

PN-ACP-751

114907

## FINAL REPORT

Submitted to Human Capacity Development  
Bureau for Global Programs, Field Support and Research  
US Agency for International Development

### **Improvement of sheep production in Kazakhstan**

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CDR project No. TA-MOU-94-CA13-028

USAID Grant project Officer:  
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Project Duration: 1995-1999

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## EXECUTIVE SUMMARY

The aims of the present project were A. to explore the possibility to improve sheep production in Kazakhstan by introducing dairy breed to be used as pure breed or for crossbreeding. The Israeli improved Awassi fat tail breed known for its high milk production and hardiness was pointed out as the dairy breed of choice. B. to define physiological criteria for selection of highly prolific ewes. C. to improve techniques of freezing ram semen. In addition, an important aspect of the project was to support Kazakh scientists to continue their work for Kazakh agriculture under conditions where governmental support is limited.

According to the working plan, Awassi crosses were established in Semipalatinsk region, on the border of Siberia, by inseminating fat-rump Edilbaev ewes with frozen Awassi ram semen Imported from Israel. The 150 F1 lambs born showed good adaptability and performed well under the severe conditions. Pure Awassi breeding nucleus was established near Almaty by transporting live Improved Awassi ram and ewe lambs. Milk production of the improved Awassi in Kazakhstan, even under inferior management found to be about 3 time more then that of local breeds, showing that revenue form a sheep can be doubled.

Monitoring induced ovulation rate at 5 month of age found to be an efficient way to identify prolific ewe lambs in the Booroola-Assaf crosses. Low viability rate following thawing of frozen ram semen is a limitation. By using the Directional Solidification Apparatus and the modified Tris-based diluent we were able to obtain high motility rate up to 73% in frozen thawed ram semen.

Several working visits of the Kazakh collaborators to the Volçani Center were conducted through the project. The knowledge they gained during those visits and the scientific instruments, chemicals and scientific literature the they carried each time on their way back contributed to their ability to continue research activity in Kazakhstan.

## Section I: Scientific

### A. Research Objectives

1. Low profitability of raising sheep for wool, meat or pelts under market conditions in Kazakhstan put sheep production in the country under threat. As milk production and supply of milk products is in shortage, moving into dairy production can make sheep production profitable again. To do that, dairy sheep have to be used. Our objectives were to introduce to Kazakhstan the Improved Awassi breed as pure breed and by crossbreeding and to evaluate its adaptability and performance under local conditions.
2. Usually, Dairy sheep are managed under semi-intensive or intensive production systems. Under those conditions, high prolificacy can be of economic advantage. Carrying the FecB (Booroola) gene increase prolificacy. As the gene is segregating, our objective was to further develop pre-pubertal means for early detection of prolific ewes. Induced ovulation rate in five month of age ewe lambs was investigated in Booroola-Assaf crosses.
3. Unlike the situation with dairy cattle where AI using frozen-thawed bull semen has become the major reproductive procedure in commercial herds, AI with frozen ram semen is of limited use in sheep due to the unsatisfactory pregnancy rates obtained by vaginal insemination. It was found that frozen-thawed ram semen has limitations in passing the cervix. Different diluents for freezing ram semen were developed in the former Soviet Union and in the Western world. Our objective was to compare those diluents and to test new freezing techniques developed by Dr. A. Arav from the Cryopreservation lab. of the Volcani Center.

### B. Research Accomplishments:

#### **Establish of Awassi breeding nucleus in Kazakhstan.**

On January 1998, three month old Awassi ram lambs (n=5) and Awassi ewe lambs (n=25) were send by air from the Volcani Center to the Kazakh Institute of Sheep Breeding. The lambs were out of the Improved Awassi flock of Kibbutz Ein Harod, progeny of nine different Awassi sires. The lambs were selected based on their dams' milk production. All lambs arrived safely to Kazakhstan. The lambs were housed at Kazakh Institute of Sheep Breeding and on May, 27, 1998, the average body weight of the ram lambs and the ewe lambs was  $41.6 \pm 2.0$  and  $33.1 \pm 0.9$  kg (mean $\pm$ SD), respectively.

The Awassi nucleus was kept under extensive traditional management conditions of Kazakhstan where ewes are kept almost only on pasture. Awassi ewes found to be adapted to those conditions and gave relatively reasonable yield of milk. Ewes in their first lactation who were milked once a day for four months while nursing their lambs, and later after weaning twice a day for a month, produced on the average 92.5 l of

milk. Ewes that their lambs were removed and they were milked twice a day from lambing produced 145 l (Malmakov et al., 2000). It is clear that the Awassi in Kazakhstan was kept under inferior management, as similar ewes under the intensive management of Ein Harod in Israel produce 370 l in their first lactation. It was found that while mean daily milk yield of the Awassi in Kazakhstan was 0.84 l/day, milk yield of contemporary Kazakh fine-wool ewes was 0.29 l/day only. Taking into consideration that average income from selling a lamb at 30 kg is 2,400 KZT and that the price for one l of milk is 15-25 KZT, milking Awassi ewes, can clearly doubled their revenue (Malmakov et al., 2000).

