ALPACA GENETIC IMPROVEMENT PROGRAM OF THE CAYLLOMA PROVINCE - PROMEGE

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COLLABORATION

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- Eduardo Frank – Michel Hick
  - UCC - SUPPRAD - Argentina
- Marco ANTONINI
  - ENEA - Italy

Various Projects

Project		Partnership	Time
PELOS FINOS "Program to improve Argentinean South American Camelids' fiber production"	EU DG1	Italy, Spain, Argentina	1992-1995
SUPREME "Sustainable Production of Natural Resources and Management of Ecosystems : The Potential of South American Camelid Breeding in the Andean Region"	EU DGXII	Italy, Germany, France, U.K., Argentina, Bolivia, Chile, Ecuador, Peru	1996-2001
DECAMA "Sustainable Development of Market-Oriented Camelid Products in the Andean Region"	EU INCO DEV	Italy, Germany, Argentina, Bolivia, Peru	2002-2006

"PROMEGE"

ALPACA GENETIC IMPROVEMENT PROGRAM OF THE CAYLLOMA PROVINCE

BACKGROUND

- 1985 desco - Rural Development Colca Canyon Program
- 1996 desco- Center for Development of Alpacas-Toccra
- 1997 EU - INCO Program (ended in 2001)
- 1998 desco - Supreme Program: Formula Selection Plan (Gonzales and Renieri)

- 2003 – AGE Home Selection Program: Australia & New Zealand
- 2005 – ITALPACA Home Selection Program: Italy
- 2005 – Promege Start Selection Program: Caylloma – Arequipa
- 2007 - desco becomes a member of ICAR (International Committee of Animal Recording)

2007 – Promege – Genetic Index Determination

DEMOGRAPHIC PARAMETERS OF THE ALPACA POPULATION IN CAYLLOMA

- **200,000 Alpacas**
- **90% Huacaya**
- **10% Suri**
- **60% White**
- **40% Color**

SPECIFIC OBJECTIVES OF PRE-SELECTION

On the TOCCRA Population was discarded animals that have:

- Morphological congenital defects
- Unknown features of specific race.
- Spotted alpacas
- Non-uniform color patterns
- Undefined fleece

SPECIFIC OBJECTIVES OF SELECTION

- Fleece Type:
  - **HUACAYA**
  - **SURI**
- Solid Color:
  - **BLACK OR WHITE**
  - **BROWN**
- Reduction of Fiber Diameter (fineness)
- Reduction of Coefficient of variation (CV) of Fiber Diameter
- Increase of Fleece Weight

SELECTION CRITERIA

- Direct observation of animals at birth, by fleece type and color
- Produced fiber weight in the first shearing at age one with a confidence interval of ± 2 months (Antonini et al 2004)
- Average fiber diameter and the coefficient of variation of fiber obtained during the first shearing through a sample on the left side of the alpaca

Genetic Parameters

Quantitative Features

- Fleece weight
- Fineness of fiber (diameter)
- Coefficient of Variation of the Fiber Diameter

Tab. 1. Alpacas (n = 288)

	Huacaya (255)		Suri (33)	
Color	Female	Male	Female	Male
White	87	98	12	21
Brown	21	34	-	-
Black	7	8	-	-
Total	115	140	12	21

+ 5 animals in other colors (Gray, LF)
Total = 29

Statistical Difference between Variables

Factors →	TYPE		SEX		Birth year	
	Huacaya Suri		Male Female		2005 2006	
Variable ↓	F	Sig.	F	Sig.	F	Sig.
Fleece Weight	0,322	0,571	0.28	0,868	0,910	0,763
Fiber Diameter	2,205	0,139	0,008	0,931	10,461	0.001
Coefficient of Variation	7,939	0,005	0,057	0,811	2,575	0,110

Uses of the Statistical Program

- **Multiple-Trait Animal Model**
- **MTDFREML (Multiple Trait Derivative-Free Restricted Maximum Likelihood) (“Agricultural Research Service – United States Department of Agriculture”)**
- **Excel.**

Heritability and Correlations

	Fleece Weight	Fiber Diameter	Coefficient of Variation
Fleece Weight	0.84	0.230*	0.377* ← g
Fiber Diameter	0.179*	0.32	0.324*
Coefficient of Variation	0.091	0.124*	0.46

f $P \leq 0.001$

SI -Selection Index

	Fleece Weight	Fiber Diameter	Coefficient of Variation
variable Weight	0.10	0.50	0.40

