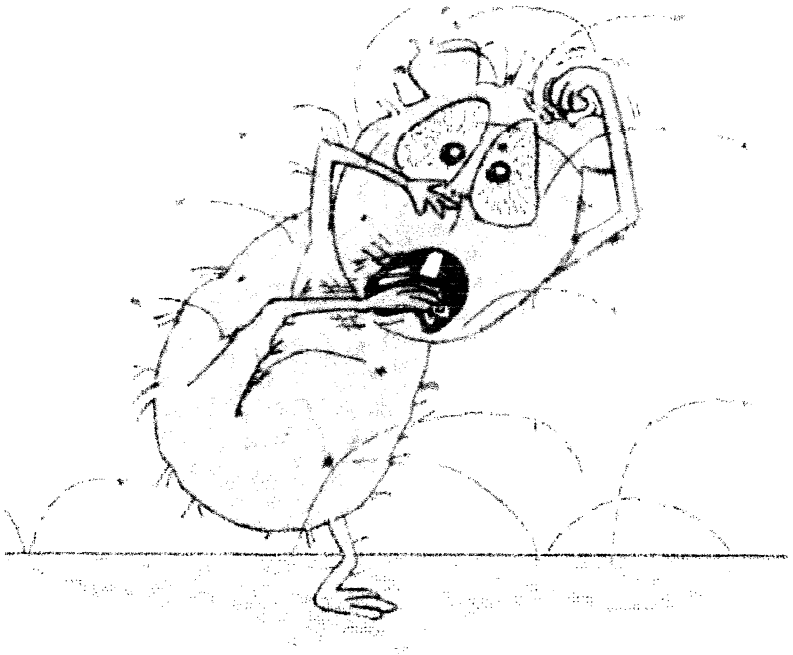
Forage plus concentrate for rapid growth

Fresh green forage is important for the health of the cuy

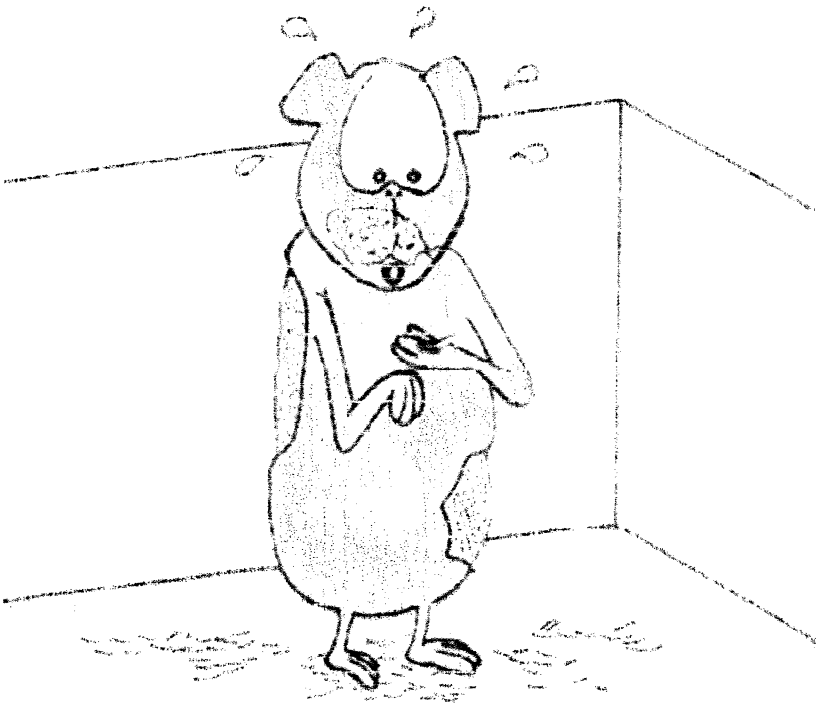


Prevent disease by cleanliness, disinfecting and feeding high quality food

Protect them from ectoparacites...

