I. PRINCIPAL INVESTIGATORS

U.S. Principal Investigators: William Dobson, Anatoly Khazanov, Kenneth Shapiro, David L. Thomas

U.S. Co-Investigators: Randy Gottfredson, Russell Zanca, Liba Brent

Regional Co-Investigators: Meruert Abuseitova, Saulesh Esenova, Kenes A. Kalyshev, M. Kasymov, Sergei Klyashtornyi, Nurlan I. Malmakov, Nurbulat Masanov, Kiilybai U. Medeubekov, Olga Naumova, Saniya Sagnaeva,

II. TITLE OF PROJECT

Impacts of Economic Reform on the Livestock Sector of Central Asia

III. NARRATIVE SUMMARY

Field research on new private farms continued in Kazakhstan and Kyrgyzstan. In addition, since most rural residents in Kazakhstan still live on large cooperatives and other large descendants of Soviet-era sovkhozes and kolkhozes, structured interviews were held with the management of 30 such units. Marketing research continued with processing, wholesaling, and retailing enterprises near Almaty, following up results of the work in year two. A similar marketing research program was undertaken near Astana. Marketing outlets facing farmers in rural areas were also studied. Efforts continued to improve the prolificacy of the region's sheep and the effectiveness of artificial insemination techniques. In addition, sheep were placed on commercial farms under farmer supervision to begin a program of on-farm evaluation.

The governments of Kazakhstan and Kyrgyzstan are showing signs of favoring cooperatives and similar large units over the smaller, private farms that have been evolving. The large units we studied show a very mixed pattern, but few show strong prospects for long-term success. Marketing outlets in NW Kazakhstan are more favorable for meat and animals than for milk and wool, contributing to the decline in stock numbers. That decline has already sent meat prices higher in that area, as we have been projecting. Some backward integration into animal production by processors was observed. Imports of meat and milk from Russia are providing significant competition for processing firms in NW Kazakhstan.

Processing and wholesaling firms near Almaty and Astana continue to suffer from inadequate supplies of meat and milk. Meat processing firms in those areas seem less likely to attempt backward integration into raising their own animals. Food Master's network of collection and cooling centers continues to play an important role in dairy marketing around Almaty. However, the conditions for other foreign investment are not very favorable, and even Food Master (a US-Kazakh joint venture) has suffered losses from macroeconomic policies. Credit continues to be a major constraint for processing firms.

Ewes born in 1998 were mated in autumn/winter 1999 and completed their first lambing in 2000. There were no large differences in body weights among the breed groups, indicating that the introduction of prolific breeding into the Kazakh Finewool population should not have a detrimental effect on growth rate and may, with some prolific breeds, actually result in a slight improvement in growth rate.

Thirty-five of the ewes born in 1998 were mated in 1999, and 28 of them lambed in 2000. The lambs born per ewe lambing were: Kazakh Finewool = 1.00, Kazakh Prolific = 1.45, and Rambouillet x Kazakh Finewool = 1.55. While this is very little data, it does indicate that the prolific genotypes have the potential to increase the number of lambs born in Kazakh Finewool flocks. Additional information on lamb production of the genotypes will come available in future years as these ewes have additional lambings and the ewes born in 1999 and 2000 enter reproduction.

IV. RESEARCH

A. Problem Statement

Privatization of Central Asia's livestock sector continues to yield new forms of farm organization with considerable variation in physical assets, farm membership, decision-making structure, access to markets and credit, and relationships to government and to other farm units. Some forms of organization, especially the larger ones, appear to be transitory, leading to creation of other forms. The legal environment also continues to evolve as does the administrative implementation of relevant law.

The challenges to livestock development start with this ongoing disequilibrium and the uncertainty it engenders. New farm organizations struggle to develop effective production and marketing strategies, often with economic decision-making responsibility thrust on individuals with no relevant experience. In other cases, especially on larger units, some farm leaders are not interested in the farm's success, but simply seek to convert assets to cash for investment elsewhere. The depressed national economies limit market opportunities, and the infant banking sectors do not provide adequate credit options. Legislation stops short of providing for full land ownership, and much of the farm population is unaware of what rights they do have under the new laws. Illegal fees extracted by government officials add to the cost of doing business from the farm all the way to the consumer.

Even in this difficult environment, one can see pathways toward development of the livestock sector, and, indeed, some enterprises are succeeding. Our research hopes to identify such pathways and also to garner lessons learned from successful enterprises. Thus far our work has focused mainly on new, small private farms. However, in Kazakhstan, the majority of the rural population continue to live and work in large farm units that are the direct descendants of the Soviet-era sovkhozes and kolkhozes. Thus our research in year three expanded to included an intensive study of such units. In addition, the marketing research in year two has yielded a number of questions for follow-up research that was conducted in year three.

Another priority is to pursue research that will help transform the critically important sheep sub-sector toward much greater reliance on meat as the key to profitability. Sheep numbers in

Kazakhstan have been in a free-fall since the country became an independent state. Numbers have decreased from approximately 30 million head in 1990 prior to independence to 9.8 million head in 2000. Low profitability of the sheep sector has been one reason for the drastic decrease in sheep numbers. After World War II, the local coarse-wooled meat sheep of Kazakhstan were largely replaced with Finewool sheep of Merino-type in order to provide raw wool for the Russian textile industry. The Kazakh Finewool was a new breed developed in the 1950's and 1960's for its wool production. Economic collapse in Russia and a glut of wool on the world market selling at very low prices has left Kazakhstan with few markets and unprofitable prices for its fine wool. Therefore, there has been little economic incentive to maintain sheep numbers.

A second reason for the recent decrease in sheep numbers is due to the privatization of agriculture. When sheep were privatized in the early 1990's, they were the major liquid assets of many farmers and were sold or bartered in order to obtain other agricultural inputs and household necessities. Farm families also consumed many sheep as food. Still today, many of the large cooperative or joint-venture farms pay their members and farm workers with sheep because money is in short supply. The liquidation of the national breeding flock resulted in a large supply of sheep meat at reasonable prices available in the market place. However, this cannot continue because the decrease in breeding sheep numbers will eventually result in a shortage of sheep meat in the market place.

Since Finewool sheep have low reproductive rates (approximately 1.25 lambs born per ewe lambing), increases in population numbers are slow. An increase in the number of lambs raised per ewe in Finewool flocks can result in an increase in the number of replacement females produced in order to help rebuild national flock numbers as well as an increase in the amount of lamb meat produced per ewe. With a higher reproductive rate, fewer ewes are required to produce the same amount of lamb meat. This results in less feed required to produce a kg. of lamb meat and less pressure on range lands and other feed resources.

Studies aimed at improving ram semen freezing procedures and artificial insemination techniques have also been conducted with the goal of improved conception rates from artificial insemination with frozen-thawed semen.

B. Progress

Progress is discussed following the activities projected in the workplan for 1999 - 2000.

Activity One: Studies of Successful Private Farms and Marketing Outlets

Socioeconomic field surveys for year two were completed between April and September, 1999. Analysis and write-up took place in year three and resulted in publications as shown in the publications section. In April, 2000, a workshop was convened in Almaty with Abuseitova, Masanov, Naumova, Sagnaeva, Klyashtornyi, Khazanov and Shapiro. The group reviewed the work of year two and planned the field surveys for year three. Masanov's preliminary work on successful farms was one starting point for this planning. The three field teams, headed by Masanov (South and Central Kazakhstan), Naumova (Northwestern Kazakhstan), and Klyashtornyi (Central Kyrgyzstan) conducted their surveys between May and September, 2000.

In both Kazakhstan and Kyrgyzstan, the national and regional government have begun favoring large "cooperative" farms over small private farms. We provide details from Kyrgyzstan. (Our colleague, Dr. Abuseutova provided details for Kazakhstan in her presentation at the last GL CRSP conference in Mexico). In 1999, T. Koychev, an economist close to the president of Kyrgyzstan, wrote of the need for government to re-exert more control over agriculture and of the desirability for farmers to cooperate. Movement toward restoration of administrative controls over Kyrgyz agriculture can be seen in the president's March 6 decree, "On Timely and Improved Creation of Spring Fieldwork on Rural farms of the Republic in 2000." On June 1, 2000, A. Kasmaliev, the head of the Naryn Regional Administration in Kyrgyzstan published Order No. 242(b), "On the Production of Agricultural Goods." It calls on local administrations "to carry out local efforts to organize cooperatives. In July in the city of Naryn, there was an oblast-wide seminar for local directors to learn about organizing agricultural cooperatives. Two years ago these proclamations and organizing efforts would have been considered contrary to government policy.