### Performance of Awassi Edilbaev F1 lambs

During 1995-1996, 450 Kazakh fat rump ewes belonging to "Auezoz" cooperative Kaskabulak Village, near Semipalatinsk were artificially inseminated with Awassi frozen semen imported from Israel. Semipalatinsk is located about 1,200 km away from Almaty, on the border of Siberia. A total of 150 F1 ram and ewe lambs were born. Awassi crossbreds adapted well to the severe conditions of Semipalatinsk and as can be seen in Table 1, their growth rate was comparable with that of the local breed.

There are now some 1000 Awassi crossbreds in several commercial flocks in the Semipalatinsk region. Due to the remote location of the place, there is no regular data collection on the performances of those Awassi crosses in general, and on their milk production in particular.

Table 1

Body weights at birth and at weaning of F1 Awassi and 1/4 Awassi - 3/4 Kazakh fat rump ram lambs born in 1997.

Age	F1		1/4 Awassi		Kazakh fat rump	
	n	Body Weight	n	Body weight	n	Body weight
At birth	28	5.3	13	5.4	30	5.2
4 months	21	35.7	11	35.6	332	35.3

### Development of physiological criteria for high prolificacy in sheep

Previously, we showed that induced ovulation rate (IOR) at five month of age can be used as an early physiological criterion for high prolificacy. We continued to follow that line of research and so far obtained results from 1092 Booroola-Assaf crossbred ewes (Table 2) and 130 Booroola-German Mutton Merino ewes (Table 3). As can be seen, IOR is correlated in the Booroola Assaf crosses with prolificacy and showing 3

or more induced ovulations can be suggested as a selection criterion for prolific hoggets. No such clear correlation was obtained with the Booroola-German Mutton Merino crosses. This genotype-related difference requires further investigation.

**Table 2**  
Induced ovulation rate at 5 months of age and prolificacy up to  
forth lambing in Booroola Assaf crossbred ewes

No. of induced ovulations	No. of ewes	No. of lambings	Prolificacy (lamb born / ewe lambing) (Mean+SEM)
0	116	353	1.77±0.06
1	202	647	1.57±0.04
2	311	1004	1.79±0.03
3	269	807	2.11±0.07
4	111	325	2.23±0.06
5	51	148	2.40±0.10
6	23	81	2.38±0.15
7	9	29	2.41±0.23
Total	1092	3394	

**Table 3**  
Induced ovulation rate at 5 months of age and prolificacy up to  
the forth lambing in Booroola G.M. Merino crossbred ewes

No. of induced ovulations	No. of ewes	No. of lambings	Prolificacy (lambs born/ ewe lambing) (Mean+SEM)
0	19	35	1.93±0.15
1	26	57	1.61±0.08
2	38	80	1.45±0.08
3	22	43	1.79±0.12
4	12	28	1.81±0.11
5-7	13	29	1.72±0.15
Total	130	272	

### Comparison of Soviet and Western diluents for freezing ram semen

Cryopreservation of ram semen is important for preservation and disseminating of genetically-valuable breeding material. Successful cryopreservation of ram semen depends on freezing extender in use and on freezing and thawing methods. Different extenders were developed in former Soviet Union and in Western countries.

However, to our best knowledge, the ability of those extenders to support ram semen freezing has not been compared under similar condition.

In several studies we evaluated the post thawing motility of ram semen following the use of different "Eastern" and "Western" extenders, using a novel freezing apparatus. The "Eastern" freezing extenders examined were VK1 and VK2 that contain sucrose and EDTA salts, and the BNII extender that contained lactose, dextrin, EDTA and TRIS. One of the "Western" extenders examined was based on TRIS, glucose and citric acid and the other one was a commercial extender (Triladyl, Minitub, Germany). In a Typical experiment, semen from four Booroola Assaf crossbred rams was collected, diluted to a concentration of  $500 \times 10^6$  sperm/ml, loaded into maxi straws (5ml) and frizzed. For semen freezing we used the new freezing device (Alon 500, Merchavia, Is). This device has a constant thermal gradient, linearly distributed through a gap ( $d=1\text{mm}$ ) between two blocks with temperatures of  $T_h=5$  and  $T_c=-50$  C, respectively. Maxi-straws were passed through a temperature gradient ( $G=55$  C/mm) at a constant velocity ( $V=1.5\text{mm/sec.}$ ) which produce cooling rate of ( $B=GV=4950$  C/min.). For thawing, the straws were plunged in a hot water bath (75 C) for not more then 8 seconds and transferred to 38C water bath for further warming. Semen motility was investigated in each straw. Results are summarized in Table 4.

Table 4: Post-thawing viability of ram semen frozen using different extenders.