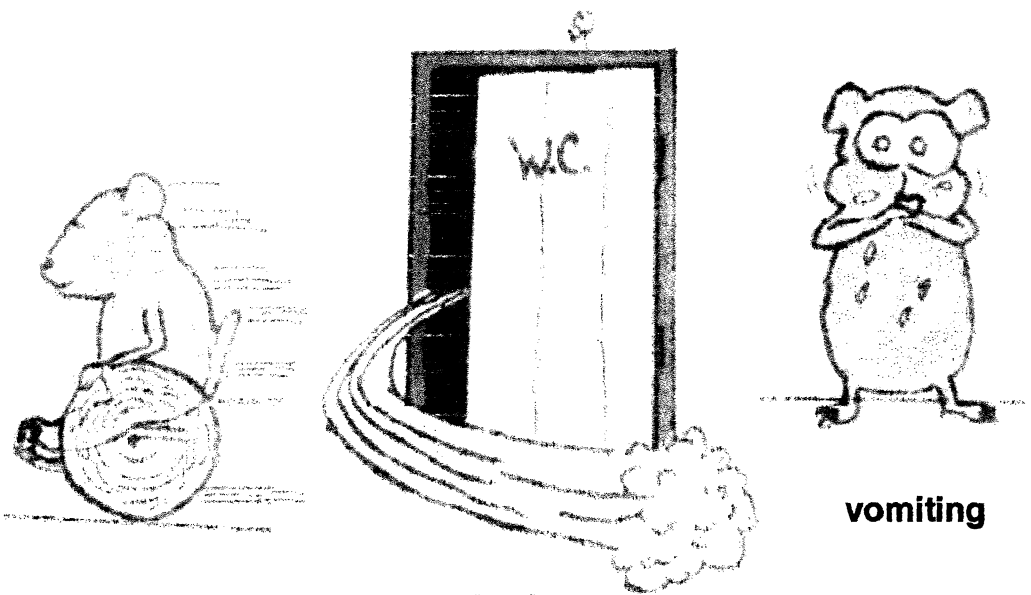


Fleas, mites and lice



It is very important to always have the pens clean to prevent dermatitis

An outbreak of salmonellosis can cause:

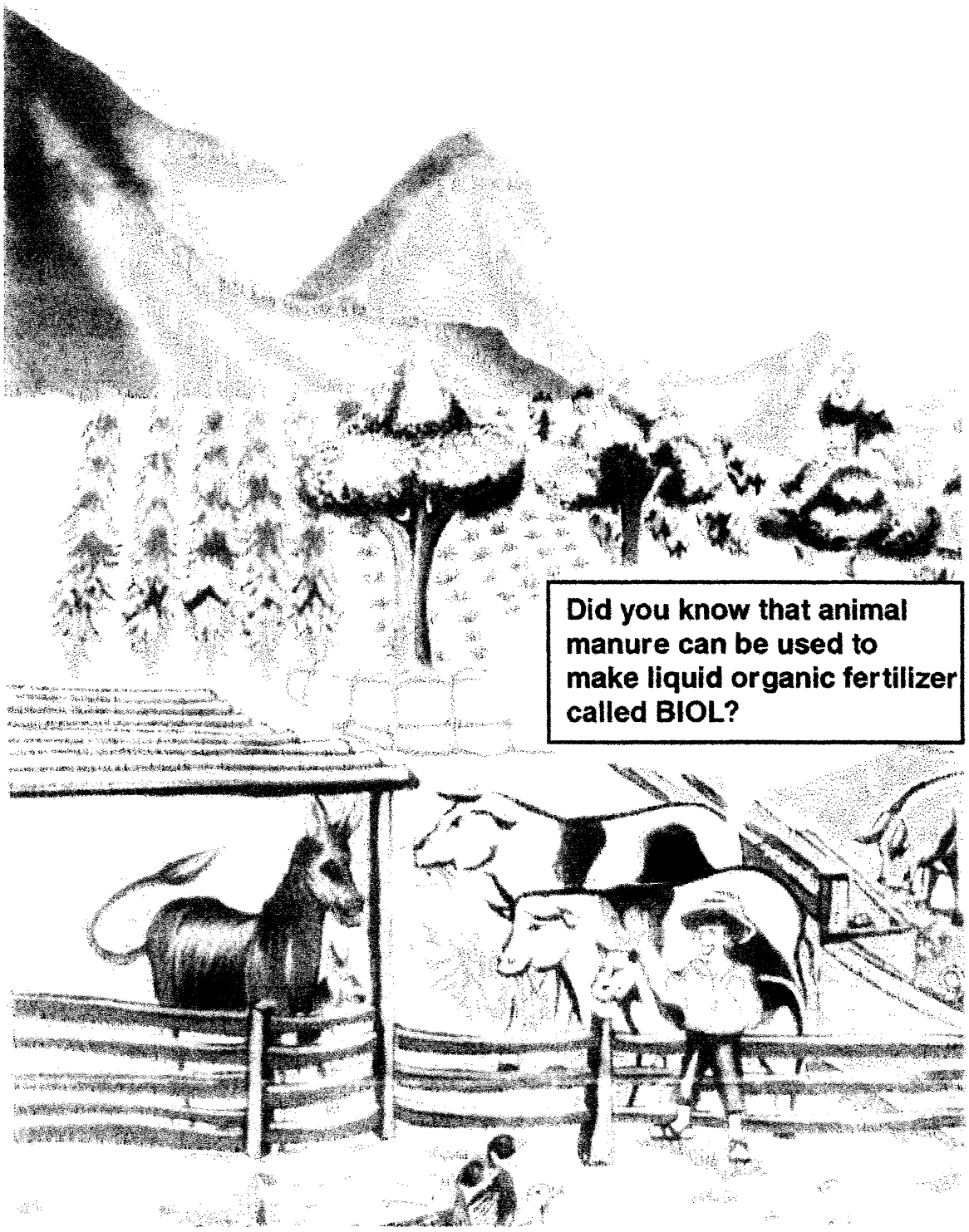


paralysis of the rear legs

diarrhea

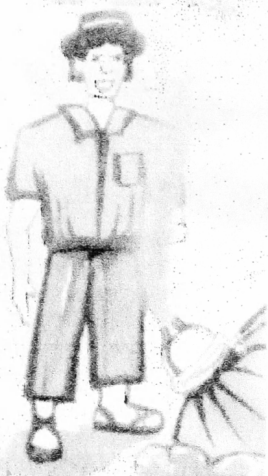
vomiting

APPENDIX 3. BIOL METHOD OF LIQUID FERTILIZER PRODUCTION

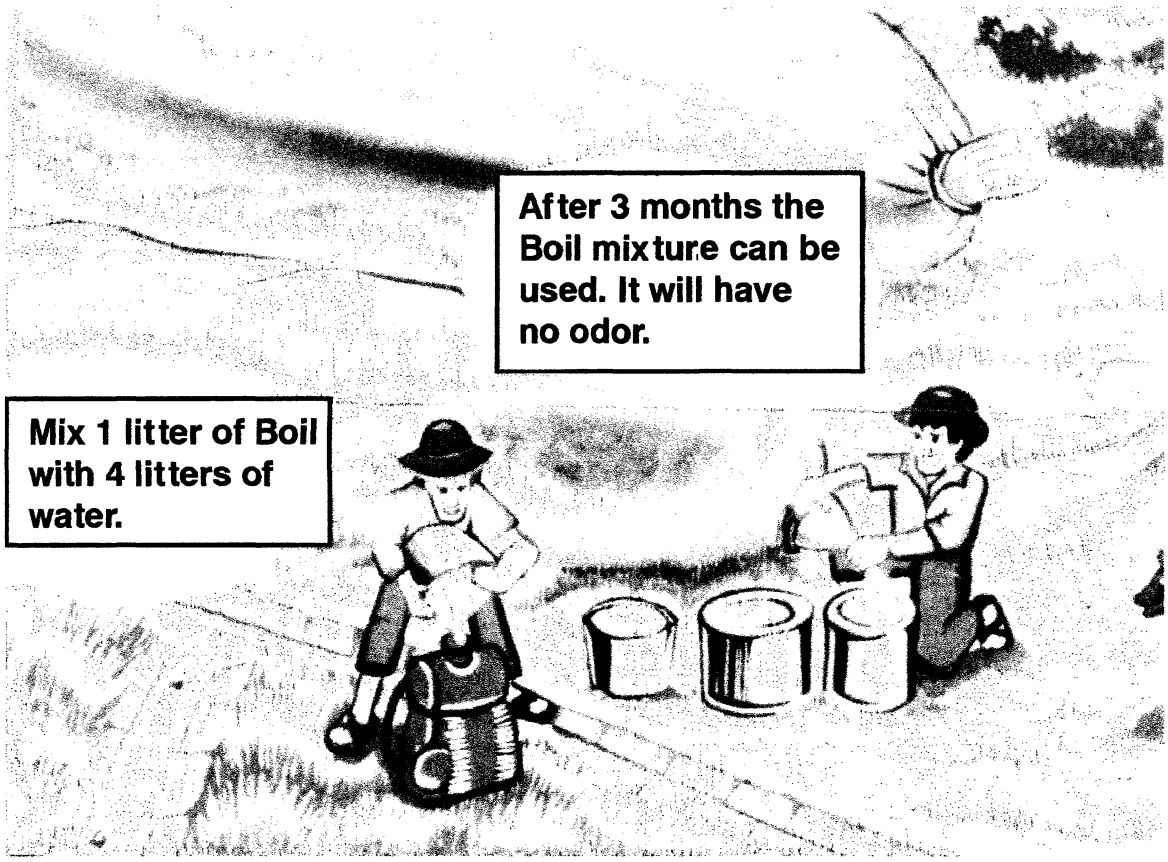



Collect the manure and put it in a shady area to conserve the humidity.
Mix one pail of manure with a pail of water. Place this inside the plastic bag.

As the mixture ferments, gas is produced. The top should be carefully opened to allow the gas to escape.



Advantages: increased plant growth, disease resistance, increased harvest.