Marketing was given higher priority in the field surveys of year three. The report from from NW Kazakhstan is presented here.

Sale of agricultural products.

Meat. Most of the farms sell their livestock to buyer-merchants, who specialize only in the purchase of livestock. Among the buyers are specialists in different types of animals – some buy only cattle, others only sheep, and so on; and also regional specialists. As a rule, these buyers have had long experience in their business and carry it out in areas that are well known to them; however sometimes new buyers go into unfamiliar areas.

The buyers working in West Kazakhstan Oblast (WKO) come from Uralsk and from Altyraus and Aktausk Oblasts. Those from Aktausk and Atyrausk take live animals and use trucks capable of carrying 10-15 cows. According to them, there have been no livestock in Atyrausk and Aktausk Oblasts for several years, however the people there have money thanks to the developing oil and gas industries, and many work for foreign companies. Thus meat in Atyrau and Aktau is expensive, and business is profitable.

Buyers from Uralsk (there are around 50 by some estimates) provide meat for that city. They take both live and slaughtered animals, and the meat is delivered to market in the form of sausage, to canneries, and to the service sector – restaurants, cafeterias, and cafes.

All buyers pay with cash up front. Sometimes those from Atyrausk Oblast exchange fuel and oil inWKO for livestock, which works well for the population since it can be attained more cheaply than local fuel.

The cost of meat in the last year grew 1.5-2 times. The causes of this were the decrease in the number of livestock and high prices on meat offered by buyers from oil refining regions.

Buyers can be somewhat knowledgeable on the conditions of livestock raising in the oblast. According to them, in western Kazakhstan (Aktausk, Atyrausk, West Kazakhstan, and Aktiubinsk Oblasts), livestock remains only in West Kazakhstan Oblast. In Aktiubinsk Oblast

there are few livestock, and those are of low quality. Virtually no livestock remains in Atyrausk and Aktausk Oblasts. The livestock inWKO are maintained unequally. In WKO livestock are kept in Dzhangalinsk and Kaztalovsk Regions. In the traditionally livestock raising region of Karatobinsk, according to the buyers, many have sold off their livestock and moved to Askai, where gas fields are being opened up.

Dairy products. The sale of dairy products is difficult. In several population centers, according to the local administrations, the "Bereke" firm has opened several stores in the past year, which buy milk, butter, and eggs from the local population and sell them other goods: flour, pasta, sausage, beverages, etc. However, the scale of this activity is very limited.

Sometimes some merchants who bring products and manufactured goods to the village from the city agree to take milk, sour cream, or butter as payment from the locals. Peasant suburban farms have the ability to take their milk to Uralsk and sell it there in the markets or on the street. But for the most part dairy products are consumed in the home.

Wool. The main buyer of wool and hides is Aiaz, a firm that specializes in the preparation of felt and knit fur clothing. This year Aiaz opened its own center for the purchase of wool and hides in Dzhangalinsk Region. However, this work is complicated by the fact that the firm does not have real money for purchasing, and instead offers the locals products such as detergents, washing powder, soap, etc. for their wool and hides, at higher costs than in the city. The locals are displeased with the low purchase prices for wool and the absence of real cash. According to the director of Aiaz, Dagestani and Chechen buyers are also working the oblast, and taking the wool to Russia. These buy with cash. However, we never heard anything about this.

Thus, the sole source of real money for the population appears to be livestock. This remains one of the causes for the continuing decline in the number of livestock in the oblast.

Livestock product processing enterprises.

Meat processing enterprises. The number of enterprises engaged in the production of sausage and canned meats in Uralsk is less than ten. Raw materials are delivered by meat buyers, and sometimes through direct contact with farmers. The main problem in the supply of raw materials is the stoppage of delivery in the winter. Because of this, in winter the factories do not operate at full potential, and several have to change over to the production of other types of products – canned fish, for example. Another problem is the absence of documents on added value tax from meat suppliers. Thus, meat processing plants have to pay this tax twice. There continues to be the problem of production standardization. The cost of standardization is very high, and requires spending at every level of production, even those without specialized technology. Many enterprises are forced to do incomplete standardizing or to decrease their assortment.

The major competitor for local producers is Russia. The technology for producing sausage in Uralsk's factories is classical (100% meat). This sausage is 50-60% more expensive than that made with German machinery and brought in from factories in Samara, Russia (30% meat, the rest soy filler). Also, meat canned locally is 50% more expensive than that from

Russia. Local processors, therefore, occupy only a small segment of the meat market. For example, 90% of the boiled sausage in Uralsk comes from Samara.

This year the meat processing plants suffered the consequences of the decline in the number of livestock in the oblast. The cost of meat stayed high, and several plants did not buy meat until July, waiting for the price to decline. According to the directors of several meat processing plants, after one or two years Uralsk will be importing all of its meat from Russia. Even now from January to April meat buyers are bringing meat in from Russia, where it is cheaper in winter. Aktiubinsk, which consumes 20 tons of meat a day, has lived on Russian meat for 4 years already. Uralsk, which requires 6 tons of meat, still has some of its own livestock.

The problem of raw materials is forcing several processing plants to maintain their own herds. This works fine for medium and small enterprises, such as the Limited Partnership Company Tamerlan, which requires 1000 tons of meat a year. To this end it maintains a herd of 8000 cattle, which is beyond the capabilities of any single farm.

Dairy processing enterprises. There are 5-7 of these in Uralsk. Their main problem is the absence of high quality packaging. Several plants in general do not package milk, instead delivering milk to hospitals and closed (to the public) institutions in the city. Milk is then sold in stores in plastic bags. Local producers can sell their goods at a lower price than their Russian competitors. However, the overwhelming majority of the market is occupied by dairy products from Samara, which uses TETRAPAK packaging. All the stores prefer to deal with the Russian products, which have a longer shelf life than the plastic bags (which last for only one day). Experts believe that those stores that order milk and dairy products packed in modern materials can do stronger business in the market.

Wool. Wool processing is the business of Joint Stock Company Aiaz, which was established in Soviet times and averaged processing 500 tons of pure wool per year. Today it is having greater difficulty in obtaining raw materials and in selling its products. All the suppliers of raw materials for Aiaz are private individuals, and only a small portion of these can deliver wool in large quantities. This year Aiaz established local centers for receiving wool. However, the problem remains that Aiaz does not have real cash for dealing with suppliers and purchasing wool at these purchase points. The amount of wool purchased is twice what is required, since the suppliers supply only rough wool – only 48-50% can be used. Also of low quality are the hides, which are currently salted using traditional means by suppliers (Aiaz needs 8 thousand hides a month). Aiaz's main competitor for the processing of raw materials is Russia. Merchants from Russia buy the local wool with cash. Due to the shortage of raw materials it is necessary to switch to other activities not connected with the processing of wool, particularly manufactured clothing.

The sale of products is no less serious a problem. A local market for the sale of Aiaz's goods is virtually nonexistent. The main part of their products goes to Russia. Russian *valenki* (felt boots) are 40% cheaper (and at prime cost, nearly 3 times), and finding buyers is very difficult. Together with this, Aiaz has been forced to fix prices on its products for 4 years. However, together with this the buying cost of wool has not risen, which hindered the supply of raw materials (according to the Aiaz director, 100% of the products of other wool processing plants in Pavlodarsk and Semipalatinsk in northern Kazakhstan is sent to Russia). State orders

are non-existent. Payment of local suppliers is often postponed, or buyers end up paying not with money, but in kind (with coal, for example), and thus Aiaz does not have the ready cash it needs to purchase raw materials. In all, our opinion is that this is the biggest problem of large processing enterprises, which have not been able to cope with their situation (Aiaz, Asan Agrofirm). Small enterprises, which have broadened their means of accumulation, do not have this problem with real cash. These also have a wider possibility of receiving credit.

The search for successful farms was expanded to include the large farms that are descendants of the Soviet-era sovkholzes and kolkhozes. Most of the rural population of Kazakhstan still live and work in these large units. Therefore, it is important to assess their current status and prospects: (1) developmental and structural changes occurring in the course of reform; (2) current assets and organization of production and distribution; (3) relationships with their members and workers; (4) linkages to the state; (5) marketing patterns; (6) current economic conditions, recent trends, and constraints. In April/May, Liba Brent, a UW graduate and native (Czech-born) Russian speaker, undertook in-depth interviews with one or more members of the management teams of 30 large farms (cooperatives and joint stock companies): 7 in Taldy Kurgan, 13 in Almaty, and 10 in Dzhambul. In most cases the interviewees included the Director and sometimes the Chief Economist or Accountant. In addition she interviewed four local administrations responsible for oversight of cooperatives and private farms in these areas.

