EXPERIENCES WITH A LARGE SCALE SHEEP GENETIC IMPROVEMENT PROJECT IN THE PERUVIAN HIGHLANDS

J.P. Mueller\(^1\), E.R. Flores\(^2\) and G.A. Gutierrez\(^2\)

\(^1\)Instituto Nacional de Tecnología Agropecuaria, Bariloche, Argentina
\(^2\)Universidad Nacional Agraria La Molina, Lima, Perú

INTRODUCTION
We describe experiences during the development and implementation of a low input sheep breeding program aimed at improving living standards of Andean peasant communities. Target communities are located in the “Sierra Central” an isolated high mountain range environment (4000-4500 masl) to the east of Lima with subhumid cold weather conditions where sheep, alpacas and cattle, in that order of importance, are run in extensive pastoral familiar, communal and multi-communal production systems. Typically, familiar flocks involve 30-400 sheep which are kept close to the owners house and serve for basic subsistence needs of the family. Communal flocks involve about 4000 sheep which are run as a single flock on public land in the vicinity of a peasant community. Meat and wool revenues produced in such a flock are distributed among members of the community (about 1000 families). Multi-communal flocks (on average belonging to 6-10 communities) originated from expropriation of former privately owned land and mining companies. Such flocks consist of up to 100.000 sheep which are run on several sites but respond to a single general breeding arrangement. The different production systems entail differences in breeding infrastructure, organizing capacity and technological input which in turn result in differences in productivity parameters (Flores 1996).

Project background. In the Sierra Central there is no governmental or private agricultural advisory service. Animal research activities supported by the USAID Small Ruminant – Collaborative Research Program generated basic information in the 80s (Flórez 1990) but ceased as terrorism escalated. Early in the 90s the Agricultural University La Molina of Lima started a comprehensive sheep and camelid production project in the Sierra Central with survey activities and regular meetings with peasant representatives to discuss cooperation areas. In the process, the development of a genetic improvement program emerged as a priority. This was to some extent a surprise as plenty of other production and marketing difficulties were observed. As the university itself had no experts involved in sheep breeding it applied successfully to the Argentine Technical Cooperation Fund for support from its National Institute of Agricultural Technology. Further financial support was obtained from the Agrarian Development Fund and from the mining corporation. A joint effort to establish a sheep breeding program in the Sierra Central started in 1996 with an analysis of the traditional breeding system.

Traditional breeding system. Most sheep are of the double purpose (meat and wool) Corriedale breed or are native type sheep with different levels of upgrading. Body weights are comparable to commercial flocks run in more benign breeding regions of South America, however fleece weights are relatively low and wool quality and uniformity is poor. Breeders claim for improved stock in particular in view of consistent market signals for finer high
quality wool. Rams may be homebred, bought or exchanged, produced in independent ram-breeding flocks or introduced from elsewhere. There is no genetic structure involving the whole Corriedale population (Figure 1). In addition there is no performance recording nor pedigree keeping, all selection decisions are based on visual appraisal of animals. Only the large multi-communal populations have 3 tier genetic structures but again without following a formally designed breeding program (Gutierrez 1999).

**Figure 1. Initial situation, lack of breeding structure with flocks of unknown genetic merit and various sources of rams**

**PROGRAM DEVELOPMENT AND IMPLEMENTATION**
After about two years of discussions 7 peasant communities and one multi-communal company, agreed on (1) the development of a breeding program aimed at improving wool production and (2) the establishment of an appropriate extension service in order to make full use of available breeding technology.

**Choice of breeding strategy.** The options were: (a) Adjust work on present ram producing flocks with the advantages of drawing on a loose but already established dissemination system and of requiring a minimum number of people to be trained, but has the disadvantage of potential lack of participation and compromise by ram users. (b) Develop independent breeding programs for each of the participants with the advantages of individually tailored programs and personalized training but disadvantage of high operative and coordination costs. (c) Generate a collective breeding structure for the production and supply of rams for the whole Corriedale
population in the region which may be less efficient but sets room for expansion and sustainability. The last option was chosen and a pyramidal breeding structure was designed.