Extender	VK1	VK2	BNII	Tris based	TRI
Ram No.	Semen viability				
2808	40%	60%	50%	60%	45%
5527	25%	25%	40%	45%	25%
3728	30%	35%	45%	45%	35%
78	20%	30%	25%	50%	
Mean SD	28 8 <sup>b</sup>	35 17 <sup>ab</sup>	40 10 <sup>ab</sup>	50 7 <sup>a</sup>	35 10 <sup>b</sup>

Our results show that on the average, higher semen viability was obtained by using the "Western" Tris-based extender.

#### Publications:

Arav, A., Gacitua, H., Zenu, A., Malmakov, N., Gootwine, E., Bor, A. (2000). Cryopreservation of ram semen using various freezing extenders and new freezing device. ICAR 2000 Satellite symposium on Reproduction in Small Ruminants. Sandes, Norway, June 30-July 1.

Malmakov N.I., Kasymov K.T., Tokaev Z.K., Bazaralinova K., Avonov N., Bor A., Zenou A. and Gootwine E. (1998). [Use of Awassi sheep in Kazakhstan]. In: "Problems in sheep selection, technology and feeding in market conditions", Proceedings of the Kasakh Sheep Breeding Institute, Almaty, Bastau, :164-170. (in Russian).

Malmakov N.I. and Asilbekova G.K (1999). The influence of certain amino-acids on motility and survival of frozen-thawed ram semen. In: "The present state of cattle breeding and animal husbandry in Kazakhstan and the prospects of their development" International Conference (Almaty, January 12-13, 1999) Moscow: 170-181.

Malmakov N.I., Asilbekova G.K., Kasymov K.T. and Gootwine E (1999). [Increasing motility in frozen-thawed ram semen and improvement of the buffering capacity of freezing media with Bis-Tris buffer]. Vestnik Selskohozaistvennoi Nauki Kazakhstana Almaty (Agricultural Science in Kazakhstan), 7: 130-137 (in Russian).

Malmakov N.I., Kasymov K.T, Gootwine E. and Smagulov D., (2000). [First experimental data on milk and reproductive performance of Awassi sheep in Almaty Oblast of Kazakhstan]. Vestnik selsko-hozaistvennoi nauki Kazakhstana, Almaty 3: 38-42 (in Russian).

Medeubekov K.U., Thomas D.L., Kasymov K.M. and Malmakov N.I. (1999). Increasing prolificacy and meat quality in Kazakh fine-wool and meat-wool sheep. In: "The present state of cattle breeding and animal husbandry in Kazakhstan and the prospects of their development" International Conference (Almaty, January 12-13, 1999) Moscow: 93-102 (in Russian).

### **C. Scientific Impact of Collaboration**

Dr. Gootwine and Dr. Bor traveled to Kazakhstan once during the project time to evaluate the Awassi crosses. Prof. Kasymov made one visit and Dr. Malmakov made two one-week working visits and one three-weeks working visit to The Volcani Center. During those visits, both Kazakh scientists had the opportunity to experience scientific work in well-equipped laboratories. They were able to examine and order Western scientific literature (books and periodicals) and have close examination on the sheep production system in Israel, They took active part in the cryopreservation experiments, contributing their knowledge and experience.

### **D. Strengthening of Developing Country Institutions:**

Through the project, a breeding nucleus of Awassi sheep has been established in the Kazakh Institute of Sheep Breeding. This is the first Awassi breeding material introduced to Central Asia. The cryopreservation laboratory of the Institute was equipped with modern and advance scientific instruments bought in Israel. The supply of chemicals and reagents enable continuation of the work of the Kazakh scientists. Not less important was the regular supply of professional Journals. This proved itself when the Kazakh scientists used successfully the material for preparation of grant proposals submitted to international agencies.

### **E. Future work**

Work with the Awassi sheep is now in progress in Kazakhstan and Awassi breeding material has been sent for the first time from Kazakhstan to Kyrgistan. To support our activities aiming to develop dairy sheep production in Central Asia, we jointly submitted to CDR AID a new proposal entitled "Dairy sheep production in Kazakhstan - second stage (No. CA22-006).

## **Section II: Management**

### **A. Managerial issues**

We faced major difficulties in budget management. As was indicated in the Annual reports, there was a problem with transferring budget to Kazakhstan. Once part of the budget was transferred, the Kazakh collaborators were not free to use it according the project demands. This was a serious problem and USAID was requested to help in solving that problem. Unfortunately, we got no response for that request. Subsequently, as no satisfactory budget reports were obtained from Kazakhstan, sending additional budget was out of question and the money left was returned to AID. However, as time passed, more international projects are run now by the Kazakh Institute, and there is more experience with "Western" standards of budget management.

### **B. Special concern**

None.

### **C. Collaboration:**

Information was given in Section A.

### **D. Request for the American Embassy Tel Aviv or A.I.D. action**

See managerial issues.