Community Action in Integrated and Market Oriented Feed-Livestock Production in Central and South Asia

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I Introduction

This report covers the period from 1 January to 31 December 2008 and relates to the last twelve months in the second annual workplan.

The second annual workplan specified detailed activities for each region, each research theme and country/project site. The section on project implementation and achievements (II) in this progress report is organized accordingly by region, themes and countries. Regional activities are reported in a separate section. The present report is based on progress reports by the national teams that were received in January and March 2008.

For Theme 1 in Central Asia the present report briefly describes the progress in the planned activities; all technical results will be summarized in an updated version of the first socioeconomic report from April 2008. The updated report is in preparation by Aden Aw-Hassan and Nariman Nishanov. For Theme 2 and Theme 3 in Central Asia and for all activities in Pakistan some preliminary results will be presented to illustrate the progress and achievements of the activities. However, the statistical analysis and most of the cost benefit evaluations will be done when the activities have been completed (mostly in autumn 2009).

In addition to the this annual progress report two detailed progress/technical reports were prepared: 1) on activity 16 “Value added local processing of goat fibres” by Liba Brent (University of Madison, Wisconsin) in March 2008 and March 2009 describing the results from the field missions to Khojand/Tajikistan in April/May and October/November 2008; and 2) on the breeding activities (activities 10, 11 and 15) by Joaquin Mueller in November 2008 after his field mission to Kyrgyzstan, Tajikistan and ICARDA HQ in October/November 2008. All technical reports were shared with IFAD.

An additional important source of information on the progress and achievements of the project is the IFAD supervision mission report prepared by Antonio Rota which gives an excellent overview of the state of project activities

The major activities in 2008 included:

- Conduction of the producers’ survey in Central Asia (CA)
- Continuation of market studies of sheep and goat products and value chain analysis in CA
- Socioeconomic evaluation of technologies in Pakistan and initiation of economic evaluation in CA
- Continuation of field experiments under Themes 2 and 3 (activities 4-17) in CA
- Second cultivation cycle of summer crops and third cultivation cycle of winter crops (testing of improved varieties and agronomic measures) in Pakistan
- Feeding experiments with cattle and buffalos testing the new fodder crops and balanced rations in Pakistan
- Inclusion of Master and PhD students into the project activities in CA and Pakistan
- Updating of the project webpage and training of webmasters in the partner institutes in CA
- IFAD supervision mission in Kyrgyzstan, Tajikistan and Pakistan in April 2008
- Second annual national workshops in four countries in October 2008
- Inter-regional workshop and second SCM in Dushanbe/Tajikistan from 24-27 November 2009, including field visits to the project sites near Khojand and Dushanbe.

II Project Implementation and Achievements

1 Central Asia

1.1 Theme 1: Socioeconomics

Kazakhstan

1.1.1 Activity 1: Livestock producers' survey

Sampling frame and procedure

- The sampling frame was developed from January to March 2008 using a clear geographical territory and farm household typologies
- Sampling procedure was defined, and sample was selected;
- List of 3 villages and 150 households to be interviewed were identified
- Preliminary analyses of the collected data included:
  - characteristics of households
  - households' land assets
  - livestock flock size of smallholders
  - marketing practices of households.

In the previous technical report marketing practices are not discussed in detail, this will be done in the next technical report.

Developing of production and market survey

Household questionnaire was adapted and tested for local conditions by May 2008

Training of enumerators and researchers

Enumerators and researchers were trained by May 2008

Enumerators	Institution	Date of training	Place of training
2 researchers	South-West Research Center of Livestock and Crop Science, Int'l Kazakh-Turkish University	18 March 2008	South-West Research Center of Livestock and Crop Science in Shymkent
2 MSc students	Int'l Kazakh-Turkish University		
3 students	South Kazakhstan State University		

Conducting of multi-theme survey of livestock keepers in the target area and data entry.

- Survey was conducted from June to August 2008
- Data were entered into database in August-September 2008.

1.1.2 Activity 2: Assessment of economic feasibility of the newly introduced technologies

Results obtained by September 2008:

1. Cost benefit analysis of the early lambing technology was completed. However, the methodology should be reviewed.

2. Cost benefit analysis of fattening of the early weaned lambs was completed. Results show that this technology helps to increase the profit from sales of each lamb by 75%.

3. A rough estimate of the cost benefit ratio for cow and sheep milk processing was done. The data indicate that milk processing for production of cheese (called chechel) does not generate enough income to cover milk and labor costs and to achieve a significant profit:

Technology	Milk (l)	Price per liter of milk (Kaz. Tenge)*	Total cost of milk (Kaz. Tenge)	Produced cheese (kg)	Price per kg of cheese (Kaz. Tenge)
Chechel production	10	50	500	1	1200
Income			700 KZT		

*1 USD= 120 Kaz. Tenge (KZT)

1.1.3 Activity 3: Analysis of livestock market integration

The questionnaire for weekly livestock price data collection was elaborated and tested by May 2008

Price data collection was conducted at two rural (Arys and Badam) and two urban (Turkistan and Shymkent) livestock markets from June to December 2008. It is expected to be completed by June 2009. So far analysis of traded livestock by the volume of transactions and animal types has been conducted for the period May-August 2008. Supply of lambs at all livestock markets significantly increased from July. For example, at Shymkent livestock market, the quantity of sheep in May was 1,100 sheep, while in July it reached 2,000 sheep. This trend, similar to both Kyrgyzstan and Tajikistan, indicates that smallholders anticipate a cold winter and try to sell more lambs rather than buy expensive forage for winter. Lamb prices decreased in July and slightly increased in August due to the wedding season.

Kyrgyzstan

1.1.4 Activity 1: Livestock producers' survey

Sampling frame and procedure

- The sampling frame was developed from January to March 2008 using a clear geographical territory and farm household typologies.
- Sampling procedure was defined, and sample was selected;
- List of 3 villages and 150 households to be interviewed were identified

Developing of production and market survey

Household questionnaire adapted and tested for local conditions by May 2008.

Training of enumerators and researchers

Training of enumerators and researchers was conducted in March 2008 at the Agrarian University in Bishkek.

Enumerators	Institution	Date of training	Place of training
3 researchers	Kyrgyz Agrarian University, Kyrgyz State University	28 March 2008	Kyrgyz Agrarian University in Bishkek
6 students	Kyrgyz Agrarian University		

Conducting of multi-theme survey of livestock keepers in the target area and data entry.

- Survey was conducted from June to August 2008
- Data were entered into database in August-September 2008
- Preliminary analyses of the collected data included:
  - characteristics of households
  - major income sources
  - income generated from the livestock production with special emphasis on small ruminants
  - marketing practices of households.

1.1.5 Activity 2: Analysis of livestock market integration

The questionnaire for weekly livestock price data collection was elaborated and tested by May 2008.

Price data collection was conducted at three livestock markets, one in Tokmok town and two in Bishkek, from June to December 2008. It is expected to be completed by June 2009. So far analysis of traded livestock by the volume of transactions and animal types has been conducted for the period June-Sept. 2008. Regular fuel price increase pushed lamb prices up in the beginning of the year. This was followed by a massive supply of lambs from rangelands in late July that pulled prices down. This increase in supply was also caused by a very dry season and, consequently, lack of forage on the summer ranges.

1.1.6 Activity 3: Analysis of price dynamics for livestock products, feed / forage, and staple food

Price data were collected for January to December 2008, and factors of price change were determined for all three types of commodities by December 2008. Nominal food prices have increased by 20-25% from January to December 2008. For the same period, feed prices increase was recorded in August, but by the end of 2008 they went down to the January level. The maximum lamb meat price was recorded in July 2008; by the end of the year prices decreased by 5-10% compared to the level recorded in January.

Tajikistan, Sogd province, Khujand site

1.1.7 Activity 1: Mohair goat producers' survey

Sampling frame and procedure

- The sampling frame was developed by January 2008 using a clear geographical territory and farm household typologies.
- Sampling procedure was defined, and sample was selected.
- List of 5 villages and 150 households to be interviewed were identified.
- Small ruminant populations were obtained.

Developing of production and market survey

Household questionnaire adapted and tested for local conditions by May 2008.

Training of enumerators and researchers

Enumerators and researchers were trained in March 2008 (see above comments).

Enumerators	Institution	Date of training	Place of training
2 researchers	Tajik Research Institute of Livestock	17 March 2008	Tajik University of Technology
5 students	Agrotechnology department, Tajik University of Technology		

Conducting of multi-theme survey of livestock keepers in the target area and data entry

- Survey was conducted from June to August 2008
- Data were entered into database in August-September 2008.

1.1.8 Activity 2: Mohair traders' survey

Identification of the target markets for survey

Mohair markets were selected by March 2008.

Developing of mohair market survey

Traders' questionnaire adapted and tested for local conditions by May 2008

Train enumerators and researchers

Enumerators and researchers were trained by May 2008.

Conducting of survey of mohair traders in the target area and data entry.

- 50 traders were interviewed by November 2008. The survey is expected to be completed by March 2009 rather than end of 2008, as many traders are expected to return from Russia to Tajikistan in winter.
- Data entry will be finalized by April 2009

1.1.9 Activity 3: Analysis of price dynamics for livestock products, feed/forage, and staple food

Price data were collected for the period from January to December 2008, and factors of price change were determined for all three types of commodities by December 2008. There was no significant change on mohair market. Demand from the foreign buyers remains weak, and mohair as well as yarn prices have not changed in spite of the price hike for staple food and feed/forage recorded in the first half of 2008. Price data for staple food and feed indicate that there was a decrease of these prices that started in September 2008 and continued till December. However, food and feed prices still remain higher than those recorded at the end of 2007.

Tajikistan, Vahdat district, Dushanbe site

1.1.10 Activity 1: Livestock producers' survey

Sampling frame and procedure

- Sampling frame was developed from January to March 2008 using a clear geographical territory and farm household typologies.
- Sampling procedure was defined, and sample was selected.
- List of 11 villages and 150 households to be interviewed were identified.

Developing of production and market survey

Household questionnaire adapted and tested for local conditions by May 2008.

Training of enumerators and researchers

Enumerators and researchers were trained in March 2008.

Enumerators	Institution	Date of training	Place of training
3 researchers	Tajik Research Institute of Livestock	14 March 2008	Tajik Research Institute of Livestock in Dushanbe, Karsang village in Vakhdat district
3 temporary workers hired for survey	Local administration office in Vakhdat district		

Conducting of multi-theme survey of livestock keepers in the target area and data entry.

- Survey was conducted from June to August 2008

- Data were entered into database in August-September 2008.

1.1.11 Activity 2: Analysis of livestock market integration

The questionnaire for weekly livestock price data collection was elaborated and tested by May 2008.

Price data collection was conducted at two urban (Sharora and Chorbogh) and two rural (Sangob and Eski Bozor) livestock markets from June to December 2008. It is expected to be completed by June 2009. Preliminary results show that the highest number of livestock is sold at Rudaki market located nearby Dushanbe city limits. From June to August lamb prices have been increasing. Major factors explaining the price movement in June are the rising feed/forage prices and 30% fuel price hike recorded in 2008 from May to September. In July, despite increased supply of lambs brought for sales from the summer ranges, demand caused by the wedding season pushed lamb prices higher.

In general, better marketing conditions exist in Rudaki and Sharora livestock markets. Most of the livestock producers were concerned about the winter season and try to sell as many sheep as possible to avoid high forage costs. The other reasons for early sales of lambs are the peak condition of lambs and lack of forage on rangelands due to exceptionally dry season. This definitely will negatively affect the size of households' flocks and limit the reproduction opportunities for the next year.

1.1.12 Activity 3: Analysis of price dynamics for livestock products, feed / forage, and staple food

Price data were collected for the period from January to September 2008, and factors of price change were determined for all three types of commodities by December 2008. Data show that beef and lamb meat prices increased for 9 months of 2008 by 20 and 29%, respectively, while live lamb prices gained about 40% for the same period.

1.2 Theme 2: Range and Forage Productivity

1.2.1 Assessment of current status of fodder crop production and feed resources. Feeding calendar

A questionnaire for a comprehensive survey on feeding strategies and forage production was developed and distributed to the partners in the three countries by the end of September 2007. The aim of the questionnaire was to interview about thirty farms and households in each village including those participating in the project and neighboring households.

Data collection for comprehensive survey finalized in May 2008 in three villages at each research site (total 314 respondents): 75 in Dushanbe; 90 in Khujand; 75 in Kyrgyzstan; 74 in Kazakhstan. The most common and popular forage crops planted by households and farmers of the selected villages are maize and alfalfa. The yields of planted forage crops are often low. Forage production becomes an economic disadvantage for the households when livestock prices are low and labor, machinery, and fuel costs are high and increasing. Therefore, farmers need higher yielding varieties of forage crops. In addition, the length of the grazing season and the efficiency of grazing management will be optimized with the available forage crops.

The majority of the respondents were interested in cultivation of forage crops such as sorghum, millet and forage beet. Sorghum and proso millet can be successfully grown in households and farmer's field in the Khujand site, Tajikistan, as grain for animal feeding and for seed multiplication of improved varieties.

The preliminary results from the feed survey also point at the need for improved grazing management. This need is enforced by the prevailing scenario of increasing fuel prices and decreasing area under fodder crops, salinization of irrigated lands, drought and heat problems, and low priority to fodder production. Overstocking of rangelands nearby settlements can decrease available feed resources in the region. It seems that the shortage of feeds and fodders will be a great challenge to the future livestock production in the project sites' villages.