Interviews covered the following topics: (1) name, legal status, and location; (2) history including soviet-era antecedents and changes during reform; (3) number of workers and shareholders and how these have changed since 1990; (4) land and livestock, including changes and causes for changes since 1990, and objectives; (5) privatization process, including the legal changes, how assets were divided, allocations to those who left the farm, and relationships with surrounding private farms; (6) production activities and their relative profitability; (7) farming inputs, how they are obtained, evolution of their cost, availability of credit, changing use since 1990 — labor, machinery, fertilizer and insecticide, irrigation water, fuel; (8) output markets, including who the buyers are, terms of sale/barter, evolution of prices; (9) debt, how much inherited from antecedents, prospects for repayment, impact on creditworthiness; (10) investments; (11) management structure; (12) role of the unit in the community and how that has changed since 1990; (13) evaluation of the farms prospects for success in the future.

The 30 sets of interviews have been developed into farm profiles. The next step is a series of papers analyzing the interview information across themes.

Activity Two: Studies of Marketing Channels

The study conducted in 2000 was a follow-up to research conducted by Saulesh Esenova and William Dobson during 1999. The 1999 study, which involved field research in the Almaty Region of Kazakhstan, produced findings appearing in the following publication:

> Esenova, S. and W.D. Dobson, "Changing Patterns of Livestock, Meat, and Dairy Marketing in Post-Communist Kazakhstan,"Central Asian Livestock Sector in Transition Series, Report No. 3, 2000.

Challenges facing Kazakhstan's livestock and dairy marketing and processing sectors were identified in the 1999 study, including the host of difficult structural adjustments needed to move from a communist system to a market economy, uncertainties regarding business taxes, problems with land rights, a lack of market information for farmers, a lack of grades and standards for sale of livestock, problems with veterinary inspections, and lack of sophistication in marketing branded and other differentiated meat and dairy products. Three major findings, which suggested the need for additional research, emerged from the challenges noted in the 1999 study:

Kazakhstan's livestock herd declined sharply from 1991 to 1999. Sheep and hog numbers, for example, declined by 79% and 69%, respectively, from 1991 to 1999. The decline was so severe for sheep, cattle, and hogs that it became difficult for processing and marketing firms to maintain viable levels of throughput and viable distribution systems for products made from these livestock species.

Capital was a major constraint to development of a modern, expanded livestock and dairy marketing system in Kazakhstan. Both domestic credit and investment capital from foreign firms were in short supply or available to processing and marketing firms only under unacceptable terms.

Officials of several Kazak livestock and dairy processing and marketing and processing firms were strongly interested in attracting foreign direct investment capital into their livestock and dairy marketing firms, but had little success in attracting such capital.

There was little doubt about the importance of the problems and needs identified. However, Esenova and Dobson were not able to identify an adequate number of practical remedies for the problems that processing and marketing firms encountered in attracting foreign direct investment, in particular.

Major Questions Addressed in Follow-Up Research

These findings indicated that additional, follow-up research was needed to address several questions. As part of the follow-up research, the investigators conducted structured interviews during July and August, 2000 with executives of 12 Kazak dairy and meat marketing/processing companies, bank officers, an official of the Kazak Research Institute of Feed and Pastures, and farmers producing and marketing livestock and milk in Kazakhstan. Respondents were asked for background information on their businesses, information relating to their access to resources, and purchasing, marketing and other business practices, marketing challenges they faced and future plans. Most of the follow-up research involved interviews with firms in the Almaty region of Kazakhstan. However, the dairy marketing research for 2000 also involved companies in the Akmola region which includes Astana, Kazakhstan's national capital.

The major questions addressed and the summary findings regarding those questions are summarized below in a Question and Answer (Q&A) format:

Q1: What are the current trends in livestock numbers in Kazakhstan?

A1: Livestock numbers are continuing to trend downward in Kazakhstan. However, the downward spiral is less pronounced than in much of the 1990s. Dairy cow numbers, in particular, appear to be stabilizing. This reflects the effects of actions taken by Food Master and a few other dairy marketing and processing firms. These firms have provided stable markets, prompt payment to farmers, and, in the case of Food Master, modern cooling and milk collection facilities for small farmers. These actions have encouraged dairy farmers in the Almaty and Akmola regions to stay in business. Economic conditions facing beef cattle and hog producers are less favorable. Hence, there is little to indicate that the downtrends in beef cattle and hog production are stabilizing to the same extent as dairy cow numbers.

Part of the problem facing livestock producers is deteriorating terms of trade. Prices paid by Kazak farmers for electricity, motor fuel, and natural gas have increased more sharply in recent years than prices farmers received for livestock and meat. This development has curtailed crop irrigation and feedstuffs available for livestock, and increased farmers' marketing costs.

While a number of livestock marketing and processing firms still plan to integrate backward into production to obtain greater assurance of livestock supplies for processing, they have increasingly come to realize that this may not be a cost effective way of maintaining livestock supplies. They, like many North American firms, have discovered that livestock production is a specialized and costly, capital intensive business.

Q2: What changes would be required to encourage additional foreign direct investment in Kazakhstan's livestock and dairy processing firms?

A2: The complexity of this problem became more evident during the research carried out in 2000. Macroeconomic conditions pose a severe constraint. For example, the devaluation of Kazakhstan's tenge during 1998 and 1999 caused losses by Food Master--a U.S.-Kazak dairy marketing/processing firm that had been profitable prior to this development. Banks regard Kazakhstan's agricultural sector as risky and unstable. In some cases, this reflects a lack of knowledge of the sector on the part of banks rather than a sound assessment of lending problems. Foreign firms are aware of the problems existing in Kazakhstan's agricultural sector, the corruption that exists in Kazakhstan, and allocate capital accordingly.

The constraints to foreign investment vary by location. Indeed, the constraints to foreign investment in Kazakhstan's livestock and dairy marketing and processing firms in major cities such as Almaty and Astana appear not to be severe. Livestock and dairy market/processing firms located in these cities that have well-developed business plans and reasonable prospects for success reportedly can attract foreign capital. However, even well situated firms in these cities face problems with obtaining adequate livestock and milk supplies. Until this problem is resolved, it will be a deterrent to foreign investment in these firms.

Finally, improved infrastructure (better roads, improved access to electric power, and modern communication equipment) in Kazakhstan's farming areas and an enhanced ability on the part of farmers and small processing/marketing firms to develop business plans would make these firms more attractive as investment opportunities for domestic and perhaps a few foreign firms.

Q3: In what ways could the government of Kazakhstan help domestic livestock and dairy processing/marketing firms to acquire the foreign or domestic capital required for expansion?

A3: The problem most often mentioned by officials of larger livestock and dairy processing/ marketing firms in the Almaty and Akmola regions related to getting long-term loans on acceptable terms. These larger firms wanted 15 to 20-year loans at 3% to 5% interest rates for use in purchasing new plant and equipment. They were, of course, implicitly asking for subsidized loans from the government since loans at these terms are not available to even the most credit-worthy U.S. and European firms. The larger firms in the Almaty and Akmola regions expressed few problems with getting short-term (a year to 18-month) loans. However, they said that even these loans carried interest rates that were so high as to be frequently unacceptable.

Credit was often unavailable to smaller marketing and processing firms at acceptable terms. They also complained about bank bureaucracies, long delays in getting loans, and problems encountered in providing banks with acceptable collateral for loans.

If demands for credit on the part of Kazakhstan's livestock and dairy marketing/ processing firms are to be more fully satisfied, the government of Kazakhstan will have to decide whether it wishes to expand the amount of subsidized credit available to these firms. Kazakhstan's government might chose to make use of government credit guarantees and to involve foreign banks and foreign lending organizations in the endeavor. If such an initiative is undertaken, the government simultaneously will find it necessary to improve the ability of Kazakhstan's livestock and dairy processing/marketing firms to develop sophisticated business plans and loan repayment plans. Getting small livestock and dairy processing firms the credit they desire, will represent a difficult challenge for Kazakhstan's government.