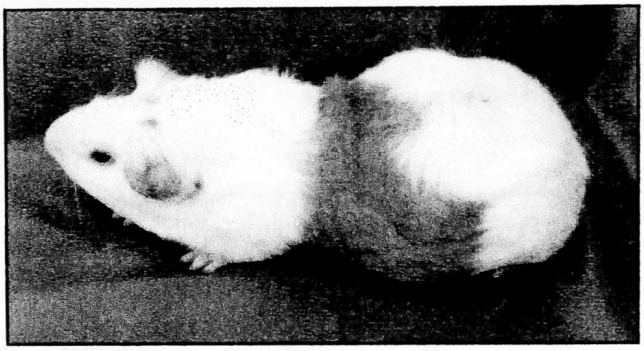

After 3 months the Boil mixture can be used. It will have no odor.
Mix 1 litter of Boil with 4 litters of water.

APPENDIX 4. BREEDS OF CUYS

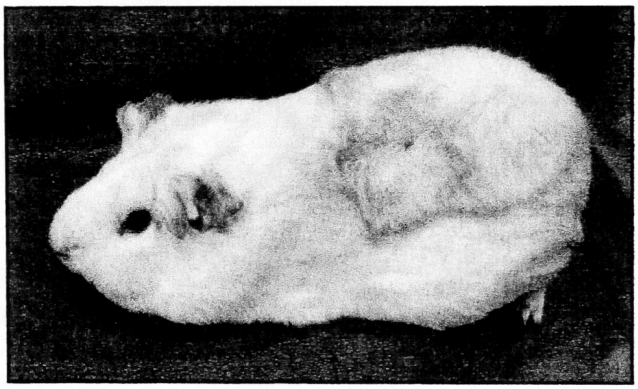
English Cuy
Fig. 1

Abyssinian Cuy
Fig. 2

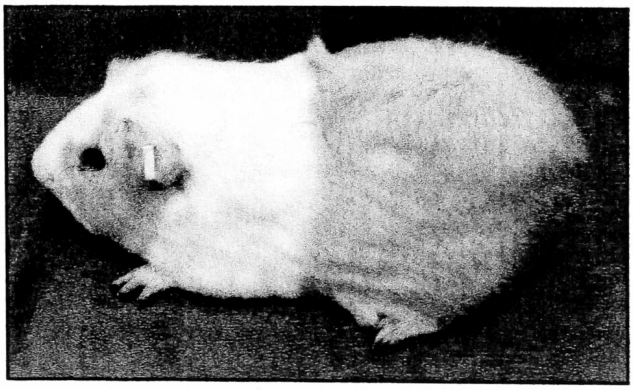
Peruvian Cuy
Fig. 3



Improved Breed Peru
Fig. 4

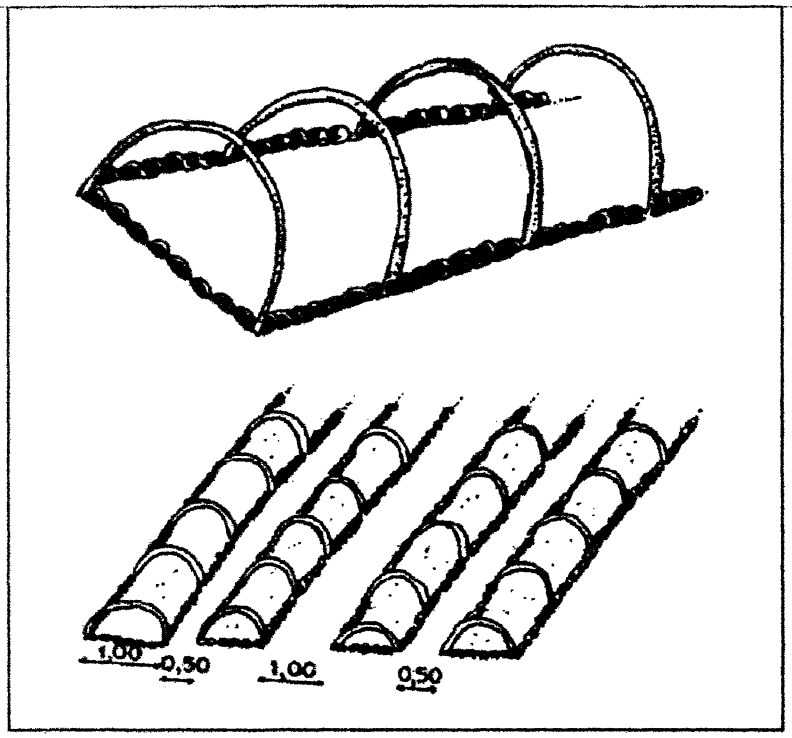


Improved Breed Andina
Fig. 5



Improved Breed Inti
Fig. 6

APPENDIX 5.



Structure for growing alfalfa
Fig. 7
Source: Aliaga 1993

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