Kazakhstan

1.2.2 Activity 4: Participatory evaluation and dissemination of improved fodder crops and agronomic packages to increase the feed resource base

Activity 4.1: Community action for improving the carrying capacity of degraded rangelands around settlements

Activity 4.1.1 Effect of oversowing on productivity of degraded rangeland

The experiment could not be carried out due to a severe cold in the winter 2007/2008 and flooding in spring 2008 followed by a drought. The flood in the South Kazakhstan province was caused by heavy rains and the melting of snow due to a sudden rise in the temperature in March 2008. The rangeland and agricultural land in Akdala village were completely flooded. Thus, the planting of the experiment had to be postponed and Haloxylon and Kochia were planted in December 2008 according to approved workplan.

4.1.2. Effect of continuous and rotational grazing on productivity of natural pastures

Natural pastures are an important feed resource for livestock production. Therefore, research approach to develop improved system of the pasture management is the most important issue. It is essential to develop this system as animals are grazed in the steppes almost around year.

It is known that diverse plant composition effects to the grazing system differently: at continuous grazing the pastures can be degraded while in proper pasture rotation can increase productivity of the livestock and ranges, and also it improves forage crops composition in the pasture.

It is necessary to note that many communities have certain practices and knowledge on grazing animals in their respective pastures; however, they are not experienced yet to manage pasture rotation on pastures nearby village.

Therefore investigations of this activity are linked to introduce improved pasture rotations on the basis of plant composition by seasons of the year.

The grazing experiment testing rotational grazing was started in May 2007 and all planned measurements on biomass and botanical composition were carried out. However, the grazing was not

managed by the herder according to the agreed experimental plan. Several times the researchers discussed with the farmer to assure grazing of sheep according to the experimental scheme. As this failed, it was decided to discontinue the experiments. However, it is being discussed to analyze and present the data collected on seasonal changes in biomass quantity and quality.

Activity 4.2: On-farm demonstration of improved fodder production options

Three experiments were conducted.

Experiment 1

Improved maize hybrid from Uzbekistan was brought and planted at two households' fields on four different planting dates according to the approved workplan for 2008. The objectives of this study were to study the impact of different planting dates on maize performance under irrigated conditions. The experiment was completely randomized with four replications. Four planting dates were tested, 15 April, 30 April, 15 May and 30 May 2009. The results showed that the sowing date on 30 April gave the highest average biomass (12.6 t) and grain yields (6.8 t) in both farms but the yields did not differ significantly from sowing on 15 May (11.7 and 6.3 t).

Experiment 2

Two maize seeding rates (25 and 35 kg/ha) were evaluated on two farms in Akdala village. First year results showed that the higher seed rate increased the average biomass yield by 0.57 t and the grain yield by 0.36 t.

Experiment 3

Traditionally no fertilizer is applied to alfalfa (*Medicago sativa*) under irrigation in Kazakhstan in the first harvest year. The aim of this experiment was to study effect of ammophous fertilizer on alfalfa biomass in the first harvest year. Three treatments were tested: control with no fertilizer application; 40 kg/ha ammophous; and 60 kg/ha ammophous. Four cuts were done during the vegetation period. The overall yield of green fodder mass was equal to 20.7 t per hectare in the control, 21.2 and 23.4 t per hectare with 40 and 60 kg/ha ammophous application, respectively.

Kyrgyzstan

1.2.3 Activity 4: Participatory evaluation and dissemination of improved fodder crops and agronomic packages to increase the feed resource base

Assessment of botanical composition and biomass

Dry conditions in the last three years in Kyrgyzstan led to a decrease in productivity of natural hayfields. In 2008 the dry biomass yield of the natural hayfield yield was 420 kg/ha composed of 185 kg/ha annual grass (44.0 %), 5 kg/ha legumes (1.2 %), 32 kg/ha sedges (7.6 %), 90 kg/ha wormwood (21.4%), and 72 kg/ha forbs (17.1 %). Wormwood is consumed by animals when the plant is dry.

4.1. Effect of over-sowing and ammonium nitrate fertilization on productivity of hayfields

Three experiments were conducted.

Experiment 1

The effect of two tillage methods for over-sowing with sainfoin (*Onobrychis viciifolia*) on productivity of hayfields was studied in the natural hayfield of Alymseit farm, namely plowing and minimal tillage (disking) and compared to the natural hayfield. Over-sowing with sainfoin and tillage methods (full and minimum tillage) increased the productivity of the natural hayfield from 397 kg/ha to 661 kg/ha, with disking and 787 kg/ha with plowing.

Experiment 2

There are several forms of nitrogen available for fertilization of spring hayfields, but ammonium nitrate is the most common type in Kyrgyzstan. Ammonium nitrate can be used any time during the vegetation because surface volatilization losses are minimal. In this experiment, ammonium nitrate

was applied at the rate of 50 kg/ha, and the natural hayfield was used as control. The results of the experiment showed that, ammonium nitrate application led to 13 % higher plant cover and increased plant height by 7 cm larger but plant germination percentage was 16 % lower than in the control.

Experiment 3

Oversowing a natural hayfield with two different seeding rates of sainfoin (50 and 70 kg/ha) with disking as land preparation were compared with an undisturbed natural hayfield as control. Plant density, plant height and biomass yield were determined.

The analysis shows that the natural hayfield (control) produced a higher dry biomass (419 kg/ha) than the two treatments oversown with sainfoin. The lower yield can be explained by the fact that sainfoin grows slowly in the year of establishment and that about 30-40% of the natural grasses were damaged by disking and planting with the seeder. It is expected that the yield in the two treatments will increase in the second harvest year. The higher seeding rate of 70 kg/ha led to higher plant density and higher biomass than the rate of 50 kg/ha (Table 1).

Table 1. Effect of two seeding rates on the productivity of natural hayfields oversown with sainfoin

Treatments	Plant density (no/ m^2)	Plant height (cm)	Yield (kg/ha)
1. Control (natural hayfield)	19.0	24.25	418.8
2. Disking + sainfoin 50 kg/ha	61.2	12.75	345.5
3. Disking + sainfoin 70 kg/ha	89.5	12.75	406.0
	LSD_{05} 2.7	LSD_{05} 0.8	LSD_{05} 18.6

Activity 4.3: Integration of food/feed legumes into cereal cropping systems

Wheat, barley and maize continued to be the major crops grown by private and public sectors in Kyrgyzstan. It is proposed to introduce mung bean or pearl millet into the continuous wheat and barley cropping practiced by the households at the project site to increase good quality forage and to improve soil fertility. Nevertheless, it will be difficult to change Government policy that tends to concentrate on one or two agricultural crops. In this case, crop diversification can be reached only through cultivation of alternative crops in the marginal or degraded lands.

Experiment 1

In the reporting period, mung bean seeds were purchased from the Southern part of Kyrgyzstan where they are widely grown, while they are not common in Chuy province. Fields continuously planted with wheat or barley were selected on three farms and divided into two. One half was planted according to common practice with cereals, the other half was planted with cereal followed by mung bean. Preliminary results showed that a seeding rate of 20 kg mung bean per hectare was optimal under the conditions of Chuy province. The experiment will be repeated in 2009 and results presented for two consecutive years.

Experiment 2

It is well known that drought tolerant varieties of pearl millet have a great potential for agriculture in drought-affected regions. Three varieties of pearl millet were obtained from ICARDA and planted at the central experimental station of the Kyrgyz Research Institute of Veterinary, Livestock and Pastures and in the backyard of one of the scientists. Pearl millet had not been planted before in Kyrgyzstan. That is why the experiment was done mainly at the research station.

Biomass and grain yields were determined and compared with maize. The highest biomass yield was obtained from HHVBC tall 36.9 and 35.3 at the research station and in Joldosh household. This was higher than the maize yield with 32.3 and 30.8 t/ha but not significantly different from variety EEBC, while the biomass yield of the third variety Raj 171 only amounted to 25 and 26.5 t/ha at the research

station and in Joldosh household. The highest grain yields (1165 and 1092 kg/ha) were obtained from the variety EEBC in both research sites; the other varieties did not differ much from each other or from maize.

1.2.4 Activity 5: Promoting efficient use of fodder crops, crop residues and agro-industrial by-products for increased meat and milk

Experiment 1

A feeding experiment was conducted in Alimseyit farm in Kemin district over a period of two months to compare the feeding of chopped and unchopped types of coarse fodder. The experiment showed that the quantity of residues after feeding was reduced through chopping with the exception of sainfoin hay which was consumed equally well in both forms (Table 2).

Table 2. Percent of forage type eaten

	Forage type				
	Alfalfa hay	Natural hay	Barley straw	Sainfoin hay	Barley (grain)
Control	70	62	48	90	100
Experimental group	95	89	78	88	100

The experimental group of sheep was fed by a diet of chopped fodder and agricultural by-products. The results of the experiment showed higher weight gain in the group receiving chopped feed during the fattening period compared to the control but the difference was not significant (Table 3).

Table 3. Live weights and weight gains during the fattening period (average per head)

Treatments	Liveweight (kg)		Growth rate	
	15/01/2008 г	15/03/2008г	Total (kg)	Daily growth rate (g)
Control	32.9 ± 1.8	39.3 ± 3.7	6.4	107
Experimental group	32.5 ± 1.3	42.8 ± 2.3	10.3	171

Experiment 2

A second feeding experiment with the same objective was carried out in two households in Akbeket village with 13 adult sheep each. The control group (Toktogunov Erkin) was fed with unchopped straw and the experimental group (Rysbekov Shaken) with chopped straw. The experiment showed that the loss in the liveweights of the sheep over the winter period was decreased in the experimental group (12.8 kg) compared to the control group (16.6 kg).

Tajikistan, Sogd province, Khujand site

1.2.5 Activity 4: Participatory evaluation and dissemination of improved fodder crops and agronomic packages to increase the feed resource base

Activity 4.1: Community action on improving productivity of degraded pastures close to the villages

Two experiments testing the effect of nitrogen application and of reseeding with saltwort and Persian clover were conducted in the selected rangeland site. The meteorological data in 2008 showed that the temperatures were very low in January and February 2008 and that there was a drought in spring (high temperature and low rainfall). The total precipitation was only 23 mm during the whole vegetation period according to the meteorological station called Aeroport).

Experiment 1

The experiment was started on 5 April 2008 when some rain was received. 50 kg/ha nitrogen was applied by hand in the natural rangeland according to the experimental design. Field observations of growth and development were made during the vegetation period from 5 April to 25 August 2008. However, due to the drought biomass production was very low and no effect could be measured. The same experiment is being repeated in 2009.

Experiment 2

Planting of saltwort, Persian clover and of the mixture was done in March, later than originally planned due to the cold winter. Nitrogen was applied at the rate of 40 kg/ha. The lack of rain led to a poor germination and poor plant growth. In the beginning of June the percentage of germinated seeds was as follows: 28.6% for saltwort, 11.1% for Persian clover, and 16.6/5.3 % for the mix of saltwort/Persian clover. Later on the plants died because of the continued water shortage.

Activity 4.2.1 Introducing nontraditional crops into existing crop rotation

Crop diversification has started in Northern Tajikistan. Nevertheless wheat, barley, and maize continue to be the major agricultural crops grown by the private and public sectors in the country. The project proposes to introduce nontraditional crops such as pearl millet and sorghum into the existing crop production system in the households. Maize, pearl millet, and sorghum were planted after winter wheat harvest in the beginning of June. Yield was recorded before harvest. The research results show that with irrigation of 700-800 m^3/ha and fertilizer dressing at the rate of 150 kg/ha is sufficient to get good yields from maize, pearl millet, and sorghum even during a dry year. Seed emergence was higher in pearl millet (78 %) than in sorghum (67%) and maize (66 %). Plant density of sorghum (290 plants per $m^{2)}$ was higher than that of maize (200) and pearl millet (199), while plant height as well as the number of leaves per plant of maize was higher than pearl millet and sorghum.

1.2.6 Activity 5: Promoting efficient use of fodder crops, crop residues and agro-industrial by-products for increased meat and milk

Low-quality cereal crop residues, especially rice straw, are important feed resources in the smallholder crop-livestock systems. It was planned to test new feeding rations from January to March 2008 including the use of a locally made chopper for chopping straw and other crop residues. Due to the cold winter and related scarcity of feeds this activity had to be postponed to the next winter season (December 2008 to February 2009).

Tajikistan, Vahdat district, Dushanbe site

1.2.7 Activity 4: Participatory evaluation and distribution of improved fodder crops and agronomic packages to increase fodder resource base.

Activity 4.1: Improving carrying capacity of degraded rangelands and hay pastures and effect of nitrogen fertilization on productivity of hayfields

Two experiments were conducted with two households to rehabilitate natural hayfields through surface application of nitrogen-phosphorus fertilizer and planting of sainfoin. The natural hayfields are currently dominated by *Hordeum bulbosum*.

Experiment 1

Oversowing the natural hayfield with 60 kg/ha sainfoin was compared with a seeding rate of 80 kg/ha and with a natural hayfield. The average biomass yield at the end of the vegetation period was 0.74 t/ha for the seeding rate of 60 kg/ha sainfoin and 0.79 t/ha for a rate of 80 kg/ha, while the biomass of the natural hayfield (control) amounted to 2 t/ha. This experiment is being continued in 2009. It is expected that the biomass and nutritional quality produced on the improved hayfield will increase considerably in the second and coming years.