Activity Three: Comparison of Sheep Sired by Polypay, Rambouillet (Likely carrying the FecB gene), Kazakh Prolific, and Kazakh Finewool Rams for Lamb Meat Production Under Scientific Supervision on a Commercial Farm and Under Experimental Conditions at a Research Institute

Materials and Methods. In collaboration with the Center for Sheep Selection and Genetics (CSSG) of the Kazakh Scientific Research Technological Institute of Sheep Breeding (KSRTISB) near Almaty, Kazakhstan, a study was initiated in October 1997 to evaluate the effectiveness of prolific Kazakh and U.S. breeds of sheep to increase lamb production of Kazakh Finewool flocks through an increase in the number of lambs born per ewe. Prolific breeds used in the study were Kazakh Prolific, U.S. Polypay, and U.S. Rambouillet. The Kazakh Prolific was developed by crossing Kazakh Finewool with the prolific breed of Finnish Landrace. The Polypay is a four-breed cross containing equal parts of the breeds of Finnish Landrace, Dorset (a meat breed), Rambouillet (a wool breed), and Targhee (a wool breed). The Rambouillet is the major finewool breed in the U.S., and the particular Rambouillet used in this project are from a flock where the FecB gene for increased ovulation rate is present. All two-way cross ewes resulting from these matings should have a greater prolificacy than the Kazakh Finewool ewes, but the Rambouillet crosses should have comparable fleeces to the Kazakh Finewool whereas the Kazakh Prolific and Polypay crosses should have poorer fleeces.

Semen was collected and frozen from Polypay and Rambouillet rams at the University of Wisconsin-Madison in the autumns of 1997, 1998, and 1999 and shipped to CSSG. Semen was collected from Kazakh Finewool and Kazakh Prolific rams at CSSG during the same years. In the autumns and winters of 1997 and 1998, Kazakh Finewool ewes at the cooperative farm, Aksengerskoe, were inseminated with semen from the four breeds of rams. Semen from Kazakh Prolific rams also was used on Kazakh Prolific ewes to produce purebred lambs. Aksengerskoe is located near KSRTISB and has a long history of involvement with the institute. Prior to privatization of farms in Kazakhstan, the large flocks used in the genetics' program of KSRTISB were located at Aksengerskoe. Many of the breeding flocks of the institute still remain at Aksengerskoe even though the farm is no longer under any government obligation to maintain the flocks. The lambs born in 1998 and 1999 at Aksengerskoe were trekked to the traditional mountain pastures owned by the cooperative near the border with Kyrgyzstan for summer grazing. The lambs were weaned and weighed on the mountain in August at three to four months of age. Ewes and lambs were trekked back to Aksengerskoe farm in September. Lambs were moved to KSRTISB, fed in pens, and weighed at monthly intervals through approximately one year of age, after which they returned to Aksengerskoe. In the autumn of 1999, semen from the four breeds of rams was used on the cooperative farm Koktalsky (Koktal National Breeding Center) near the city of Taldy-Korgan in Panfilov Region of Almaty Oblast that also has a long history of cooperation with KSRTISB. The lambs born from these matings in 2000 spent the summer on the mountain pastures of the farm near the border with China in southeastern Kazakhstan.

The small number of ewes born in 1998 was mated in the autumn and winter of 1999 and completed their first lambing in the spring of 2000.

Growth of lambs. Lamb birth weights, weaning weights and fleece length at weaning for the lambs born in 1998 and 1999 and 12-month weights of lambs born in 1998 at Aksengerskoe are presented in Table 1. Table 2 presents the weights of lambs born in 2000 at Koktalsky.

Table 1. Weights and Fleece Lengths of Lambs of Four Breed Groups Born a Aksengerskoe in 1998 and 1999

	At birth		At weaning			At 12 months	
Breed	**No.**	**Weight, kg**	**No.**	**Weight, kg**	**Fleece, cm.**	**No.**	**Weight, kg**
K. Finewool (KF)	104	3.04	66	23.8	3.6	30	44.5
K. Prolific x KF	88	2.93	49	24.1	4.0	26	43.9
Polypay x KF	80	3.15	38	24.8	3.8	15	47.2
Rambouillet x KF	138	3.26	58	25.7	3.1	31	47.0

Table 2. Weights of Lambs of Four Breed Groups Born at Koktalsky in 2000

Breed	At birth:		At 8 months:		
	No.	Weight, kg	No.	Weight, kg	Wool length, cm
K. Finewool (KF)	56	3.94	33	26.08	5.40
K. Prolific x KF	44	4.23	25	27.85	6.01
Polypay x KF	16	3.91	9	26.15	4.97
Rambouillet x KF	30	4.00	8	27.70	5.08

There are no large differences in body weights among the breed groups indicating that the introduction of prolific breeding into the Kazakh Finewool population should not have a detrimental effect on growth rate and may, with some prolific breeds, actually result in a slight improvement in growth rate.

The decrease in number of lambs from birth to later ages is of concern. Since both farms are private with extreme economic pressures, many of the lambs are used as payment to workers or are consumed on the farm before measurements at later ages can be recorded. In order to preserve as many of the remaining ewe lambs as possible for evaluation of reproductive performance, the Sheep Breeding Institute has purchased the experimental ewes that remain after reaching one year of age and removed them to another farm.

Ewe Reproduction. Thirty-five of the ewes born in 1998 were mated in 1999, and 28 of them lambed in 2000. The lambs born per ewe lambing were: KF = 1.00, K. Prolific = 1.45, and Rambouillet x KF = 1.55. While this is very little data, it does indicate that the prolific genotypes have the potential to increase the number of lambs born in Kazakh Finewool flocks. Additional information on lamb production of the genotypes will come available in future years as these ewes have additional lambings and the ewes born in 1999 and 2000 enter reproduction.

Activity Four: Insemination of Ewes with Frozen-Thawed Semen Using a Diluent Containing the Amino Acids Argnine, Betaine, Glutamine, or Proline

Collection and freezing of ram semen and artificial insemination techniques is a major area of interest of Nurlan Malmakov of the Sheep Breeding Institute and of the sheep program at the University of Wisconsin-Madison. The development of semen freezing and artificial insemination technology applicable to conditions in Central Asia is essential for the success of the present study on prolific sheep breeds and for future spread of genetically superior rams in the region.

During the past year, efforts have been spent developing low-cost but effective methods of artificial insemination and freezing of ram semen that can be used in Central Asia. The results of these efforts including a summarization of results from using amino acids in freezing diluents from 1998-99 are presented in a paper in Appendix I. This paper was written by Nurlan Malmakov and is unedited. After editing, we will determine the best route for publication.

Activity Five: Evaluation of Sheep Genotypes in other Commercial Environments (on farm trials)

Materials and Methods. Even though the experimental sheep have been raised on two private farms, each farm still has major involvement and oversight of the staff at KSRTISB. In order to evaluate these breeds under more commercial conditions, prolific crossbred rams born in 1998 at Aksengerskoe were mated to ewes on three commercial farms in Almaty Oblast in the autumn of 1999.

Results. On the "Turan" peasant farm in Iliisk Region of Almaty Oblast, which practices year-round pasturing of the Kazakh Meat-Wool (KMW) breed, two crossbred rams (one Rambouillet x KF and one Polypay x KMW) were used for breeding. The results are presented in Table 3. On the "Turan" farm, the 4-month-old lambs had excellent measurements in both categories, and the lambs from the two prolific-cross rams had slightly greater live weights.

Table 3. Measurements of 4-month-old lambs born on peasant farm "Turan"

Breeding of lamb	**No.**	**Measurements Measurements**	
		Live wt, kg	**Wool length, cm**
(Rambouillet x KF) x KMW	11	36.0Å0.42	5.6Å0.50
(Polypay x KMW) x KMW	23	34.3Å0.79	5.8Å0.74
KMW	16	33.2Å1.1	5.8Å0.46

During the 1999 mating season on the peasant farm "Akmyrza", 23 ewes were inseminated with semen from crossbred Rambouillet x KF rams. Of these 23 ewes, 17 had lambed at the start of April 2000, producing 19 lambs - 8 male and 11 female. The live weight of the _ blood Rambouillet lambs at weaning was 32 kg for rams (n=7) and 29.7 kg for ewes (n=9). In the control group, the weights were 30.6 kg for 24 rams and 28.9 kg for 35 ewes.

On the production cooperative "Eskeldy" from November 9-30 1999, Kazakh Finewool ewes in the flock of chief shepherd O. Boskynov were artificially inseminated with fresh semen from crossbred Polypay x KM ram No. 9041. Lambs were born in April. The live weight of single-birth ram lambs at weaning at 4 months of age was 34.5 kg (n=27), for twin-birth rams it was 30.2 kg (n=10), for single-birth ewe lambs it was 29.8 kg (n=36), and for twin-birth ewe lambs it was 25.7 kg (n=12). The corresponding measurements for lambs in the Kazakh Finewool control group were as follows: single-birth ram lambs: 32.1 kg (n=37); twin-birth rams: 27.9 kg (n=37); single-birth ewe lambs: 27.2 kg (n=38); twin-birth ewe lambs: 23.5 kg (n=28).