**Planned breeding structure.** Each participating village establishes a multiplier flock (some already had one) and supplies the very best ewes to a central nucleus. The multi-communal company participates as an additional member supplying ewes from its top layer. Optimum open nucleus design demands best ewes be concentrated in the nucleus, and cull for age ewes be replaced with best ewe hoggets available in the nucleus and in the participating flocks in proportions depending on selection accuracy (Mueller 1984) but the lack of performance records and genetic links precludes accurate between flock selection. In addition participants prefer having each equal access to rams. Therefore each flock contributes the same number of foundation ewes. This is clearly not efficient but is accepted in the sake of group harmony. Considering necessary rams, effective reproductive rate, mating ratios, age structure and inbreeding tolerance the minimum size for the central nucleus is set to 250 ewes and 6 rams and minimum size for multipliers to 200 ewes and 4 rams. Initially frozen semen from 3 Argentine rams donated by the Argentine Corriedale Breeders Association and 3 additional rams donated by the multi-communal company are used. Local rams have good reputation and foreign rams performed very well elsewhere. Performance (weaning weight, hogget weight and fleece weight) and pedigree recording was planned in the central nucleus, best progeny tested sires would be intensively used. Performance recording was planned for the multipliers. It was expected that operational problems would limit further upward gene flow (Figure 2).

![Figure 2. Planned genetic structure. A central nucleus providing rams to multiplier flocks](image-url)
Establishment and operation of central nucleus and multiplier flocks. Eventually in June 1997, 432 ewes were synchronized and artificially inseminated in the central nucleus, half by laparoscopy with frozen imported semen and half with fresh local semen. At 7 month of age lambs were classed and shorn. Foreign sires performed better than local sires in fleece weight (5%) and fleece quality score (6%) but worse in body weight (4%). The following year 521 ewes were inseminated. In both years half of the ewes with their lambs returned to their village setting the foundation of multiplier flocks. In 2001 participants have increased to 15 and central nucleus to 300 ewes. Most multiplier flocks reached the desired size. In the nucleus, ram hoggets are performance tested and visually classed. Best rams are used on nucleus and multiplier ewes. Total sheep population involved in the program is close to 160,000.

Technical support. Participants wisely emphasized the necessity of technical support. Options were analyzed in terms of other experiences and foreseeable resources. Eventually community leaders agreed on the cession of land to the University for the establishment of the so called “Research and Peasant Training Center” (CICCA) which harbors the central nucleus but also serves as demonstration farm. At the CICCA courses are held on visual selection criteria, reproductive and health inspection procedures, wool classing and artificial insemination. Farmers judged the CICCA activities as successful and in 2001 extended the agreement for another 5 years. This may be the single most important decision for the future of the program.

EXPERIENCES AND FUTURE DIRECTIONS
Main positive consequence of the program has been on the social front. Cooperation and interaction between participants has fostered discussions on technical and operational aspects of the breeding program as well as on other aspects affecting the villages (including marketing, legal and security matters). The establishment of the CICCA has been essential for the training, and the building up of confidence and involvement of farmers and has attracted attention for private and public, national and international cooperation and sponsorship. Operational difficulties resulted larger than expected, mainly because many assumed husbandry figures and skills did not correspond to reality. Selection accuracy is increasing progressively but not as fast as planned as many difficulties in performance recording remain. Interestingly, importation of semen and use of laparoscopic artificial insemination was of a great attraction, even though pregnancy rate was rather poor and progeny of foreign sires did not perform extraordinarily well. It was not easy to convince farmers that sustainable programs depend more on genuine resources and capabilities. At this time, we believe that more years of external orientation and support will be needed before the program can run independently and efficiently.

REFERENCES