Experiment 2

Fertilizers (ammonium nitrate and ammophos) were applied by hand according to experimental design. Field observations and data collection were carried out according to the workplan. The results showed that plant height of the *Hordeum bulbosum* in the stage of flowering was 150-160 cm with nitrogen application, and 110-120 cm in the control, while plant height of wild oat *Avena trichophora* was 70-80 cm with nitrogen application and in the control 25-35 cm. The same trend was observed in dry biomass yield. The average dry biomass yield with nitrogen and phosphorous application *Hordeum bulbosum* was increased 2.2 times compared to the control. The results indicate that the productivity of hayfields in the highlands of Tajikistan could be increased considerably by application of nitrogen and ammophos fertilizers.

Activity 4.3: Integration of legumes into cereal cropping systems

The area of rangelands around the village is limited, the plant cover is highly degraded, and yield is low due to overgrazing. A considerable part of forage has to be produced on the irrigated croplands. The farmers in Vakhdat district cultivate vegetables and cereal crops (wheat and rice). They grow alfalfa for hay and maize for grain and fodder. Presently farmers increase the area of forage crops, especially alfalfa, as forages have a good market potential. Furthermore, after continuous cultivation of cereals (in particular wheat) the soil fertility has decreased, and farmers are searching for options to increase soil fertility in the irrigated land. However, the yield of fodder crops on irrigated and rainfed fields is low due to lack of knowledge of best agronomic practices for growing fodder.

Experiment 1

It was assumed that early maturing varieties of food-feed legumes would be more suitable for double cropping after the wheat harvest. However, the comparison of an early and a late maturing variety of mung bean showed little difference in grain yields between the two tested varieties and the two households. The comparison of produced biomass was non-conclusive: in one household the early maturing variety produced more than the late maturing one, while it was the opposite in the other household. However, the experiment clearly showed that households can obtain good grain and fodder yields from planting mung bean as a summer crop.

Experiment 2

In the second Tajik-2 was sown after harvesting wheat at two seeding rates (15 and 20 kg/ha). Planting was done by hand method. Growth characteristics and yields did not differ much between the two seeding rates. Two households were involved to the experiment.

Experiment 3

Alfalfa (Medicago sativa) has been in use for a long time in Central Asia. The crop is mainly cultivated under irrigated conditions in Tajikistan. In the first harvest year alfalfa usually produce low biomass yields as the root system is not yet well developed. Traditionally alfalfa is not fertilized in the first year. In this experiment alfalfa was fertilized in the first year with 40 kg/ha and 60 kg/ha ammophos and compared to a control without fertilizer. The first cut was done on 27 April at the beginning of flowering with a height of 75-80 cm. The plants were cut manually at a height of 5-7 cm from the ground. In total alfalfa was cut 5 times during the vegetation period (spring-summer-autumn), and the overall fresh biomass yield was 22.6 t/ha, 23.5 and 20.7 t/ha in the control, and with 40 and 60 kg/ha ammophos application, respectively; the corresponding dry biomass yields were 5.4, 5.8 and 4.9 t/ha, respectively. Thus, applying 40 kg/ha ammophos proved to increase the biomass yield in the first yield but it is probably not economically feasible.

1.3 Theme 3: Improvement livestock productivity

Kazakhstan

1.3.1 Activity 6: Early lambing for targeting lamb sale during Navruz (March) involving a genotype comparison in household flocks

Location: Ak-Dala village (Arys district)

Objective:
The main objective is to test impact of early lambing on performance of ewes and lambs and on farm economics

Activities and results:
In the households “Abdukarim”, “Andas”, “Ergesh”, and the farm “Kasymbay” Karakul and fat-tailed ewes were divided into two groups: experimental group, in which sheep were mated in August and control (traditional), in which ewes were mated in October 2007 (Table 4). Accordingly the lambing of experimental group occurred in December 2007, and of the control group in March 2008. The framers were also trained on additional feeding of sires during mating and feeding of ewes during gestation.

Table 4. Experimental Design (number of ewes mated/inseminated in 2007)

Households	**Karakul sheep**		**Fat-tailed sheep**	
	early	**traditional**	**early**	**traditional**
Farm “Kasimbay”	43	57	48	52
Household “Abdukarim K.”			17	23
Household “Ergesh”	4	6	8	12
Household “Andas”	9	11	6	4

Lambing rate was in most cases as high in the group with early lambing as in the group traditional lambing; prolificacy was in some cases even higher in the early lambing group (Tables 5-8).
High lamb mortality was observed in the early lambing group of Karakul lambs in households “Andas” (67%) and “Ergesh”(75%). However, both households also experienced relatively high moratlity (67%) in Karakul lambs born in the traditional group. Relatively low mortality was observed among fat-tailed lambs with early lambing in households Kasymbay (25.5%) and Abdukarim (15.8%). There were several reasons for the high mortality of lambs: 1. Severe and prolonged winter, snow from end of November and until March, at the end of winter a lot of rain and still frost, which caused flood and destruction of houses and farm buildings in Akdala. 2. Lack of preparation of households Andas and Ergesh for the severe and prolonged winter (insufficient storage of fodders and lack of shelters). 3. Small number of ewes in the experiment, in household Ergesh 4 lambs only in the early lambing group (Karakul), so each death changes the rate drastically. As a result of the difficult natural conditions and the high mortality occurred the households Andas and Ergesh refused to further participate in the project activities.

Table 5. Prolificacy of ewes and lambs survival rate at farm "Kasymbay"

Parameters	**Early lambing**		**Traditional lambing**	
	Karakul	**Fat-tailed**	**Karakul**	**Fat-tailed**
Ewes inseminated (heads)	43	48	57	52
Ewes lambed (heads)	41	45	57	52
Ewes lambed/mated (%)	95.3	93.7	100	100
Lambs obtained (heads)	45	51	61	57
Lambing rate (%)	109.8	113.3	107.0	109.6
Lambs died (heads, (%))	12 (26.6%)	13 (25.5%)	4 (6.5)	3 (5.3)

Table 6. Prolificacy of fat-tailed ewes and survival rate of their lambs in the household "Abdukarim"

Parameters	Early lambing	Traditional lambing
Ewes inseminated (heads)	17	23
Ewes lambed (heads)	17	23
Ewes lambed/mated (%)	100	100
Lambs obtained (heads)	19	27
Lambing rate (%)	111.8	117.4
Lambs died (heads)	3 (15.8%)	1 (3.7%)

Table 7. Prolificacy of ewes and lambs survival rate in the household "Andas"

Parameters	Early lambing		Traditional lambing	
	Karakul	Fat-tailed	Karakul	Fat-tailed
Ewes inseminated (heads)	9	11	6	4
Ewes lambed (heads)	8	11	6	4
Ewes lambed/mated (%)	88.9	100	100	100
Lambs obtained (heads)	9	10	6	4
Lambing rate (%)	100	90.9	100	100
Lambs died at Navruz, (heads)	6 (66.6%)	-	4 (66.7%)	-
Lambs survived/remained (heads)	3 (33.4%)	-	2 (33.3%)	-
Lambs died at weaning in August (heads)	-	2 (20%)	-	1 (25%)
Lambs survived/remained at weaning (heads)	3 (33.4%)	8 (80%)	2 (33.3%)	3 (75%)

Table 8. Prolificacy of ewes and lambs survival rate in the household "Ergesh"

Parameters	Early lambing		Traditional lambing	
	Karakul	Fat-tailed	Karakul	Fat-tailed
Ewes mated (heads)	4	6	8	12
Ewes lambed (heads)	4	6	8	12
Ewes lambed/mated (%)	100	100	100	100
Lambs obtained (heads)	4	7	9	12
Lambing rate (%)	100.0	116.7	112.5	100.0
Lambs died at 1 February (heads)	3 (75.0%)	-	6 (66.7%)	-
Lambs survived/remained (heads)	1 (25.0%)	-	3 (33.3%)	-
Lambs died at weaning in August (heads)	-	2 (28.6%)	-	3 (25.0%)
Lambs survived/remained at weaning (heads)	-	5 (71.4%)	3 (33.3%)	9 (75.0%)

The dynamics of lambs in the traditional group showed slightly higher liveweights than the live weight with early and traditional lambing from lambing to 2.5 monthly age showed that there are not significant differences in live weight between lambs of early and traditional lambing.

Table 9. The dynamics of live weight of lambs in the early lambing group

Households	Breed	Live weight of lambs, kg					
		3 days	15 days	1 month	1.5 month	2 months	2.5 months
Abdykarim	Fat-tailed	4.1	6.1	12.0	17.6	21.5	35.4
Kasymbay	Karakul	3.5	5.3	8.6	12.6	13.2	19.9
	Fat-tailed	3.9	5.8	10.2	15.8	20.5	32.9
Andas	Karakul	3.6	4.6	6.9	12.7	-	-
	Fat-tailed	4.0	5.7	9.1	14.6	-	-
Ergesh	Karakul	3.2	4.7	8.2	-	-	-
	Fat-tailed	3.6	5.3	9.2	14.4	-	-

Table 10. The dynamics of live weight of lambs in the traditional lambing group

Households	Breed	Live weight of lambs (kg)									
		3 days	15 days	1 month	1.5 months	2 months	2.5 months	3 months	3.5 months	4.0 months	4.5 months
Abdukarim	Fat-tailed	3.6	6.1	13.8	18.6	23.5	36.7	38.7	40.8	42.4	43.7
Kasymbay	Karakul	3.5	5.2	8.7	13.2	15.8	22.4	24.8	26.1	28.2	31.4
	Fat-tailed	3.9	5.7	10.9	16.4	22.7	34.9	36.5	38.8	41.1	42.3

Table 11. Economical comparison of early and traditional lambing

Parameters	Kasymbay				Abdukarim	
	Early		Traditional		Early	Traditional
	Karakul	Fat-tailed	Karakul	Fat-tailed	Fat-tailed	
Expenses for maintaining 1 sheep (Tenge)	2232	2232	2952	2952	3168	4152
Average selling price of 1 lamb at Navruz (Tenge)	2879	5060	-	-	5460	-
Live weight of lambs at Navruz (kg)	19.9	32.9	-	-	35.4	-
Price for 1 kg liveweight (Tenge)	144	153.8	-	-	154.2	-
Income at Navruz (Tenge)	647	2828	-	-	2292	-
Average selling price of 1 lamb in August (Tenge)	5000	10500	3497	8719	-	9678
Live weight of lambs in August (kg)	35.4	47.2	31.4	42.3	-	43.7
Price for 1 kg liveweight (Tenge)	141.2	222.4	111.4	206.1	-	221.4
Income in August (Tenge)	2768	8268	545	5767	-	5526

The comparison of market prices for lambs shows that there was no advantage in selling lambs at Navruz based on price per kg of liveweight; actually the price of fat tailed sheep was higher in August. The early lambing intervention was discussed with farmers in a training workshop. It was clarified that this method can only be successfully applied with appropriate feeding and shelter during he winter lambing. The farm Kasymbay achieved higher income when selling lambs from early lambing in August than from traditional lambing. However, selling early lambed lambs during Navruz was less profitable than selling traditional lambs in August for Kasymbay and for the household Abdukarim. The

farmers see the main advantage from selling at Navruz in obtaining cash income in March, when there are no other sources of income.

The experiment is being repeated in 2008/2009 in Ak-Dala village with Kasymbay and Abdukarim and two new households in Akbulak village, Ordabasin district located 27 km from Shymkent. The number of ewes per household, sheep breed and treatment is between 14-25 ewes (Table 12).

Table 12. Experiment design for 2008/2009 (number of ewes mated/inseminated in 2007)

Participating farms/households	Karakul		Fat-tailed	
	early	traditional	early	traditional
Farm Kasymbay	20	25	20	25
Household Abdukarim	-	-	15	20
Household Bahytjan	-	-	15	17
Household Abish	-	-	14	15

1.3.2 Activity 7: Early weaning and fattening (Nagul) of lambs for lamb marketing and milking of early weaned ewes for value addition in household flocks

Location**:** Ak-Dala village (Arys district)

Objectives:
The main objective is to test impact of early weaning on performance of lambs and milk production of ewes as well as the effect on the farmers' income.

Activities and results:
The ewes on the farms Kasymbay and Abdukarim were inseminated artificially (Table 13). To increase the conception rate artificial insemination was done during two cycles. After completion of the second cycle rams were admitted for 20 days to the ewes to cover ewes that had not conceived through AI. In the experimental group weaning was done 75 days after lambing and in the traditional groups at 4 month age.

Table 13. Experimental Design (number of ewes inseminated in October 2007)

Households	Karakul sheep		Fat-tailed sheep	
	early	traditional	early	traditional
Kasymbay	50	63	54	50
Abdukarim	-	-	24	20

All ewes in both groups lambed. While a higher mortality of both Karakul and fat-tailed lambs was observed for early weaning than for the traditional system in the farm Kasimbay, early weaned lambs showed a lower mortality in the household Abdukarim (Table 14).