Genetic Index: General Data

- 293 animals
- 154 positive indexes (53%)
- Reliability

  Variation = 50.3% - 78.3%

  Average = 73.3

  126 animals ≥ 73.3%

HUACAYA *n. = 255*

	♀(115)		♂ (140)	
Color	+	-	+	-
White	47	40	41	57
Brown	15	6	26	8
Black	3	4	4	4
Overall	65	50	71	69

SURI (n = 33)

	♀(12)		♂ (21)	
Color	+	-	+	-
White	5	7	11	10
Brown	-	-	-	-
Black	-	-	-	-
Overall	5	7	11	10

Selection Scheme

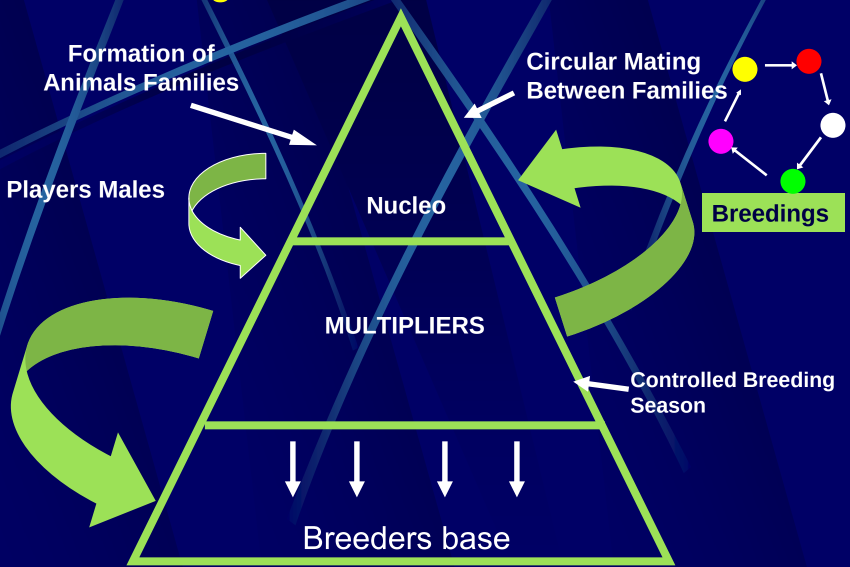
2 SCHEMES:

- **Open Nucleo**
  HUACAYA WHITE
  - SURI WHITE
- **Cooperation Nucleo**
  - HUCAYA BROWN

Benefits to Schedule the Open Nucleo

- Best population stratification
- Reduction of the number of control animals
- Good intensity selection
- Election of elite group

Diagram Selection Scheme



Nucleo Families Structure

Alpaca huacaya white (9)

Alpaca huacaya brown (4)

Alpaca suri white (4)

Reproductive Management of Open Nucleo

CIRCULAR MATING SYSTEM

(Wright, 1921, 1931: Kimura and Crown, 1963)

“Maximum Avoidance of Inbreeding”

- $N_e = N$
- Avoid close consanguinity (Current inbreeding)

HALF SIB CIRCULAR MATING SYSTEM

Subdivide the nucleo units (families)

- Equalize the number of families (EFS = Equalization of family size);
- To reduce the fluctuation of the number of families across generations

CIRCULAR SCHEME

- The families form a circle alternatively
- The breeding season is between distant animals in terms of inbreeding
- The males in the family breeders pass to the right family

PROMEGE MATING PROGRAM

FAMILIES

- Same race
- Same color
- Children to cousins in the first degree
- Average of 20 to 30 females

Reproductive Reference Parameter

- Male to female 15

Using males with a replacement:

- Nucleo: biannual
- Multipliers every three years
- Average females fertility above 70%

Intensity Selection of the Nucleo

NEGATIVE ALPACA
Males → slaughter
Females → outside the selection plan or slaughter

POSITIVE ALPACA
Male
10% - 20% Nucleus
80% - 90% → Multipliers
Female
50% Nucleus
50% → Multiples

Criteria for Choosing Multipliers

- Stud Book
- Performance CONTROL
- Programmated Mates

CONCLUSION

- The selection plan achieves a greater genetic progress since it enables the implementation of scheduled breeding season between animals with positive selection index
- The plan for selecting the Nucelo can be disseminated in a context of “Campesinos” systems
- The genetic improvement program must set their objectives, geographical areas, populations and priorities to prevent the occurrence of undesirable effects on its target population


Thanks