These three on-farm trials under commercial conditions show that lambs from the prolific breed crossbred lambs have slightly greater growth rates than contemporary Kazakh Finewool or Kazakh Meat-Wool lambs. These three farms have been encouraged to retain a high percentage of the prolific-cross ewe lambs so their reproductive performance can be measured in future years.

Activity Six: Biological modeling of Sheep Production Systems — Fitting Sheep Genetic Resources to Feed Resources

Work on modeling of sheep production systems in order to better fit sheep genotypes to feed resources is still deemed an important area of study, but work in this area has not yet started. It will be carried out in conjunction with the UC-Davis team supported by ICARDA funds.

V. GENDER

The following researchers are female: Meruert Abuseitova, Project Coordinator based in Almaty; Liba Brent, UW Graduate Student conducting field research in Kazakhstan; Saulesh Esenova, Marketing Researcher in Kazakhstan; Olga Naumova, Field Researcher in NW Kazakhstan; Soniya Sagnaeva, Field Researcher in NW Kazakhstan.

VI. POLICY

The project started with interviews of policy makers in Kazakhstan, Kyrgyzstan and Uzbekistan. In Kazakhstan, we have maintained closest contact with the Minister of Science, Dr. Shkolnik. He has now become Minister of Industry. Our regional coordinator in Almaty continues to keep the Ministry of Agriculture apprised of our research and distributes widely our Russian language research papers. The Dobson/Esenova marketing research has been of particular interest most recently.

The Kazakhstan Ministry of Agriculture's interest in our research is indicated in the letter from the Deputy Minister in the appendix.

VII. OUTREACH

This year marked the start of distribution of improved sheep to commercial farms. The initial placement on three farms was monitored closely and is reported above. This outreach effort will continue in the future.

The prior year (year two) saw a major effort to reach policy makers and the broader public with a conference and a series of presentations, publications, and press briefings. A similar effort was not planned for year three but had been proposed for year four.

VIII. DEVELOPMENTAL IMPACT

This project attempts to increase lamb production so Kazakhstan can increase its sheep numbers and increase its lamb meat production at the same time, while improving the efficiency with which range and feed resources are used. Thus the project has a positive effect on economic development at the same time that it has a positive impact on the environment and promotes agricultural sustainability.

Results of this experiment have direct application in the U.S. Much of the sheep industry of the Western and Southwestern U.S. is based on the production of finewool sheep. Due to low world wool prices and loss of a government subsidy on wool in 1995, wool sheep production is unprofitable, and U.S. sheep numbers are falling. U.S. sheep producers in the range states need to switch their emphasis from wool to lamb production, and increased prolificacy of the flocks is one way for them to increase lamb meat production.

The farm surveys are intended to help policy makers by expanding their information about the new forms of farm organization that are actually emerging and how they are faring. Our detailed, on-the-ground surveys are useful supplements to the national statistics and ad hoc observations that often define the limits of information reaching policy makers. In addition, to the extent that local officials have a stake in certain forms of farm organization, that stake may affect the information they pass to national agencies.

The marketing studies play a similar role, but may have more rapid, direct impacts in that they deal with a more concentrated set of institutions and companies. Recommendations from the marketing surveys may be implemented more easily and quickly than those dealing with millions of rural inhabitants living and working on over one hundred thousand farms.

IX. OTHER CONTRIBUTIONS

This project has a major focus on the following elements listed under this section: (1) free markets and broad-based economic development (i.e., agribusiness and private enterprise); (2) concern for individuals; and (3) support for democracy. The marketing research assesses the constraints to efficient processing and marketing of animal products, and it provides an initial set of recommendations. The farm surveys are documenting the evolution of new forms of organization and the ways in which different individuals (e.g., former state farm leaders versus workers) are advantaged and disadvantaged by different aspects of the process. The structure of land ownership, the control of other rural assets, and the extent of agribusiness monopolization all have a bearing on the development of democracy in the region.

X. LEVERAGED FUNDS AND LINKED PROJECTS

This project plus the UC-Davis GL-CRSP project in Central Asia are partners with ICARDA and ILRI in the IFAD project "Integrated Feed and Livestock Production in the Steppes of Central Asia" for a three-year period starting on October 1, 1999. The project is funded for $1.5 million, and the GL-CRSP will receive $250,000.

As reported last year, USDA's Faculty Exchange Program awarded UW a grant to bring two Kazakh and two Russian agricultural economics professors to Madison for training between September and December, 1999. Professor Dobson directed their program.

XI. TRAINING

Arin Crooks, M.S. student with David L. Thomas, was supported with University of Wisconsin-Madison funds allocated to this project. He completed his M.S. degree in February 2000 working with the biological and economic advantages of prolific sheep.

Two other UW graduate students continued to work on the project under UW funding. They are David Weber and Liba Brent.

Under the USDA faculty Exchange Program, two Kazakh agricultural economics assistant professors received training in agribusiness during fall semester, 1999. The two are Aslan Naurzgaliyev of West-Kazakhstan Agrarian University and Askar Khamzin of Astana Agrarian University. The classes they attended included: International Business; Marketing Research; Managerial Economics; Agricultural Trade and Environmental Policies; and Farming Systems Management. In addition to course work, they visited area agribusiness enterprises, state and local government, the Chicago Board of Trade; area farms; and state extension offices. They will be using their training to revise course offerings in their home university. Dr. Dobson subsequently collaborated with Khamzin on our marketing research in Astana.

XII. AND XIII. COLLABORATING PERSONNEL AND THEIR INSTITUTIONS

Meruert Abuseitova
Institute of Oriental Studies
Ministry of Science-Academy of Sciences
Akademgorodok
480032 Almaty, Kazakhstan
Phone: 7-3272-48-04-77
Fax: 7-3272-62-17-97
Email: meruert@alash.almat.kz

N. Babakulov
Samarkand (Uzbekistan) Karakul Sheep Institute

Yves M. Berger
Spooner Agricultural Research Station
University of Wisconsin-Madison

W6646 Hwy 70
P.O. Box 2335
Spooner, WI 54801-2335
Phone: 715-635-3735
Fax: 715-635-6741
Email: YMBERGER@FACSTAFF.WISC.EDU

S. Berdikulov
Department of Sociology and Political Science
Oshkii (Kyrgyzstan) State University

Liba Brent
International Agricultural Programs and
Department of Sociology
University of Wisconsin-Madison
(608) 262-1271

William Dobson
Department of Agricultural and Applied Economics
University of Wisconsin-Madison
(608) 262-8965
dobson@aae.wisc.edu

Randy G. Gottfredson
Department of Animal Sciences
University of Wisconsin-Madison
256 Animal Sciences Building
1675 Observatory Dr.
Madison, WI 53706
Phone: 608-265-2499
Fax: 608-262-5157
Email: GOTTFRED@CALSHP.CALS.WISC.EDU

A. Kalyshev
Kazakhstan State University

K.M. Kasymov
Center for Sheep Selection and Genetics (CSSG)
Kazakh Scientific Research Technological Institute of Sheep Breeding
Mynbaevo Village
Almaty Region, 483174
Kazakhstan
Phone/Fax 7-327-8 270 64 125

Anatoly Khazanov
Department of Anthropology

5240 Social Science Bldg.
University of Wisconsin
1180 Observatory Drive
Madison, WI 53706
Phone: 608/262-4343
Fax: 608/265-4216

Sergey Kliashtornyi
Institute of Oriental Studies
Russian Academy of Sciences
St. Petersburg University
191186 St. Petersburg, Russia
Phone: 256-41-540707
Fax: 256-41-543382

K. Kokombaev
Bishkek (Kyrgyzstan) Humanities Institute

N.I. Malmakov
Center for Sheep Selection and Genetics (CSSG)
Kazakh Scientific Research Technological Institute of Sheep Breeding
Mynbaevo Village
Almaty Region, 483174
Kazakhstan
Phone/Fax: 7-327-8 270 64 125

Nurbulat Masanov
Institute of Oriental Studies
Ministry of Science-Academy of Sciences
Akademgorodok
480032 Almaty, Kazakhstan
Phone: 7-3272-69-94-94
Fax: 7-3272-69-94-94
Email: nurbulat@eawarn.alma-ata.su

K.U. Medeubekov
Center for Sheep Selection and Genetics (CSSG)
Kazakh Scientific Research Technological Institute of Sheep Breeding
Mynbaevo Village
Almaty Region, 483174
Kazakhstan
Phone/Fax: 7-327-8 270 64 125

Vitaly Naumkin
President
Russian Center for Strategic Research and International Studies
12, Rozhdestvenka St.