Table 14. Prolificacy of ewes and lambs' survival rate at the farm Kasymbay and in the household Abdukarim

Parameters	Farm Kasimbay				Household Abdukarim	
	Karakul		Fat-tailed		Fat-tailed	
	early	traditional	early	traditional	early	traditional
Ewes inseminated	50	63	54	50	21	23
Ewes lambed	50	63	54	50	21	23
Conception rate (%)	100	100	100	100	100	100
Lambs obtained	50	63	54	50	21	23

Lambs died (heads)	9 (18.0%)	6 (10.5%)	10 (18.5%)	2 (4.0%)	2 (9.5%)	3 (13.0%)
Lambs remained for experiments	41	57	44	48	19	20

The daily ration of ewes consisted of 2.5 kg hay, 0.25 kg chopped barley and 0.25 kg chopped corn; the ewes were fed twice per day.
At weaning (75 days after lambing) the ewes in the early weaned group were around 2-3 kg heavier than the ewes in the traditional group (Table 15). The highest difference between the groups was observed five months after lambing, thereafter the difference decreased to 0.5-1.3 kg seven months after lambing.

Table 15. Dynamics of liveweights of ewes

Liveweights	**Farm Kasimbay**				**Household Abdukarim**	
	Karakul		**Fat-tailed**		**Fat-tailed**	
	Early	**traditional**	**Early**	**traditional**	**Early**	**traditional**
At lambing	35.7	35.6	41.6	40.7	43.8	43.3
30 days	40.1	40.5	44.2	44.3	50.0	49.8
60 days	45.4	44.7	49.4	47.2	52.3	52.0
75 days	50.1	47.1	52.0	49.8	55.8	53.7
90 days	52.7	50.1	53.4	51.1	58.3	55.3
120 days	54.3	51.0	56.2	54.1	64.5	58.7
150 days	57.6	53.4	59.5	57.3	67.4	60.6
180 days	58.5	57.7	63.6	61.5	68.3	64.5
210 days	60.0	59.5	63.8	62.5	67.8	66.2

The liveweight of the lambs in the early weaned groups was smaller at early weaning (45 days) than in the traditional group and this was still the case at weaning of the traditional group (4 months). When the lambs were sold with seven months the early weaned lambs were slightly heavier (Table 16). The fat-tailed lambs were more than 10 kg heavier than the Karakul lambs. The price per lamb differed only slightly between the early and traditionally weaned lambs.

Table 16. Dynamics of liveweights of lambs

Liveweights	**Kasimbay**				**Abdukarim**	
	Karakul		**Fat-tailed**		**Fat-tailed**	
	Early	Traditional	Early	Traditional	Early	Traditional
At lambing	4.0	4.0	4.0	4.0	4.2	4.1
30 days	10.1	10.1	10.2	10.3	12.9	13.0
60 days	14.1	16.0	16.7	22.8	22.4	22.5
75 days	15.7	16.6	18.0	23.9	24.7	24.8
90 days	17.3	18.9	19.4	25.7	25.1	27.8
120 days	20.4	21.7	23.0	28.8	28.7	31.3
150 days	27.3	28.6	34.4	37.8	35.7	38.6
180 days	33.9	34.2	41.5	45.0	43.7	46.6
210 days	37.9	35.9	47.5	45.8	49.9	47.7

Milk production was only measured in the farm Kasymbay and only with 10 ewes per breed and group. During two months daily milk yield was measured every five days once per day in Karakul and fat-tailed ewes in the early and traditional weaning groups (Table 17). The average milk yield for the two month period ranged from 400 to 590 g per day and was higher in the early weaned ewes; fat tailed ewes gave on average 60 g more milk per day than Karakul ewes.

Table 17. Karakul and fat-tailed ewes' milk productivity be periods of lactation, gram/day Dynamics of liveweights of lambs

Sampling date	**Milk production (g per day)**			
	Karakul		**Fat-tailed**	
	Traditional	Early	Traditional	Early
07/05/2008	525	630	585	675
11/05/2008	508	624	564	653
16/05/2008	483	601	560	650
22/05/2008	435	586	551	642
27/05/2008	428	548	546	623
02/06/2008	412	523	524	604
07/06/2008	406	516	513	588
12/06/2008	375	498	456	561
17/06/2008	358	475	402	524
23/06/2008	320	456	344	497
08/07/2008	122	423	133	456

1.3.3 Activity 8: Community-based household cow and sheep milk processing improvement and sausage making for value addition and income increasing.

Location: Ak-Dala village (Arys district)

Activities and results:
Following tasks were conducted during 2008:

- further improvements of technologies for production of chechil, homemade cheese, brynza and homemade sausage;
- preparing of chechil and training of farmers (January);
- preparing of rennet and training of farmers (March, April);
- preparing of homemade cheese and training of farmers (May, June);
- preparing of kurut with cherry and training of farmers (July, August);
- preparing homemade sausage and training of farmers (September, October);
- preparing of brynza and training of farmers (November, December)

Processing methods for milk products that are demanded on the market were developed and applied in the household Elan (G. Kuleeva) and at Kasimbay farm. In the training chechil preparation technology on 17 January 2008 25 households from Akdala village and A. Ombaev, B. Narbota, E. Kunanbaeva, and A. Saniyazova from the South West Research Institute participated. During the training some of the householders learnt of the. About 15 households decided to process milk in the future and 4 of them are already producing chechil.
As differences in composition of cow's milk may require changes in the preparation or cause differences in the flavor of milk products, the composition of cow's milk was analyzed four times during the year at the times when feeding and climate change most drastically. Protein content in the milk produced in autumn exceeded spring and summer milk by 0.15 and 0.23%; fat percent was also highest in autumn (Table 18).

Table 18. Seasonal composition of cow's milk

	Chemical composition of cow's milk (%)				
	Winter	Spring	Summer	Autumn	Average
Protein	3.05	3.00	2.92	3.15	3.03
Fat	3.65	3.63	3.65	3.78	3.68
Total solids	11.70	11.81	11.90	11.94	11.84

Kyrgyzstan

1.3.4 Activity 9: Improvement of livestock management for improved productivity: integrating management of lambing period, animal health, feeding system, lamb management

Location: Kemin district – Alimseyit farm and 10 households in Akbeket village

Objectives:
The main objective is to improve farmers' and households' knowledge of livestock management in small and medium scale farms through implementation of improved husbandry practices.

Activities:
Improved husbandry practices were implemented in the medium scale farm "Alimseyit" (Kemin district) and in 10 households located in the "Akbeket" village of Kemin district.
The improved husbandry practices include:

- Optimum grazing on the pastures around the village with additional feeding in late autumn, winter and early spring periods;
- Supplemental feeding in winter;
- preparation sheds for animals (mechanical cleaning, disinfection);
- Monitoring of sheep lambing;
- Monitoring of growth and development of lambs;
- periodical observation and examination of animals,
- Training of farmers and households for diagnoses and prophylactics of sheep diseases
    - vaccination of sheep against clostridiosis
    - Trenching (anthelminthics) against intestinal parasites;
    - bathing against itching.

The training was conducted jointly for the farm Alymseyit, the households from Akbeket, Kenesh farm and the households Progress community. The training theme was "Veterinary and sanitary measures for improving health and growth of lambs, including preventive measures against brucellosis". The workshop participants were informed about feeding during gestation and lactation and requirements for sheds for adult and young animals. They were trained in methods of disease treatment, and in preventive measures against infectious diseases with special attention to brucellosis. Training materials were distributed to the farmers and households.

The winter 2007/2008 was exceptionally cold with relatively little snow (compared to the last 40 years). In Bishkek during 2 months temperatures remained at about -30°C. In addition the summer 2008 was very dry, posing extra challenges to the workplans.

Results in Akbeket community:
The 10 households Akbeket applying the improved management scheme were encouraged to collaborate more closely, in particular in the joint use of the remote pastures in summer, and in marketing. In autumn and winter 2007 the sheep were grazed on pastures around village and fed twice a day by a mixture of hay and straw. During the lambing period sheep were fed with concentrates following the recommendations of the scientists. A subgroup of five out of the 10 households is also participating in the improved breeding scheme (see below). In 2007/2008 data have been collected from the 10 "improved" flocks and from 2 "traditional" flocks to assess the effect of improved management on flock productivity. In order to enable a more reliable comparison the number of traditional farmers in Akbeket village was increased to five farmers in autumn 2008, namely T. Duysheev with 27 ewes, T. Moldaliev with 10 ewes, T. Ibraimov with 32 ewes, M. Jumabekov with

12 ewes, and K. Aydaraliev with 20 ewes. The data collection and analysis is ongoing and the results will be presented in the final report. To provide conclusive results will not be easy as intensity of data collection and the level of adopting recommended practices differ between the three groups of households ("improved management and breeding", "improved management" and "traditional management").

Preliminary results from improved management at Alimseyit farm and from comparing fine-wool and coarse wool sheep production:

To improve the wool quality in fine wool sheep, 8 Orgochor sires were bought in 2007 and a selection scheme implemented for ewes that started with culling non-qualifying ewes in 2007.

The fine and coarse wool sheep of Alymseyit farm were kept separately on the Jelargy winter pasture in 2007/2008. During late gestation and lambing the ewes received the feed ration shown in Table 19. Coarse and fine wool lambs born in 2008 were treated against intestinal helminths by albendazolum, the adult sheep were bathed against mange in spring and all flocks were sent off to the distant summer pastures. Because of the drought it was decided to conduct the mating season in 2008 one month earlier: the coarse wool sheep were mated in September and the fine wool sheep in October.

Table 19. Daily feed rations for ewes at Alimseyit

Name	**Amount per head (kg)**	**Starch Units**	**Digestible protein (g)**	**Calcium (mg)**	**Phosphorous (mg)**	**Carotene (mg)**
Recommended	-	1.25	120	-	-	-
Alfalfa hay	0.5	0.24	42.5	6.2	0.7	25
Mountain hay	0.5	0.25	25.0	3.6	0.5	20
Straw	0.5	0.15	5.0	1.5	0.3	2
Barley	0.3	0.36	28.5	0.3	1.0	-
Total	1.8	1.00	101	-	-	-

At lambing in spring 2008 there were 150 coarse wool ewes and 216 fine-wool ewes of different ages (from 2 to 7 years old, Tables 20 and 21). Lambing of coarse wool sheep began on 16 February and ended on 20 March 2008; lambing of fine wool sheep began on 5 April and ended on 2 May 2008. Out of 135 born, six coarse wool lambs died: 2 because of the bezoar disease, and 4 because of carelessness. Out of 226 lambs born, 19 fine wool lambs died: 7 heads because of the bezoar disease, 2 from white-muscle disease and 10 because of carelessness.

Table 20. Liveweight and mortality of ewes at mating in 2007 and lambing in 2008

Breed	**No of ewes at start of mating**	**Average liveweight in autumn**	**No of ewes at the start of lambing**	**Average liveweight after lambing**	**Ewes died**	
					Heads	%
Coarse wool sheep	160	47.1	150	40.6	10	6.25
Fine wool	230	42.7	216	38.4	14	6.08

Table 21. Reproductive parameters of the fine and coarse wool flocks in the lambing season 2008

Breed	**Ewes aborted**		**Barren ewes**		**Twins**		**Lambs survived**	
	heads	%	heads	%	heads	%	heads	%
Coarse wool sheep	7	4.7	14	9.4	10	6.7	129	86.3
Fine wool	7	3.2	13	6.0	20	9.3	207	96.0

The comparison of wool quantity and quality in 2007 and 2008 shows an improvement in quantity but not in quality (Table 22).

Table 22. Quantity and quality of fine wool (averages from 2007 and 2008) in Alimseiyt farm

Year	% output	Fineness of wool (µm)	Natural length of wool (cm)	Average wool yield (kg)	Wool produced (kg)
2007	53.31	21.59	7.70	3.01	875
2008	54.61	21.82	7.80	3.30	1098

There is also an indication of improved lamb liveweights in the fine wool sheep from 2007 to 2008, while there is nearly no difference in liveweights of the coarse wool lambs between the two years (Table 23).

Table 23. Average liveweights of lambs in 2007 and 2008

Years	Breed	At lambing (kg)	At 15 days age (kg)	At weaning (kg)
2007	Fine wool	3.0	5.9	28.5
2008		3.5	6.6	29.2
Difference		**0.5**	**0.7**	**0.7**
2007	Coarse wool	4.2	7.4	31.5
2008		4.3	7.5	31.7
Difference		**0.1**	**0.1**	**0.2**

While coarse wool was sold for 5 Som per kg in both years, the price of fine wool doubled from 40 som per kg in 2007 to 80 Som in 2008. The increase in quantity per head and the high price increase led to a much higher income from fine wool in 2008 compared to 2007 (Table 24).

Table 24. Wool yields and income obtained in 2007 and 2008

Breed	Group	Wool yield			
		2007		2008	
		kg/head	Total, kg	kg/head	Total, kg
Fine wool	Sires	4.74	38	6.08	48
	Ewes	2.96	473	3.51	758
	Young females	2.68	187	2.12	154
	Castrates	3.40	177	3.85	138
Average		3.01	-	3.30	-
Total		-	875	-	1098
Total (Krg som)		**-**	**35000**	**-**	**87840**
Coarse wool	Sires	1.92	25	2.19	13
	Ewes	1.54	140	2.20	330
	Young females	1.19	70	1.30	45
	Castrates	1.67	61	1.75	50
Average		1.35	-	1.99	-
Total		-	296	-	438
Total (Krg som)		**-**	**1480**	**-**	**2190**

In order to ensure a full comparison between fine wool and coarse wool sheep, the income from lambs has to be assessed.

1.3.5 Activity 10: Production diversification: Improvement of milk productivity in sheep breeding

Location: Chuy district – Kenesh farm and household in Progress village

All activities related to breeding are being supervised by Joaquin Mueller from INTA, who visited Kyrgyzstan and Khojand from 25 October to 16 November 2008 and prepare a detailed report on activities 10, 11 and 15 that was shared with IFAD in March 2009).

Activities in Kenesh farm and in Progress village:
Table 25 gives an overview of the planned and conducted activities (please compare detailed report from Mueller).

Table 25. Overview on planned and performed activities (composed by Mueller, 2008)

Date	Planned Activity	Performed Activity
Oct 2007	New Awassi rams from Kazakhstan are introduced into the nucleus.	Two new Awassi rams were bought.
Oct 2007	Participants in Progress village agree on Awassi rams to be used in their flocks.	Four farmers agreed on the use of one old purebred Awassi ram of the nucleus.
Oct 2007	Participants select appropriate ewes for mating with Awassi rams.	Farmers selected appropriate ewes for mating.
Nov 2007	Mating in nucleus and participating flocks	Mating started 15November
Apr 2008	Lambing. F1 Awassi lambs are identified and ear tagged.	Progeny in nucleus flock and Awassi progeny in farmer flocks were identified and ear tagged.
May 2008	Milking starts in the nucleus.	Milking in the nucleus started June 15 and milk recording was performed every 10 days on 10 Awassi graded ewes and 10 control (F1) ewes.
May 2008	An initial training in milk processing is planned at this time to be held in Tokmok (Muhi El Dine, from ICARDA, in following already standard plans in this regard)	Training was done at the nucleus farm on June 14 2008 using regional expertise.
Oct 2008	A new cycle of mating with Awassi rams takes place with further ewes included in the plan by participants	A new cycle of mating with Awassi rams started on October 1 with the 2 new rams in the nucleus and 3 high Awassi graded rams from the nucleus in the flocks of the farmers.

Results from the farm Kenesh:
In the mating season 2007 33 crossbred (50% Awassi x LCW) ewes were mated with Awassi sires at farm Kenesh for obtaining 75% Awassi x LCW lambs. In spring 2008 23 lambs were born (Table 24) 26 local coarse wool ewes were mated with the same Awassi sires and 20 lambs (50% Awassi x LCW) were born. No difference in liveweights between 50% and 75% Awassi lambs were observed (Table 26).

Table 26. Liveweights of Awassi crossbred lambs born in 2008

Genotype	Sex	n	Live weight, kg	
			At lambing	At 1 month
50% Awassi	female	9	3.8 ± 0.04	9.9 ± 0.06
	male	11	4.1 ± 0.03	10.3 ± 0.10
75% Awassi	female	12	3.7 ± 0.04	9.8 ± 0.09
	male	11	4.0 ± 0.02	10.2 ± 0.11

Results in Progress village:
Four households in Progress village (Chuy region) started using Awassi rams in the mating season 2007 with support from Kenesh farm (Nurjan Abdymajitov). In total the four participating households obtained 55 crossbred (50 % Awassi x LCWI) lambs, of which 29 were female and 26 male (Table 27). The liveweights of the crossbred lambs in the households were slightly lower tan at Kenesh farm.

Table 27. Liveweights of F1 crossbred lambs in four households in Progress village,

Name of household	Sex	n	Live weight (kg)	
			At lambing	At 1 month
B.Ashirov	Female	6	3.3	9.3
	Male	4	3.6	9.6
T.Esenaliev	Female	7	3.2	9.2
	Male	8	3.6	9.6
A.Tashbolotov	Female	8	3.2	9.2
	Male	7	3.5	9.5
A.Esenaliev	Female	8	3.2	9.2
	Male	7	3.6	9.6

Mating season 2008:
The activities to be conducted during the breeding season 2008/2009 were jointly planned with the framers and scientists during the visit of Joaquin Mueller in November 2008.
At Kenesh farm mating of 80 ewes was conducted from 1-31 October 2008. The two sires (no. 1058, 1983) bought in Kazakhstan in 2007 were used for mating. The new breeding cycle in Progress community also started in October 2008 with mating ewes in the four flocks with crossbred Awassi sires from Kenesh farm (Table 28).

Table 28: Mating in Progress village in October 2008

Household	Ewes mated	Rams used*
Altynbek Esenaliev	15	Crossbred
Azimjan Tashbolotov	15	Crossbred
Bakhtiyar Ashirov	10	Crossbred
Tolobek Esenaliev	15	Crossbred

*Awassi crossbred rams from Kenesh farm (ear tags: 6299p, 6289p, 6234p).

1.3.6 Activity 11: Set the basis for a decentralized and participatory breeding plan for farmers to access improved animals

Location: Kemin district – households in “Akbeket" village

Activities and results:
The design and implementation of a breeding plan for a group of farmers in Akbeket with the aim to increase sheep meat production started in October 2007. Originally all 10 households participating in Activity 9 were interested in the breeding scheme. But after farmers considered the risks involved by using a new breed and realizing the work involved, some declined to participate and others were excluded due to insufficient quality of their ewes. There are now 5 farmers actively involved in the breeding plan (Table 29).

Table 29. Mating in November 2007 in Akbeket village

Farmer	Ewes mated (numbers by April 2008)	Id of ram used
Aman Omonov	18	4131
Erkin Toktogonov	21	4124
Joldosh Mambetaliev	6	6726
Keldibek Toktogonov	23	4144
Shaken Rysbekov	19	6726
Total	**87**	

Table 30 shows the working plan originally agreed on and the corresponding performed activities during the first year of implementation 2007/2008.

Table 30: Planned and performed activities in Akbeket breeding scheme (composed by Mueller in November 2008)

Date	Planned Activity	Performed Activity
Oct 2007	*Sire selection:* Participants travel to Aikol and select foundation sires. Note: if there is a good sire in the community he could be used together with the Aikol sires allowing a comparison of the progeny from local and Aikol genotypes.	Two participants (Shaken Rysbekov and veterinarian Joldosh Mambetaliev) traveled with scientists to the Aikol farm in the Tonsk district and selected 4 foundation rams.
Oct 2007	*Ewe classing:* Upon return of ewes from summer grazing good ewes are identified and ear-tagged. Inferior ewes are culled if replacements are sufficient. Ewe classing will be based on criteria discussed between participants and technical team (an example of such criteria is given in Table 1 of an attached Excel spreadsheet).	A total of 87 ewes of 5 households were selected visually and on body weight for mating the Aikol rams. Some details of the classing were recorded. See Akbeket 2008 spreadsheet.
Nov 2007	*Mating:* All ewes are pen-mated to Aikol sires giving priority to best ewes. Sire-ewe mates and corresponding mating dates are recorded (Table 2) to enable pedigree recording of progeny.	Mating started 17 November in individual household groups. There were 4 mating groups since the ewes of Joldosh Mambetaliev joined the ewes of Shaken Rysbekov for mating. The recording of mating dates was conducted by one of the farmers, Joldosh Mambetaliev, with visits by Kuban Abdykerimov to the farms.
Apr 2008	*Lambing:* Birth date, birth type and birth weight is recorded and lambs are ear-tagged (Table 3).	Done. See Akbeket 2008 spreadsheet.
May 2008	*Marking:* At marking all lambs are weighed (Table 4) and weights are analyzed (Table 5). About 20 male lambs with high growth rate born from superior ewes are not castrated and are candidates for future sire replacement. Decisions are made here on the basis of the data results.	All lambs were weighted at about one month of age. All lambs were retained. Inferior males will be castrated later.
May 2008	All animals go to summer pastures.	Done.
Aug 2008	*Weaning:* Weaning takes place in summer pastures. Weaning weights of ear-tagged lambs are taken (Table 4).	Effective separation of lambs from dams is not possible on summer pastures and lambs progressively wean naturally. Weaning weights were not taken.
Oct 2008	All animals return from summer pastures and ear-tagged lambs are weighed (Table 4).	All animals returned from summer pastures earlier than planned, on September 10, due to the intense drought. On September 28 all lambs were weighted.
Oct 2008	Weights are analyzed and about 10 male lambs are selected on growth rate and visual quality for final performance testing (as in Table 5).	All lambs were kept.
Oct 2008	*Performance testing:* Selected male lambs are managed together during the winter in a single flock (will get their final weight in May 2009).	Lambs were managed in respective households.
Oct 2008	*Ewe selection:* Select young replacement females and re-class adult ewes (Table 1	All young females were retained due to the small number available and the intention to

Date	Planned Activity	Performed Activity
	and 6). Put ear-tags on new ewes (using new numbers). Young replacement females will be selected and adult ewes will be reclassified. The first 2 years this will be done on the basis of the ewes' own performance.	increase flock sizes.
Oct 2008	*Sire selection:* After one year, the adaptation of Aikol rams to the Akbeket production condition and the performance of their progeny can be assessed. Results of this assessment may indicate the necessity of the replacement of one or both sires (Table 7).	One ram died and another got lame. These two rams were replaced with two new rams (Numbers: 5890 and 5894). All rams performed very well in terms of quality of the progeny produced.

As can be seen in Table 30 the work done in the first year of implementation has been in acceptable correspondence to the original plan. Specific changes are being discussed in detail in Mueller's report. From the 87 ewes mated in November 2007 82 lambs were obtained (Table 31) that were ear-tagged and weighed at lambing and in monthly intervals till 6 month of age. Data are being analyzed and will be fully reported in the final technical report.

Table 31. Average liveweight (kg) of lambs obtained from Aikol rams

Sex	n	At lambing	At 1 month
Female	49	3.3 ± 0.02	9.3 ± 0.02
Male	33	3.5 ± 0.02	9.6 ± 0.03

The Akbeket plan has started well, despite the very cold winter 2007/2008 and the very dry summer 2008. The second mating season for the ewes kept by the five Akbeket community members was conducted from 1-30 October 2008. 81 of ewes were mated with 4 sires (5890, 5902, 5894 and 5901).

1.3.7 Activity 12: Community-based household cow and sheep milk processing improvement for value addition and income increasing

Location**:** Kemin district – Alimseyit" farm and households in "Akbeket" village

Models of mini dairy plants for processing of 1000 and 2000 kg milk daily made in the Russian Federation were discussed with farmers. However, the price of these mini-plants is quite high and not affordable for the farmers.
Since the initiation of the project this activity has not will not be continued in 2009.

Tajikistan, Sogd province, Khujand site

1.3.8 Activity 13: Improvement of goat breeding in households for improved productivity (flock structure, feeding, selection/culling and animal health)

Location: Sogd province – villages Koradjingil, Takli, Uyas

Objective:
The main objective is to test a number of low-cost husbandry practices to improve flock productivity and farmers' incomes.

Activities and results:
Table 32 gives an overview of the husbandry practices that were implemented in the "improved" flocks compared to the common practice in the "traditional" flocks. Originally 13 traditional flocks were selected, but data collection became very demanding. Thus the number was reduced to only 7 control flocks (see Table 34) with good information (about the same number as "improved" flocks).

Table 32. Comparison between improved and traditional farmers

Experimental group:	**Traditional (control) group:**
Recording of changes in the flocks according to age and sex groups introduced (Flock rotation form)	No records taken
Optimization of flock structure	Optimization of flock structure not done
Recording of flock productivity - Number of kids born and their weighs (at kidding, 1, 2, 6 month age); - kids survival rate till weaning; - Sheared fiber yield	Recording of flock productivity: some owners record total sheared fiber yields
Individual record keeping for nucleus animals and tattooing	Animal identification and Individual record keeping not common, was only used in state farms
Evaluation of fiber quality in spring	Evaluation of fiber quality not done
Evaluation and classification of all animals in the flocks and determining their purpose in autumn (pedigree, production and culling)	Classifying and culling animals is not done in a systematic way
Strategic and balanced feeding (taking into account requirements and available feeds)	Additional feeding in the winter period is only done in very harsh weather conditions without taking into account physiological condition of the animals
Well planned veterinary intervention with regard to prevention of infectious diseases and parasites	Veterinary treatments are only conducted in case of disease

Implementing of recording of flock changes
For this purpose a simple recording format was developed and distributed in a booklet to the participating farmers. The main aim is to train farmers in recording and assessing their flock structure as a first step towards optimizing the structure with regard to increasing the proportion of productive animals. The flock structure in the experimental group has already improved in comparison with the traditional group (Table 33). In the flocks of the improved group on average one buck is being used for 26 does. In most flocks of the traditional group there is a surplus of bucks with an average relation of does to bucks of 7.3 to 1 meaning that the number of bucks is about 4 times higher than required (Table 34). The exception is one farmer that does not keep any buck. Thus, the proportion of does in the flock has increased by 6.8% and the share of bucks decreased by 3.5% compared to the traditional group.