Moscow, 103753, Russia
Phone: 7-095-256-84-58
Fax: 7-095-924-51-50
Email: zvigel@glas.apc.org

Olga Naumova
Institute for Ethnograpy & Anthropology
Russian Acadey of Sciences
Leninskii Prospekt, 32
Moscow, 117334 Russia
Phone: 7-095-143-2345
Fax: 7-095-938-0600

Saniya Sagnaeva
Uralsk University
Kazakhstan

Leonid Serebryanny
Institute of Geography
Russian Academy of Sciences
Leninskii Prospekt, 32
Moscow, 117334 Russia

Kenneth H. Shapiro, Associate Dean
International Agricultural Programs
240 Agriculture Hall
University of Wisconsin
1450 Linden Drive
Madison, WI 53706-1562
Phone: 608/262-1271
Fax: 608/262-8852
Email: kshapiro@cals.wisc.edu

D. Suleimanov
Department of Kyrgyz History
Oshkii (Kyrgyzstan) State university

David L. Thomas
Department of Animal Sciences
University of Wisconsin-Madison
256 Animal Sciences Building
1675 Observatory Dr.
Madison, WI 53706
Phone: 608-263-4306
Fax: 608-262-5157
Email: dlthomas@facstaff.wisc.edu

David Weber
International Agricultural Programs
240 Agriculture Hall
University of Wisconsin
1450 Linden Drive
Madison, WI 53706-1562
Phone: 608-262-1271
Fax: 608-262-8852
Email: daweber@students.wisc.edu

Rob D. Zelinsky
Department of Animal Sciences
University of Wisconsin-Madison
256 Animal Sciences Building
1675 Observatory Dr.
Madison, WI 53706
Phone: 608-846-5858
Fax: 608-846-8888
Email: rdzelins@facstaff.wisc.edu

Z. Zhambakin
KazAgro Co-op ? National Private Farmers? Federation of Kazakhhstan
Satpaev Street., 30 b
480057 Almaty, Kazakhstan

B. Zhaparov
Department of Ethnography
Kyrgyzstan Institute of History

XIV. AND XV. PUBLICATIONS

Esenova, Saulesh and William Dobson. 2000. "Changing Patterns of Livestock, Meat, and Dairy Marketing in Post-Communist Kazakhstan," The Central Asian Livestock Sector in Transition Research Paper Series, No. 3, University of Wisconsin-Madison.

Esenova, Saulesh and William Dobson. 2000. "Changing Patterns of Livestock, Meat, and Dairy Marketing in Post-Communist Kazakhstan," [In Russian] The Central Asian Livestock Sector in Transition Research Paper Series, No. 4, University of Wisconsin-Madison.

Khazanov, Anatoly and Kenneth Shapiro. 2000. "Contemporary Pastoralism in Central Asia," Proceedings of the 16th Annual Meeting of Japan Association for Middle East Studies. Sapporo: Japan Association for Middle East Studies, 2000: 11-34.

Khazanov, Anatoly. Post-Totalitarian Societies in Central Asia. In: M. Kh. Abuseitova, A. M.

Khazanov, and Zh. Kh. Dzhunusova (eds.). State and Society in the Countries of the Post-Soviet East. Almaty: Daik-press, 2000: 92-98.

Khazanov, Anatoly. "Two Approaches to the Sedentarization of Nomads: Central Asia and Israel." Ben Gurion University, Israel: March 2000.

Khazanov, Anatoly. "The End of Pastoral Nomadism in Central Asia?" presented as keynote address at the 16th Annual Meeting of Japan Association for Middle East Studies. Sapporo: Japan Association for Middle East Studies, May 2000.

Khazanov, Anatoly. "Nomadic heritage of Contemporary Kazakhstan" lecture presented at the National Museum of Ethnography, Osaka, Japan, 2000.

Khazanov, Anatoly. "The End of Pastoral Nomadism in Central Asia?" presented at the International Conference "Eurasian Nomads in the Outside World" Jerusalem, June 2000.

Klyashtornyi. S. G. "The Agricultural Revolution in Kyrgyzstan and Proposed Trends for Future Development" [In Russian] In: Livestock Raising and Animal Husbandry in Kazakhstan in the Period of Transfer to Market Economy. Moscow, 1999: pp. 60-70.

Klyashtornyi, S. G. "Report of Fieldwork in Kyrgyzstan in 1999" [In Russian] (in press).

Klyashtornyi, S. G. "Livestock Raising in Kyrgyzstan: Current Conditions and Dynamics of Change" [In Russian] (in press).

Klyashtornyi, S.G. (Prepared for publication). "Report of Fieldwork in the Republic of Kyrgyzstan in 1999." [In Russian] The Central Asian Livestock Sector in Transition Research Paper Series, No. (To be assigned), University of Wisconsin-Madison.

Masanov, Nurbulat. 2000. "Report of the First Year of the Sociological Study of Livestock Raising in Kazakhstan," [In Russian] The Central Asian Livestock Sector in Transition Research Paper Series, No. 6, University of Wisconsin-Madison.

Masanov, Nurbulat. 2000. "Report of Ethno-Sociological Research in Aktiubinsk Oblast," [In Russian] The Central Asian Livestock Sector in Transition Research Paper Series, No. 7, University of Wisconsin-Madison.

Medeubekov, K. U., K. M. Kasymov, and N. I. Malmakov. (Prepared for publication). "Increasing the Genetic Potential of Kazakh Fine-wool and Kazakh Meat-wool Sheep for fertility and Meat Production," [In Russian] The Central Asian Livestock Sector in Transition Research Paper Series, No. (To be assigned), University of Wisconsin-Madison.

Malmakov, N. I., K. U. Medeubekov, D. L. Thomas, and R. G. Gottfredson. (Prepared for publication). "Increasing Efficiency of Artificial Insemination with frozen Semen in Sheep," The Central Asian Livestock Sector in Transition Research Paper Series, No. (To be assigned), University of Wisconsin-Madison.

Naumova, Olga. 2000. "The Structure of Livestock Farming in West Kazakhstan Oblast," [In Russian] The Central Asian Livestock Sector in Transition Research Paper Series, No. 5, University of Wisconsin-Madison.

APPENDIX 1

Increasing Efficiency of Artificial Insemination with Frozen Semen in Sheep.

N.I.Malmakov[1], K.U.Medeubekov[1], D.L.Thomas[2] and R.G.Gottfredson[2]

1. Kazak Research Technological Institute of Sheep Breeding. Mynbaevo Village, Almaty Oblast, 483174 Kazakhstan.

2 . Department of Animal Sciences, University of Wisconsin-Madison, Madison WI 53706-1284, USA.

1. Introduction

Artificial insemination (AI) with cryopreserved semen plays a fundamental role in the genetic improvement programs. In sheep industry it has been not widely used as in dairy cattle. Freezing and thawing of ram semen causes ultrastructural, biochemical and functional damage to a significant proportion of spermatozoa. These changes are accompanied by a reduction in motility, impaired transport and decreased viability of spermatozoa in the genital tract, and reduced fertility after cervical insemination (Salamon and Maxwell, 1995a,b). The most effective method to increase the fertility is to increase the depth of deposition of frozen-thawed semen into cervical canal. Recently developed transcervical insemination techniques achieve deep cervical insemination or even uterine deposition of semen. However, the cervical anatomy of sheep usually prevents routine intrauterine AI; thus, laparoscopy, laparotomy, or special equipment and procedures must be used (Evans and Maxwell, 1987; Halbert et al., 1990). At present satisfactory and reliable lambing results are only obtainable by laparoscopic intrauterine insemination. (Salamon and Maxwell, 1995b). The application of laparoscopic techniques in sheep insemination has allowed for the use of frozen semen in spite of cryopreservation problems, although its large-scale application is often limited by its high cost and by the need for professional labor (Aisen et al., 2000). Most of producers do not have the skills and equipment needed for routine intrauterine AI in sheep. Economic and geographic problems add difficulties to use these techniques widely. That is why it is important to improve fertilizing capacity of the frozen-thawed ram semen basing on development of better freezing diluents and AI techniques.

In our research we have tried to improve fertilization rate after cervical AI of the sheep with frozen semen using following approaches

1. Improvement of AI instruments.

2. Improvement of ram semen freezing diluent.

3. Improvement of semen freezing regimen.

2. Improvement of AI instruments

2.1 **Visualization of the ewe cervix**.