Table 33. Flock structure in the improved group

#	**Farmer's name**	**Total**	**Reproductive part**			
			does		bucks	
		heads	heads	%	heads	%
1	Turgunboy Madaliev	146	90	61.6	4	2.7
2	Rahmon Askarov	121	52	42.9	2	1.6
3	Abdunazar Matazimov	314	120	38.2	3	1.0
4	Sherali Tilloev	94	50	53.1	2	2.1
5	Sulaymon Umarov	146	53	36.3	3	2.1
	Total	**821**	**365**	**44.5**	**14**	**1.7**

Table 34. Flock structure in the traditional group

#	Farmer's name	Total	Reproductive animals			
			does		bucks	
		heads	heads	%	heads	%
1	Abduvohid Mamtkulov	132	48	36.4	8	6.0
2	Abdurahmon Hayitmatov	42	19	45.2	3	7.1
3	Abdumalik Khanaev	70	23	32.8	4	5.7
4	Komil Mamatkulov	32	15	46.9	1	3.1
5	Ravshan Dushaboev	64	23	35.9	0	0
6	Abduvahob Uskanov	53	19	35.8	5	9.4
7	Boir Parpiev	41	17	41.4	2	4.8
	Total	**434**	**164**	**37.7**	**23**	**5.2**

Measuring productivity and classifying individual animals

The criteria developed for classifying individual ewes were explained in the last progress report. Special attention was given to the selection of replacement animals with a good size (at the age of 1.5 and 2.5 years). The best goats were tattooed with individual numbers and designated for the nucleus flock (activity 15). Animals to be culled were designated for selling and/or fattening for slaughter.

A booklet entitled "Individual classification of does and bucks (fiber length, fineness, density, sheared fiber yield, animal's age and size)" was translated into local language and distributed to each farmer of the improved group.

In spring 2008 individual classification of animals was conducted in the improved flock and the results compared with the traditional flock (Table 35). The table shows that the animals in the two groups differ in the evaluated characteristics. Liveweight of bucks in the improved group was by 11.7% higher than in the control group. For does this difference was 6.4%. Fiber length of the animals in the improved group was greater than for animals of the same age in the control group. Fiber fineness of the goats of control group was less uniform than in the improved group. The highest fiber yield per head (2.95 kg) was obtained from bucks in the improved group, which exceeded the yield in the control group by 40.5%. Average sheared fiber yield from does in the improved group was 1.55 kg and 17.4% higher than in control group. The superiority of the improved group over the control can be possibly explained through the introduction of selection strategies and additional feeding (concentrates and mineral) but the flocks might have already differed at the start of the project.

Table 35. Results from individual classification of the adult goats

Groups	Sex	Obtained progeny head (%)	No of lambs at 6 month (%)	Animals' evaluation				
				Live weight (autumn)	Natural fiber length (cm)	Fine-ness (Bradf.)	Fiber yield, kg	
							total	per head
Experimental	Bucks	-	-	52.2	21.5	48-46	71	2.95
	Does	284 (72)	272 (96)	29.8	18.2	56-48	820	1.55
Control (traditional)	Bucks	-	-	44.5	19.0	56-48	65	2.10
	Does	90 (55)	81(90)	28.1	17.5	58-48	363	1.32
Difference (exp - control)	Bucks	-	-	+7.7	+2.5	-	+5.8	+0.85
	Does	194 (17)	191 (6)	+1.7	+0.7	-	+457	+0.23

Improved feeding with taking into account goats' requirements and local availability of feeds

The last winter was the longest and coldest for the last 40 years. Animals could not to graze on pastures. The project supported additional feeding of pregnant and lactating does in the six improved farms with oat grains (100 g per day to each animal for one month).
The project also proposed supplementation with minerals from local sources, namely bentonite clays. Basic components of bentonite clays are silicon (19.6%), aluminum (5.4%), calcium (10.4%), magnesium (3.0%), gland (1.2%) and phosphorus (0.5%), and others in the range from 0.001 to 0.1%. The mineral supplement is offered in the form of briquettes, composed of bentonite, bone flour, chalk, copper sulfate, iodide potassium, and common salt.

Disease prevention program

In the improved flocks all preventive measures were done as planned in the reporting period. The brochure “Brief Farmer’s Handbook” was developed and distributed. This handbook describes the main goat diseases in the region and prophylaxis and treatment. The book includes a calendar showing the disease prevention measures to be taken in the different seasons of the year.

1.3.9 Activity 14: Improvement of shearing and classification of fiber, standardization, based on the international standards, by quality, impurity and age

Location: Sogd province : villages Koradjingil, Takli, Uyas

Objective:
The objective of this activity is to improve market prices achieved for Mohair fiber through assortment during shearing into different quality classes at least by age and sex, and to develop a new standard for Tajik mohair.

Activities and Results:
The following activities were conducted:
- collection of samples for laboratory analysis in Almaty and at INTA;
- conducting of training with farmers and scientists on international qualities standards;
- developing recommendations on requirement of mohair quality for breeding of Tajik mohair goat breed;
- developing draft of new standard for mohair with taking into account international norms.

Collection of fiber samples for laboratory analysis
In spring 2008, 740 fiber samples were collected and split into two parts for testing in Almaty (Kazakhstan) and to draw a random subsample to be tested in the INTA laboratory in Argentina. The samples were collected from different age and sex groups of animals (Tables 36 and 37).

Table 36. Number of samples that were analyzed in Almaty lab

	2007			**2008**			
	Total	White	Colored	**Total**	White	Colored	Autumn
Number	**68**	59	9	**740**	509	162	69

Table 37. Number and characteristics of samples collected in 2008

Age and sex groups		White		Colored		Autumn shearing	Total number
		Number	Sample no	Number	Sample no.	Number	Number
Young animals, 6 month (super kid)		26	801-872	14	873-886	40	40
Adult (2-6 year)			887-915			29	29
Young animals, 1 year	♀	86	001-099	61	C001-C061	-	147
	♂	41	101-161	15	C101-C115	-	56
Female, 2 year	♀	78	201-293	25	C201-C225	-	103
	♂	93	301-393	13	C303-C315	-	106
Adult 3-5 year	♀	64	401-(499-13)	18	C401-C418	-	82
	♂	80	501-(599-22)	25	C501-C525	-	105
Old, 6 year and more	♀♂	67	601-667	5	C601-C605	-	72
Total		**509**		**162**		**69**	**740**

The results from the laboratory analysis in Almaty show that fiber fineness is clearly decreasing with age in both white and colored goats, while fiber length does not show a homogenous trend in relation to age (Tables 37 and 38). Colored goats have slightly shorter fibers than white ones. The fiber from males is coarser than from females. These results indicate that grading by age and sex can be useful to achieve higher market prices for Angora fiber by dividing to classes conducted fiber investigations in Almaty lab.

Table 38. Results of fiber analysis from white Angora goat by age and sex (Almaty lab)

Age group	Sex	Fineness (µm)	SD (%)	CV (%)	CF – comfort factor (%)	Average crimp	Average length (mm)
Yearling	♀	26.4	7.48	28.4	73.3	15.97	186.3
	♂	26.2	7.43	28.2	73.7	14.87	180.8
Female, 2 year	♀	27.8	7.90	28.3	66.1	16.25	199.9
	♂	35.8	9.50	26.6	28.3	12.10	165.0
Adult, 3-5 year	♀	31.0	10.2	32.8	53.6	14.48	195.1
	♂	38.8	11.65	30.1	25.2	14.40	213.0
Old, 6 years and more	♂,♀	42.1	12.50	33.1	-	-	192.5

Table 39. Results of fiber analysis from colored Angora goat by age and sex (Almaty lab)

Age group	Sex	Fineness (µm)	SD (%)	CV (%)	CF – comfort factor (%)	Average crimp	Average length, (mm)
Yearling	♀	21.8	6.40	29.5	93.2	23.7	110.0
	♂	26.8	8.90	33.0	69.0	19.7	183.0
Female, 2 year	♀	29.7	8.62	29.1	56.6	15.4	165.5
	♂	30.6	8.90	29.0	56.9	14.4	157.0
Adult, 3-5 year	♀	30.2	9.57	31.6	53.8	16.1	182.0
	♂	34.5	11.40	32.9	37.2	17.1	190.4
Old, 6 years and more	♂,♀	39.4	12.59	32.1	26.8	14.8	174.1

Conducting of training with farmers and scientists on classing fiber by age and sex.
A training was conducted on 3 May 2008 in Uyas village:
Trainer: M. Kosimov, Assistants: R. Mamatkulov, F. Kosimov.
Participants: Abduvokhid Mamatkulov, Sulaymon Umarov, Abdufattokh Khonaev, Sherali Tilloev, Turgunboy Madaliev, Mardonkul Imomkulov, Hudoiberdi Kholmirzoev, Abdumalik Khanaev, Komil Mamatkulov, Ravshan Dushaboev, Boir Parpiev
The training consisted of a theoretical and practical part. The theoretical part included:

- Importance of fiber fineness of Angora mohair.
- Relation of fiber fineness with age and sex of goat
- Other factors affecting fiber's fineness (feeding, maintenance and individual features).

The practical part included demonstration and presentation of fleeces, and examples of fibers from different age and sex groups (at house A. Mamatkulov).

Developing a new standard for mohair taking into account international norms
The current classification system of Mohair in Tajikistan does not meet international market requirements in particular for fiber fineness. The results from the laboratory analysis of the fiber will help to develop a new standard in line with international standards.

1.3.10 Activity 15: Set the basis for a decentralized and participatory breeding plan for farmers to access improved animals

Location: Sogd province, Karajingil, Takli and Uyas villages

Objective**:**
The goal of the activities is to create a decentralized community based breeding scheme to facilitate access of farmers to improved animals.

Activities and Results:
The followings activities were undertaken to reach this goal:

- Formation of breeding flocks with the best goats in the target and neighboring villages
- Development of breeding plans with the communities informed by market assessments
- Implementation and Farmers' training on selection schemes and establishment of simple recording systems

Participants in the breeding programs
At the planning stage in September 2007, eight farmers were identified as willing to participate in the development of an Angora breeding plan. However in the process of discussing details of the work, two farmers finally refused to participate. These farmers were replaced with two new farmers. In addition another farmer may be included in 2008. From the five active farmers two may not continue since they are facing different kinds of problems. It looks as if the final number of participants will be 5 or 6, which given the farm access difficulties and distances, is a reasonable number to work with. Table 40 summarizes the list of farmers with their present involvement in the breeding plan.

Table 40: List of farmers and present involvement in breeding plan

Farmer	**Details**
Abdufattoh Khonaev	Abandoned. First he was afraid of animal identification, and in autumn 2008 he decided to sell his animals.
Abdumalik Khoji	Abandoned early
Abdunazar Matazimov	Active nucleus
Anarbai Kosimov	New nucleus
Mamarasulov Suyunboi	New black nucleus
Mamat Isomiddinov	New nucleus
Rahmon Ascarov	Nucleus, had many losses and moves a lot

Sherali Tilloev	Nucleus, coarse goats and not very interested colored
Sulaimon Umarov	Active nucleus
Turgunboi Madaliev	Active nucleus

Breeding structure
In terms of the breeding plan the five active participants are not an integrated group as such, since there are no breeding links between the flocks of the farms. Rather each farm has its own breeding plan based on a number of animals identified as nucleus animals. In addition each farm has its own bucks. This means that only the genetic variability within flocks is exploited and not the variability between flocks. Bucks which could be improvers in one farm but were born in another are not accessed.
In the actively participating farms all animals, nucleus and base, are kept together during mating, only one farmer (Sulaimon Umarov) separates nucleus and base allowing mating of the best with the best as proposed. Another farmer (Turgunboi Madaliev) mates nucleus females with best bucks during peak of oestrus joining all animals afterwards, therefore increasing the probability of having nucleus females mated to best males. Other farmers mate the whole flock only with selected bucks. This procedure means that only part of the potential selection intensity is used.

Breeding for color
Another important point is that from what could be seen, white and colored animals are run together, even during mating. All five flocks have mixed color flocks. This is actually not bad as there is a market for fleeces of different uniform solid color in the cottage industry (Brent 2008). However if mating across colors is allowed, non-solid color and non-uniform fleeces are produced. Mohair from such fleeces is difficult to process in high quality yarn and fabrics and is discarded by the industrial processors. In addition cross-color females maintained in the flock produce more variable offspring due to segregation.
Therefore it is suggested to use only solid color bucks in one mating flock, that is typically white or black. If complete separation is not possible farmers should try to separate colors at least during the peak of oestrus (eight days or so). This separation is of course even more important for nucleus females. If this is also not possible the option is to work on obtained progeny by culling non-solid colored animals. This needs reproduction to be high and for this to happen management must be optimum. Success of activity 13 (goat management) is therefore crucial in this aspect.

Breeding objective
Within a color, the original breeding objective for all farms was to improve fleece weights and to improve mohair quality without loosing body weight and fitness. Improvement of Mohair quality refers to increasing staple length, reducing contamination (medullated fibers and kemp) and improving style, character and luster.
It is clear that breeding objective changes will be driven by market signals, in particular Activity 16 is showing that fine Mohair is far more profitable than the present strong Mohair (see report of Dr Liba Brent). Farmer convincement to breed for finer Mohair will need various inputs: tangible market opportunities, farmer's women intervention, future market outlook information, objective data from the technical team, etc.
At present the variability in fiber diameter between fleeces is apparently very high (objective information is being processed) and very fine, kemp-free fleeces are available amongst kid fleeces, particularly if shorn early.Fiber contamination with kemp is another issue not considered in traditional selection practices. Kemp is a problem at all fiber diameter categories and only of interest in some carpet products. High value Mohair should be free of kemp. This breeding objective has been more easily accepted by farmers. However improvement will take time since the amount of kemp observed is quite high in most animals.

Selection
Last year a detailed account on selection procedures was given, including visual selection criteria, measurements and final decision criteria. The actual use of these procedures is not clear and probably taken only partially. For example only very few progeny was left from the nucleus does in November 2008 (see Table 41). From the 116 nucleus does only 53 kids are available. There are several reasons for this low figure including bad climatic conditions (cold winter and dry summer 2008) which limited reproduction and survival but also heavy culling has taken place before performance data became available. First shearing will be in April 2009 and selection pressure on measured performance will be very low.

This point has been discussed and needs further discussion. If selection takes place without consideration of objective performance then there is no point in measurement and fleece sampling. Genetic progress will be slower than actually possible (about 50% slower). Use of preset selection criteria (measurements and visual) is useful for systematic selection, analysis of progress and for uniform extension work.

Recording and performance

Individual identification of goats is not common among private goat owners. In the past only the goats on state farms were ear-tagged or tattooed and there were cases when animals with individual numbers were confiscated. As there are still many state goats, it was difficult to convince farmers to agree in tattooing their animals (see last progress report). However, now all nucleus animals in the active nucleus flocks have been tattooed. A. Khanaev was excluded from the list of participating farmers because he refused to tattoo his goats and later he sold his animals.

Field records were taken from all five farms. Field records included body weight in autumn, fleece weight, staple length (measured with a ruler) and visual fiber fineness (on the English Bradford scale) in April. In addition fleece samples were taken from all animals and sent to the Alrun Wool Laboratory in Almaty, Kazakhstan for analyses. Averages for nucleus does and bucks by farm and color are shown in Tables 41 and 42.

Table 41: No of animals in November 2008 and average field records for nucleus does per farmer

Farmer	Goats		Nucleus		Color	Nucleus progeny		Nucleus does			
	Total	Does	Does	Bucks		Female	Male	Body Weight Sept. 2008 (kg)	Fleece Weight April 2008 (kg)	Visual Finesse April 2008 (counts)	Staple Length April 2008 (cm)
Turgunboi Madaliev	146	90	27	2	white	13	10	31.6	1.90	49.5	21.5
			--	--	colored	--	--	--	--	--	--
Sulaimon Umarov	146	53	22	1	white	8	8	23.2	1.80	52.3	20.3
			4	0	colored	0	0	23.5	1.85	50.8	18.8
Rajmon Ascarov	121	52	11	1	white	4	2	27.7	1.80	49.8	18.1
			8	1	colored	2	1	26.6	1.71	52.0	17.3
Abdunazar Matazimov	314	120	15	1	white	0	2	23.6	1.64	48.6	17.1
			8	1	colored	0	2	21.3	1.26	50.0	17.1
Sherali Thilloev	94	50	8	1	white	1	0	17.9	1.82	49.5	15.9
			13	1	colored	0	0	20.8	1.74	49.0	17.5
Abdufatov Khonaev	80	30	18	1	white	--	--	--	--	--	--
			--	--	colored	--	--	--	--	--	--
Total	901	395	101	7	white	26	22	24.8	1.79	49.9	18.6
			33	3	colored	2	3	23.1	1.64	50.5	17.7

Table 42. Characteristic of nucleus bucks

Indexes	Turgunboy Madaliev	Sulymon Umarov	Rahmon Askarov	Abdunazar Matazimov	Sherali Tilloev
Number of animals	2	2	2	2	2
Live weight, kg	41.5	40.0	58.5	42.0	47.0
Sheared fiber (kg)	3.42	3.3	3.1	2.8	3.25
Natural fiber length (cm)	20.75	20.50	18.5	17.60	19.75
Thinness of fiber (µm)	51.8	43.4	50.5	-	51.1
Veritable fiber length (cm)	178.6	173.5	190.2	-	197.3

In spring 2008 the kids born were recorded and tattooed (adding the number 8 for the birth year). Some of the mated does did not conceive and some aborted due to the very severe winter resulting in a relatively low fertility that also differed between the farmers (Table 43). Liveweight gains of the kids in the nucleus flocks did not differ much between farms and daily gains in the first 180 days were quite low due to the dry summer (Table 44). However, in this period the daily weight gain in the nucleus flock was slightly higher (72 g) than in the control flocks (66 g, Table 44).

Table 43. Reproductive performance of does and kid survival

Parameters	**Turgunboy Madaliev**	**Sulaymon Umarov**	**Rahmon Askarov**	**Abdunazar Matazimov**	**Sherali Tilloev**
Number of mated does	32	28	20	23	29
Abortions (recorded)	3	2	1	5	4
Kids born (heads)	19	15	11	9	14
Kids born per mated does (%)	59.3	53.5	55.0	39.1	48.2
Survival of kids at weaning (heads)	17	14	9	6	11
Survival of kids at weaning (%)	89.5	93.3	81.8	66.7	78.5

Table 44. Liveweight gains (kg) of kids in the nucleus group

Farmer	**At kidding**		**At 3 months**		**At 6 months**		**Total weight gain (kg)**	**Daily weight gain (g)**
	n	mean	n	mean	n	mean	mean	mean
Turgunboy Madaliev	19	2.5	17	5.6	17	15.5	13.0	72.1
Sulaymon Umarov	15	2.1	14	5.5	14	15.2	13.1	72.7
Rahmon Askarov	11	2.2	10	5.4	9	14.9	12.7	70.5
Abdunazar Matazimov	9	2.1	8	5.4	6	14.8	12.7	70.5
Sherali Tilloev	14	2.1	12	5.5	11	15.0	12.9	71.6

Table 45. Comparison evaluation of live weight (kg) of kids in the nucleus and control group

Group	Liveweights (kg)						Daily weight gain (g)
	at kidding		at 3 months		at 6 months		
	n	mean	n	mean	n	mean	mean
Experimental (nucleus)	68	2.2	61	5.5	57	15.2	72
Control	35	2.1	35	5.1	35	13.9	66

Mating in October 2008

Mating started in October and kidding is expected for March-April 2009. Promising male kids born from nucleus does (visually superior and born from best females) will be kept un-castrated. These males and the female kids will be ear tagged or tattooed. In fact as many male kids as possible will be kept un-castrated in order to increase selection pressure.

During mating period best does were grazed with the best bucks. All mated pairs were recorded for further using these records in genotype identification.

1.3.11 Activity 16: Value added local processing of goat fibers by women and assessing the characteristics of naturally colored mohair and the potentials for its marketing

Location: Sogd region, villages: “Katabulak”, “Adrasman”, “Takli”, “Karadzhingil” and “Taboshar”

This activity is implemented under the guidance of Dr. Liba Brent (University of Madison, Wisconsin) and was carried out as planned. A detailed updated report was prepared by Liba Brent in March 2009 and shared with IFAD.

Objective:
The main objective is to develop market opportunities for value added fiber products, in particular naturally colored mohair and silk yarns, dyed white mohair and silk yarns and knitted handicrafts.

Activities and Results:
Most rural women in Tajikistan make a living by producing coarse, cheap yarns for the Russian market. Given the substantial differences between the price of handspun mohair yarns on the Russian and the American market, the Tajik spinners have a strong economic incentive to produce yarns for export to the US. The ICARDA project is helping the women to access the US luxury market with fine yarns through capacity building in the following activities:

1) Working with women's groups on improving spinning technique to produce fine, even yarns.
2) Introducing new technologies such as spinning wheels to improve productivity and the ease of spinning.
3) Producing yarns samples for the US market, bringing in market feedback and test-marketing yarns.
4) Organizing women's groups into cooperatives that can effectively perform all tasks including yarn spinning, packaging, marketing and quality control.
5) Training women to produce knitted luxury products (shawls, sweaters) for export.
6) Training women in fiber selection and linking women's groups with Angora goat farmers who produce quality mohair.

1) Working on yarn production: training spinners to make fine yarns.
During the first two years, the project has trained six groups of spinners (overall 45 women) in spinning luxury yarns. In November 2008 the project began collaborating with 12 additional organized women's groups (with 6-12 women in each group) and training them to spin fine yarns. The women were shown samples of Australian, South African, French and Italian yarns currently on the US market and explained how to produce yarns according to the standard established by the project. Based on the project experience, the majority of women who have enough experience in spinning yarns for the Russian market can be relatively easily trained to improve quality and produce fine yarns for US market. In the next phase of the project, training will be facilitated by training trainers and publishing a spinning manual that explains the quality standard for the US yarn and includes a small yarn sample.

The interest on the part of the women to join the project and learn how to produce fine, high-priced yarns has been considerable and it is clear that hundreds of women from the region could successfully participate in producing quality yarns for the US and other luxury markets in the future. Provided that they had access to quality kid mohair, it is most likely that all spinners capable of producing fine yarns according to the project standard would switch to this market while those who cannot meet the standard or are still learning how to spin would continue to make yarns for Russia. The project will work on producing more specific estimates of potential beneficiaries in the next report in spring 2009.

2) Introducing spinning wheels: increasing productivity.
The project has imported four New Zealand spinning wheels and distributed them among the women. Based on their testimonies, the use of a spinning wheel increases the spinner's productivity at least by 50%.The spinning wheels are also much easier to use that the traditional spindles and the women learn how to use them relatively quickly. Most women expressed a desire to obtain a spinning wheel and the project is trying to facilitate a domestic production of spinning wheels - the imported spinning wheels cost $400/piece and domestic production is the only viable long-term option. Several masters in Tajikistan began producing prototypes of spinning wheels based on the imported models but additional investment will be needed to fully develop the production.

3) Producing yarn samples, receiving feedback and test-marketing yarns.
Since the start of the project, the project coordinator based in the US has maintained a relationship with American knitters and yarn storeowners who have been testing yarn samples produced by the spinners. The individual samples have been registered and the spinners received a direct feedback from the knitters. After two years of sample testing, the project has developed a standard for the yarns to be exported and new spinners are being trained to maintain the standard. New types of yarns will be developed in the course of the project and standardized, including silk/mohair blends spun from locally produced fibers and yarns dyed with natural and chemical dyes.

The US market for knitting yarns has been in the process of considerable boom. Based on the research conducted by the project, the retail prices of some luxury kid mohair yarns were as high as $560/kg. The market for knitting yarns in the United States provides a perfect opportunity for the Tajik women – it values yarns made from natural fibers such as mohair and prefers handspun yarns over machine-spun yarns. The prices of fine, kid mohair yarns are much higher than $10/kg the Tajik women receive for coarse mohair yarns made for the Russian market. In addition to knitting yarns, the US market presents an opportunity for the sales of luxury items such as scarves, sweaters and other knitted products.

In order to promote the Tajik mohair yarn in the US, it is important to inform the American knitters and consumers about the project, the Tajik women and the qualities of the yarn and products. The project developed a website that explains the project objectives, describes the yarn and offers photographs and information about the spinners. A brand name "Mohair Magic" has been established and a booklet was designed that accompanies the yarns marketed in American stores. A variety of other means will be used to increase information and public awareness about the project activities. The US knitters are starting to work to publish an article about the yarn in the Spin Off Magazine and the Vogue Knitting Magazine expressed interest in publishing an article about the project.

In February 2009, the first 18 bundles of mohair yarns are being test-marketed in the Sow's Ear store in Verona, Wisconsin, USA. The yarns will sell for a price of comparable kid mohair yarns produced by the Australian Company "Wagtail Yarns" for a wholesale price of $140/kg. The women will receive $70/kg and $70 will be used to export the yarns from the community in Tajikistan to the US yarn store.

Given that most of the shipping and other costs are currently subsidized by the project, all proceeds from yarn sales will be re-invested into the project activities through a "Magic Mohair Fund." The fund will be used by the project to purchase raw material for the spinners and benefit the producer's communities in ways that will be agreed upon jointly with the project team. The possible options include purchasing raw fiber or spinning wheels for the women and designing micro-lending schemes.

4) Organizing women's producer cooperatives.

The project plans to collaborate with a local NGO "Agency for the Support of Development Processes NAU" to organize the spinners' groups into cooperatives that will be responsible for yarn production and export. The NGO established 12 cooperatives in the Asht region that are focused on producing yarn for the Russian market. These cooperatives include 6-12 women members, are lead by elected women leaders and are starting to use micro-lending to purchase raw mohair for spinning. The project plans to collaborate with the NGO on further developing the cooperative infrastructure with the orientation on the American market.

In November 2008, the project team visited several of the cooperatives and explained the project activities and objectives to their members. In the spring of 2009 the project plans to include the groups in the training.

5) Training women to knit clothing.

In October-November 2008 the project began collaborating with knitters in Tajikistan to use some of the yarn to knit shawls and sweaters based on western models. This would add more value to mohair and open a new market for knitted clothing. However, currently there are only a few experienced knitters in Tajikistan who have the skills to produce such products – most women are able to knit only socks, gloves and in some cases simple scarves. The project plans to expand the search for knitters in 2009 and begin the training of trainers to develop this new component. In spite of the current limitations, knitting is another viable opportunity to add additional value to local fiber, introduce new skills and create new earning opportunities for women to supply products to luxury markets.

In November 2008, the project team started working with two knitters in the city of Khodzhand who produced a sample of a scarf and a sweater based on a US model. Both samples received high marks from US knitters and potential buyers. The project plans to continue working with the knitters in the spring of 2009, add new knitters to the group and start developing a training program for knitting luxury scarves, sweaters and other items for the US market.