In Kazakhstan the breeding season in sheep takes place in September – November and AI is usually performed in the end of October – middle of November to conduct lambing at favorite time in March – April. During this period the temperature is already cold with autumn rains and even snows. Artificial insemination is performed in the small buildings or wagons equipped with stove for heating and providing ambient temperature close to room temperature to prevent cold shock of the semen. During Soviet time most of the sheep keeping winter and autumn places were provided with electricity, but not now. Russian AI gun has been used for cervical A.I of sheep and goats. It is semi-automatic gun with 2.0 ml capacity and 0.05 ml shots, manual dosing and shooting are available either. When AI is performed in such conditions the first limitation is the lack of the light to visualize ewe cervix. At Soviet time an operator performing insemination had an electric bulb behind him. At the present time electricity is not available in the remote places (10 to 100 km to nearest village) where sheep flocks are kept. To overcome this constraint we proposed to use a small flashlight (Mini Maglite AA – California, USA) attached to the handle of AI gun using rubber tube (photo of the ordinary A.I. gun and A.I. gun with flashlight). Flashlight enables perfect visualization of the ewe cervix and increases AI efficacy (photo of the cervical AI of sheep with flashlight). Mini Maglite is, of cause, expensive for Kazakh shepherds, but other cheap brands of the flashlights of different sizes mostly of Chinese origin are easily available in Kazakhstan. Another option is a generator of electricity. But costs for running the generator are much higher than costs of the spare batteries for torch.

2.2 Artificial insemination gun.

In the Western World glass or plastic pipettes are usually used for cervical AI of sheep. It is necessary to fill pipette with semen after each ewe inseminated. This instrument is not convenient and takes time. Russian AI gun is more convenient to work with, especially for routine cervical AI: fill it with one ram ejaculate at one time and shoot semen until it is finished. Two more things about Russian AI gun: when ewe moves gun's glass pipette could break and cause trauma; it is not available in the Western countries.

Transcervical AI (TAI) requires the presence of specific equipment that is quite expensive. Kazakh shepherd would not afford to buy it. Also TAI equipment is only used during the short period of time in the year. Randy Gottfredson proposed to use the French bovine AI gun for TAI in sheep. Inconvenience of the French gun has the same reason as use of pipettes, plus if semen was frozen in pellets or in straws of different size that does not fit French gun it is

necessary to fill French straws of the proper size with semen and then insert straw into AI gun changing it after each ewe inseminated. Few shepherds in the USA or Canada have got TAI equipment. But most of them do have veterinary auto syringe. We propose to use veterinary shooter for cervical and even for transcervical AI.

In 1999 breeding season use of Miltex 10 ml Auto Syringe was tested. This syringe adjusts 0.25 to 1 ml increments. It was fitted with a 12-gauge 12 in. long syringe needle (Aldrich) with blinded tip. 50 Kazakh fine wool ewes were inseminated with frozen semen with the aid of a veterinary shooter. From 50 ewes one ewe was inseminated transcervically and the rest – cervically. The low rate of the transcervical pass was probably due to thick diameter of the needle (4 mm). Kazakh fine wool sheep is medium size one, average ewe body weight is of 50-60 kg (Karzhasov, 1985); needle with finer diameter was, probably, needed to pass her cervix. This test showed that veterinary syringe could be used successfully as an AI gun in sheep, at least for cervical insemination. Test also showed that needle has week connection between long tube and head. This connection must be strengthened by weld. Auto syringe with 5 ml capacity might be more convenient for cervical AI when fresh undiluted semen is going to be used (hot insemination), because this syringe adjusts 0.1-0.2 ml increments.

3. Improvement of the semen freezing technique

Scientists at the Kazakh Research Institute of Sheep Breeding have usually frozen the ram semen in the form of pellets (Milovanov et al., 1985). The fluoride added polymer plate has been used to freeze semen (photo picture). Pelleted semen usually shows the motility slightly higher than semen frozen in the straws because process of the ice crystals formation during freezing runs faster when semen is frozen in pellets. However sometimes pelleted semen is not desirable because:

- semen has open surface and can be contaminated by liquid nitrogen,
- each pellet does not have identification mark,
- pelleting requires a high consumption of liquid nitrogen or presence of the solid dry ice (CO_2)

We have tested the freezing of the ram semen in 0.25 ml French straws in MVE 20/20 liquid nitrogen (LN_2) tank (MVE, Inc. New Prague, MN 56071-0234, USA). The availability and prices of the materials were considered during the development of the technique. At the first stage the freezing of the straws was performed with the aid of a metal canister (diameter of 36 mm, height of 130 mm). This canister came with another Dewar flask. Several regimens of the semen freezing were tested using a sucrose-Ca EDTA-based diluent (Malmakov and Asilbekova, 1999). The best regimen found was as follows:

1. The empty canister was immersed in the LN_2 and frozen in the MVE tank.
2. Then it was lifted and fixed in the mouth of the tank by hemostat 7 cm above LN_2 level (from LN_2 surface to canister bottom). The level of LN_2 in the Dewar must be kept constant and recommended one is 15-18 cm (Theriogenology 1997, 48, 2: 247-256; Linde-Forsberg et al., 1999)
3. Diluted and cooled semen in the 0.25 ml French straws was placed in the canister.

4. Freezing of the semen had been performed for 3 minutes: each 15 seconds the canister was immersed into the Dewar by 1 cm.

2 to 4 straws were frozen in one batch. Ram semen frozen using this approach showed slightly lower motility than one frozen in pellets: 50% and 55% respectively. But we found that new technique significantly reduced LN_2 consumption.

To increase the number of straws frozen at one freezing session, to provide equal freezing conditions to all (each) straws and to improve contact of the canister with LN_2 vapor we prepared the new canister and straw rack from 50 ml syringe (diameter of 30 mm and height of 123 mm, photo picture). The black ABS LN_2 level measuring stick (American Breeders Service, Madison, WI, USA) was attached to syringe canister for work convenience. We think that it is necessary to have several such canisters and straw racks depending on the number of rams to work with. If one ejaculate of 1 ml (an average volume) is diluted at 1:3 dilution rate and placed into 0.25 ml straws, 16 straws are necessary. Straw rack has capacity for 16 straws, e.g. one ejaculate could be frozen in one batch.

We compared our freezing technique with the CLONE regimen developed for canine semen freezing (Theriogenology 1997, 48, 2: 247-256) in February of 2000. The semen was collected from two Australian Merino rams with the aid of an artificial vagina. The semen was diluted with the sucrose-$CaNa_2$EDTA-based diluent at a 1:2-1:3 dilution rate (semen : diluent), chilled in the fridge at 2-3^oC for 1.5 h in a water-jack, placed into 0.25 ml straws and then randomly divided into two groups and frozen according to two freezing techniques. Post-thaw motility of the semen was evaluated with the aid of a Sperm Quality Analyzer (U.S. Patent No.4176953, Medical Electronic Systems Ltd. P.O.Box 21 Migdal Haemek 10550 Israel). Post-thaw motility of semen frozen by our technique was slightly higher than one frozen by CLONE regimen (38.1+4.8% vs. 34.8+5.46% respectively, n=10) but the difference was not significant ($P>0.05$).

. Improvement of the semen freezing diluent

It was found that several amino acids protect vegetable and animal phospholipids and proteins, including ram spermatozoa, from the detrimental impact of the freezing (Anchordoguy et al., 1988; Granach, 1990; Lalonde et al., 1991; Nauk, 1991: Sanchez-Partida et al, 1992; Smirnov et al., 1978; Trimeche et al., 1996). We have tested if incorporation of the amino acids: arginine, betaine, glutamine and proline into freezing diluent improves post-thaw characteristics of the ram semen. In experiment 1 conducted in spring and autumn of 1998 the supplementation of the freezing diluent with 4 amino acids in preserving ram (n=5) spermatozoa diluted in sucrose-$CaNa_2$EDTA-based extender containing 4.0% (v/v) glycerol and 11.0% egg yolk (control) during freezing and thawing was studied at 0, 40, 60 and 80 mM concentrations. All tested amino acids significantly ($P<0.01$-0.05) improved post-thaw ram semen motility by 10-28% and the highest protection was achieved at 80 mM concentration (Malmakov and Asilbekova, 1999).

In experiment 2 the influence of the amino acids at 80 mM concentration on post-thaw motility and survival at 37^oC of ram semen and buffering capacity of the diluents was investigated. pH of all diluents was adjusted to 6.7 with tris and citric acid. Semen

was collected from 3 Australian Merino rams with the aid of artificial vagina, pooled, divided onto 5 equal parts each of which was diluted at 1:4 dilution rate with a corresponding diluent and frozen in 0.15 ml pellets. Data obtained in the second experiment confirmed the results obtained in the first one. Post-thaw motility of the semen frozen in the presence of 80 mM of tested amino acids

was significantly higher than of control semen (P<0.01-0.05), however the survival of the thawed semen was approximately equal in all compared groups (table 1).

Table 1. Motility and survival at 37°C of ram semen frozen in the sucrose-$CaNa_2EDTA$- based diluent (control) with addition of 80 mM of arginine, glutamine or proline (7 observations)

Post-thaw motility, %:	D I L U E N T S:				
	Control	Arginine	Betaine	Glutamine	Proline
at thawing: M	42.5 + 1.97 [A]	54.3 + 2.48 [C]	51.8 + 2.02 [B]	53.6 + 1.80 [C]	54.3 + 2.23 [C]
post thawing:					
1.5 h	42.1 + 2.08		50.0 + 3.35	51.7 + 3.00	53.3 + 2.86
3.0h	36.8 + 2.30	53.8 + 3.28	44.6 + 2.80	35.7 + 5.64	45.7 + 2.87
4.5h	28.8 + 5.19	46.4 + 3.40	26.7 + 4.82	27.9 + 6.84	29.9 + 7.37
6.0 h	22.9 + 5.89	36.3 + 5.47	19.1 + 5.40	18.2 + 4.90	17.9 + 5.19
7.5 h	17.2 + 5.75	27.1 + 5.94	10.2 + 3.73	8.3 + 3.60	10.4 + 3.44
9.0 h	4.6 + 2.18	18.0 + 5.11	5.3 + 1.67	5.5 + 2.43	5.9 + 1.87
		5.2 + 2.62			

AB – P<0.05; AC – P<0.01.

Table 2. pH of ram semen frozen in the sucrose-$CaNa_2EDTA$-based diluent (control) with addition of 80 mM of arginine, glutamine or proline and incubated at 37°C (7 observations)

	D I L U E N T S:				
	Control	Arginine	Betaine	Glutamine	Proline
pH of the diluent	6.7	6.7	6.7	6.7	6.7
pH of the cooled semen	6.52+0.03 [B]	6.62+0.02 [A]	6.46+0.02 [C]	6.44+0.02 [C]	6.44+0.02 [C]
pH of the thawed semen				6.63+0.05	6.63+0.06
pH of the incubated semen	6.74+0.05	6.69+0.01	6.59+0.05	5.81+0.13	5.87+0.14
	5.97+0.16	6.10+0.08 [A]	5.72+0.13 [B]		
pH attitude				0.91+0.13	0.85+0.13
	0.82+0.15				
		0.59+0.10 [A]	1.01+0.14 [B]		

AB – P<0.05; AC – P<0.001.

The arginine-containing diluent had the best buffering capacity. Significant difference in the buffering capacity between arginine-containing diluent and other tested diluents was observed in the cooled semen when pH markedly reduced in all groups (P<0.001-0.05) and in the thawed incubated semen between arginine and betaine groups (P<0.05) (table 2).

In the next experiment cervical AI of the Kazak fine-wool ewes with Australian Merino semen frozen in the control and arginine-containing diluent was performed in the Mynbaevo (n=50) and Koktalsky (n=54) sheep farms. When sheep was inseminated with semen frozen in the presence of arginine, 15 ewes from 25 (60%) and in the Mynbaevo Farm and 13 ewes from 33 (39.4%) in the Koktalsky farm lambed, whereas the lambing rates in the control groups were 52% (13/25) and 33.3% (7/21) respectively.

References:

Aisen E.G., Alvarez H.L., Venturino A. and Garde J.J., 2000. Effect of trehalose and EDTA on cryoprotective action of ram semen diluents. Theriogenology 53, 5: 1053-1061.

Anchordoguy T., Carpenter J.P., Loomis S.H., Crowe J.H., 1988. Mechanisms of interaction of amino acids with phospholipids bilayers during freezing. Biochem. Biophys. Acta 946: 299-306.

Evans G. and Maxwell W.M.C., 1987. Salamon's artificial insemination of sheep and goats. Sydney: Butterworths.

Granach V.G., 1990. Protein: lipid ratio in the plasma membranes and functional indicators of gametes depending on the content of the beta-karotin, vitamins, proteins and antioxidants in the diet of the bull-sires. Avtoref. dis. kand. biolog. nauk, Lvov: 18 pp. (in Russian).

Halbert G.W., Dobson H., Walton J.S. and Buckrell B.C., 1990. A technique for transcervical intrauterine insemination of sheep. Theriogenology 33: 993-1010.

Karzhasov B.V. (1985) Characteristics of the Kazakh fine-wooled sheep in Mynbaevo farm. In:
Kazakh Fine-Wooled Breed. Alma-Ata, Kainar: 51-103 (in Russian).

Lalonde R.J., Lepook J.R., Kruuv J., 1991. Site of freeze-thaw damage and cryoprotection by amino acids of the calcium ATPase of the sarcoplasmic reticulum. Biochem. Biophys. Acta 1079: 128-138.

Linde-Forsberg C., Strom Holst B. and Govette G., 1999. Comparison of fertility data from vaginal vs intrauterine insemination of frozen-thawed dog semen: a retrospective study. Theriogenology 52, 1: 11-23.

Malmakov N.I. and Asilbekova G.K. 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 1999: 170-181 (in Russian).

Milovanov V.K., Sokolovskaya I.I., Shaidullin I.N., Golub V.S., Varnavskiy A.N., Trofimov Ew. N., Varanavskaya V.A., Stoianov V.K., Kasymov K.T., Utesinov Zh., Ashimov Zh. B., Asilbekova, G.K. Methodological recommendations on the technology

of deep freezing and use of semen from highly valuable rams. Vsesojuz. nauchno-issled. inst. zhivotn., Dubrovitsy: 13 pp. (in Russian).

Nauk V.A., 1991. Structure and function of spermatozoa of farm animals during cryopreservation. Stiinca, Kishinev, Moldavia, 199 pp. (in Russian).

Salamon S. and Maxwell W.M.C. (1995a) Frozen storage of ram semen I. Processing, freezing, thawing and fertility after cervical insemination. Animal Reproduction Science 37: 185-249.

Salamon S. and Maxwell W.M.C. (1995b) Frozen storage of ram semen II. Causes of low fertility after cervical insemination and methods of improvement. Anim Reprod Sci 38: 1-36.

Sanchez-Partida L.G., Maxwell W.M.C., Paleg L.G. and Setchell B.P., 1992. Proline and glycine betaine in cryoprotective diluents for ram spermatozoa. Reprod. Fert. Dev. 4, 1: 113-118.

Trimeche A., Renard P., Le Lannou D., Barriere P. and Tainturier D., 1996. Improvement of motility of post thaw poitou jackass sperm using glutamine. Theriogenology 45, 5: 1015-1027.

APPENDIX 2

Ministry of Agriculture
Republic of Kazakhstan
473000 Astana, Abaya St., 49
tel: 8 (3127) 32-37-63

30 June, 2000
Fax No. 11-1-5 / 236

Dean of International Agricultural Programs
University of Wisconsin Madison
Professor Kenneth Shapiro

Professor, Fellow of the British Academy
Anatoly Khazanov

The Ministry of Agriculture of the Republic of Kazakhstan wanted to bring to your attention the extreme importance of the research project being conducted by the University of Wisconsin – Madison through the CRSP program for the global support of livestock raising to the Republic of Kazakhstan. Your project has helped create the possibility for the organization of high-productivity dairy and meat cattle and sheep raising in market conditions.

It is also necessary to note that it is extraordinarily important for the Kazakh livestock sector to increase productivity and competitive production on peasant and farming homesteads.

Also of great importance has been your work on the improvement of the number of sheep and the increase in their productivity through genetics and selective breeding.

The questions of marketing regarding livestock products requires a wider investigation of ways of better organization of income and finding new basic methods. The solution of this problem has great social and economic significance for Kazakhstan.

The Ministry of Agriculture of the Republic of Kazakhstan invites you to continue your research in Kazakhstan in 2000 –02, as the Kazakh specialists and the agrarian sector of the country are very interested not only in your practical recommendations, but in your theoretical analysis of the results of the research. The cooperative work of the Kazakh agencies and the University of Wisconsin is a great example of international scientific cooperation, and we hope for your continued cooperation in this research.

Vice-Minister (signed) T. Nurkiyanov

Trans. by D. Weber.