6) Training in Fiber Selection and Linking Spinners with Mohair Producers.

The most important factor that influences yarn and product quality is the quality of the fleece from which it was spun. Even the most skillful spinner cannot produce fine yarn unless she has high quality raw mohair. Unfortunately spinners have been using low quality mohair to spin yarn for the Russian market and do not know how to correctly select fleeces to produce fine yarns for the US market. The project has been training all groups in fiber selection and in sorting and grading individual fleeces. Given that the spinners have considerable incentives to produce fine yarn for export, the groups that received training have been very proactive in searching for quality fiber. However, their search for fine, kemp-free mohair has been challenging because of the poor breeding practices of local farmers.

Based on the project research, the quality of fleeces produced by different farmers varies considerably. A minority of farmers produce Angoras with finer mohair that have less kemp and the project can use as many as 80% of their kid and yearling fleeces, and about 30% of skirted fleeces of older goats, for yarn-making. However, the majority of farmers produce animals with coarse fiber that has a high percentage of kemp and cannot be used for spinning luxury yarns. In some cases, none of the goats a farmer produces, including 6 months old kids, have fiber that is fine enough for luxury yarn. The project plans to assist the spinners by linking them with farmers who produce finer mohair and work with those farmers on further improving fiber quality. Therefore, Angora breeding program is perhaps the most important component of the project – the yarn spinning and marketing activities cannot be scaled up unless the Angora goat farmers can supply the spinners with quality raw material. In order to facilitate this, the project needs to identify farmers who currently produce the highest quality fiber, link them with groups of spinners, and work with them on further improvements in breeding and fiber quality. The selected farmers need to receive technical, scientific and organizational support to develop breeding nucleuses that will have the capacity to produce breeding animals for farms in the region.

If breeding is improved, Tajik farmers can fully capitalize on some of the unique qualities of Tajik Angora goats and the mohair they produce. Although most Tajik Angora fleeces have a serious shortcoming in terms of the presence of kemp fibers, they also have an advantage over Australian and American Angora kid fleeces by having a higher percentage of fine, cashmere-type fibers that make the Tajik mohair yarns softer than Australian or American yarns. Softness is perhaps the most important criteria by which knitters judge yarns. Soft yarns can be made into soft shawls, and sweaters that appeal to the final users. The presence of cashmere fibers (especially if they are longer) also makes the Tajik mohair more “spinable” and less slippery. This is also an advantage during manual processing. The project plans to continue to research the comparative qualities of Tajik mohair and study how different types of fleeces affect yarn quality. The research results will be used to develop breeding strategies and programs. Farmers will be encouraged to form so-called “spinners’ herds” – flocks of fine-haired goats that will be sheared specifically for spinning.

The finest and most valuable mohair is so-called “super-kid” mohair produced by 6 months old Angora goat kids. However, prior to the project activities, there has been no demand for this type of fiber on the Tajik market. Some farmers sheared 6 months old kids for other reasons – in some areas small kids can get caught on spiky plants and die and farmers shear them to prevent this. The project started working with farmers to shear 6 months old kids for super kid mohair and working with spinners to produce super-kid mohair yarns. Based on the fist results of the test-marketing, these yarns will be most desirable by the knitters. Six month old kids also have the least amount of kemp and using their fiber will help to resolve the fiber quality issues experienced thus far.

Tajikistan – Dushanbe site

1.3.12 Activity 17: Improving sheep management in the communities, aspects of feeding, lamb breeding, maintaining and sheep reproduction

Location: Buzbit, Nematobod, and Karsang (Dusti jamoat), Vakhdad district.

Objective:
The objective of this activity is to test improvements in management strategies that can be easily adopted by farms and households.

As planned two subactivities were conducted in 2008:
- additional feeding of ewes during gestation period and studying ewes reproductive abilities, lambs growth and development;
- early weaning of lambs (at 3 months) and their subsequent growing, studying growth and development of lambs and productivity of their mothers;

Sub activity 1. Additional feeding of ewes during gestation period

Two groups of 30 ewes each were formed in February 2008 from the flocks of two farms (A. Bobokhonov and K. Ne’matov) that graze their sheep on winter pastures (at the boundary Kyzyl-Aryktov). Pregnant ewes of the experimental group (farmer A. Bobokhonov) were supplemented with 0.3-0.4 kg of concentrates during the last third of the gestation period. The concentrates consisted of a

mixture of crushed barley cottonseed cake and the premix “Rovimix” as a source of vitamins, minerals and trace minerals (25 g per 10 kg of concentrates; the price of Rovimix manufactured in Poland is $9.4/kg). Both groups were vaccinated against smallpox and F&MD and trenched against internal parasites.

The additional feeding of the experimental group with concentrates and the vitamin/mineral mix increased their liveweights and prolificacy (Table 46). The ewes in the experimental group were by 2.9 kg (5.4%) heavier before lambing and by 3.6 kg (7.1%) after lambing than the ewes in the control group. In the experimental group 27 lambs were obtained from 30 ewes and in the control group only 15 lambs. Lambs were slightly heavier at birth (by 0.3 kg) and showed 29% higher liveweight gains than the lambs in the control group during the first 20 days after birth. The latter was clearly related to the higher milk producing capacity of the ewes in the supplemented (1.65 kg daily) than in control group (1.27 kg).

Table 46. Differences in prolificacy, liveweights and milk producing capacity between the supplemented and the control group

Parameters	**Experimental group**	**Control group**
Liveweight of ewes before lambing (kg)	56.4	53.5
Liveweight of ewes after lambing (kg)	50.8	47.2
Lambs obtained (heads)	27	15
Ewes prolificacy (%)	83.6	50.0
Liveweight of lambs at birth (kg)	4.7	4.4
Liveweight of lambs at the age of 20 days (kg)	11.3	9.5
Total live weight gain (kg)	6.6	5.1
Average live weight gain (g/day)	330	255
Ewes milk producing capacity (kg/day)	1.65	1.27

Subactivity 2. Early weaning of lambs

For this subactivity an experimental (M. Mahmudov) and a control (M. Niyozov) group of 10 male lambs each of equal liveweight and age were formed. The lambs of M. Mahmudov were weaned at 3 month age and grazed on the high land pastures of Rammit ravine at the boundary Kanask-Barzangy, at a distance of 150-180 km from the district center Vahdat. The growth and development of the males in both groups was recorded (Table 47).

Table 47. Changes in liveweight of lambs and ewes

Liveweights and daily weight gains	**Experimental group**	**Control group**
Liveweight of lambs**:**		
-at lambing (kg)	4.7	4.7
-at 3 month age (kg)/average daily gain (g)	28.3/263	28.0/267
-at 4 month age (kg)/average daily gain (g)	35.1/223	34.6/210
-at 5 month age (kg)/average daily gain (g)	39.7/154	38.7/136
Liveweight of ewes:		
-at lambing(kg)	53.6	54.1
-after 2 months, (kg)	51.1	52.0
-after 3 months(kg)/average daily gain (g)	53.2/70	54.1/67
-after 4 months(kg)/average daily gain (g)	58.6/180	55.6/52
-after 5 months(kg)/average daily gain (g)	64.3/190	58.2/87

Thus, it could be shown that lambs weaned at 3 month age grazing on good pastures did not lag behind lambs that were weaned at an age of 5 months in growth and development. On the contrary at the age of 5 months early weaned lambs exceeded their contemporaries by 1 kg. The observations comply with the physiological theory that the growth and development of lambs till 2 month age is strongly related to the milk producing capacity of their ewes, and thereafter to the supply of fodder. Furthermore, the separate grazing of ewes and lambs in the early weaning group contributed to a rapid increase of liveweight and condition of ewes. It is assumed that this would also lead to

improvements of the reproductive performance of ewes, e.g. allowing early mating or even three lambings in two years.

As one of the most important characteristics of Gissar sheep is their fattening ability, the fattening performance of early weaned and traditionally weaned males was compared. Fattening started on 15 October and lasted 45 days. The ration was developed on the basis of locally available ingredients (Table 48).

Table 48. Ration for fattening

Forages	Quantity (kg)	Starch units	ME (MJ)	Dry matter (kg)	Digestible protein (g)	Ca (g)	P (g)	Caro-tene (g)
Hay from rangelands	1.0	0.48	7.00	0.80	40.0	5.6	1.0	13.0
Wheat straw	0.5	0.11	2.60	0.42	4.5	0.7	0.4	2.5
Cotton seed cake	0.3	0.33	2.90	0.27	95.7	0.8	2.8	0.3
Chopped barley grain	0.2	0.23	4.50	0.30	17.0	0.4	0.8	0.1
Total	**2.0**	**1.15**	**17.0**	**1.79**	**157.0**	**7.5**	**5.0**	**15.9**

At the end of fattening early weaned males exceeded the traditionally weaned group by 1.6 kg total liveweight gain (22.9%); their average daily weight gain was by 35 g higher (Table 49).

Table 49. Fattening performance of early and traditionally weaned Gissar rams (n=10)

Parameters	Experimental group	Control
Liveweight at the beginning of fattening (kg)	43.1	42.8
Liveweight at the end of fattening (kg)	51.7	49.8
Duration of fattening (days)	45	45
Absolute gain of live weight (kg)	8.6	7.0
Average daily gain (g)	191	156
Required feeds for the fattening period (total starch units)	51.75	51.75
Required feeds (starch unit per kg liveweight gain)	6.0	7.4

Concluding, weaning of lambs at an earlier age did not have any negative effect on growth and fattening qualities. Highly nutritious summer pastures stimulated good growth. These results indicate the potential of this method for considerable savings of resources and increased production of lamb meat.

Knowledge dissemination

Farmers were regularly visited by the scientists and all problems discussed with representatives of households and farms.

On 12 June 2008 a training workshop on “Feeding, maintaining and increasing the reproductive performance of ewes” was organized. The representatives of the local authority, specialists, farmers and householders were invited. It was recommended to farmers place special attention to feeding of ewes during preparation for mating and in the late gestation. Farmers were also trained on selection of best males and females in the mating season, preparation of ewes for mating and lambing, feeding of concentrates and mineral additives, rational use of pastures, stocking of fodders for winter and improvements in the quality of fodders.

As a result of the research activities a brochure on “Recommendations on increasing of ewes’ prolificacy, lamb’s growing at dehkan farms and households” was developed and published. Three papers for publishing fin local journals were prepared and submitted (to be published in 2009).

Act 16 leftover

Main activities planned in the reporting period were:

- Working with women’s groups in Tajikistan to develop the production of competitive yarns and establishing reliable sources of equipment and other supplies in September 2007, January & April 2008

- Conducting sample testing and test marketing with yarn storeowners and knitters in the United States and developing a reliable marketing network in October 2007, February & May 2008
- Feedback on the yarn samples entered into the existing database and distributed to the Tajik spinners in November 2007, March & June 2008
- Creating a website on the artisans, their products and the project, producing a short video on the women's groups and writing articles to magazines and newspapers addressing knitters, retailers, academic audiences and the general public in the USA in July-September 2008
- Producing a report on the project activities by December 2008

1.4 Theme 4: Knowledge exchange and capacity building

1.4.1 Activity 18: Enhancing knowledge exchange for increased feed and livestock production

Participation of students in project activities

During 2008 it became clearer which Master and PhD students were able to collect sufficient data to prepare their theses from project activities. Unfortunately the students that were supposed to work on activities under Theme 2 were not well supervised or not serious enough.

The number of students decreased from eleven in 2007 to seven students in 2008 (Table 50). One PhD thesis on Awassi sheep that had been started before the initiation our project was completed and successfully defended in 2008 (Title of the thesis: "The effectiveness of the crossing of local coarse wool ewes with the rams of the Awassi breed and the characteristic of their crossbreeds" by Abdymajitov Nurzhan Keneshevich).

Table 50. List of students in the Livestock project

Name of persons	Institute or university	Project supervisor	Official supervisor	Act.	Title
Kazakhstan					
1. Ms. Alima Aymyrzaeva	Kazakh-Turkish University in Turkistan town	Dr. N. Alibaev	Dr. Borash Myrzaliev	1	Analysis of households' livelihoods in Southern Kazakhstan
2. Ms. Khalida Mamanova	Kazakh-Turkish University in Turkistan town	Dr. N. Alibaev	Dr. Borash Myrzaliev	3	Mutton markets in arid and semi-arid regions of Southern Kazakhstan
Kyrgyzstan					
3. Katosheva Tulganoy	Kyrgyz Agrarian University	Razzakov Imatbek	Razzakov Imatbek	9-12	Improvement in the quality indicators of the merino wool
4. Nazarbekov Daniyar	Kyrgyz Agrarian University	Razzakov Imatbek	Razzakov Imatbek	9-12	Comparative characteristic of the management of the coarse wool and fine-wooled sheep
Khujand/Tajikistan					
5. Farkhod Kosimov	Khujand Branch of Tajik Research Institute of Livestock	M. Kosimov	M.Kosimov	13-16	Productive and some biological special features of the many-coloured types of the woolen goats
Dushanbe/Tajikistan					
6. Khurshed Davlatov	Tajik Research Institute of Livestock	F. Ikramov		17	Raising of merinos under the conditions of mountain house management
7. New: Mr. Kobil Soliev was registered as a PhD student at	Tajik Institute of Agricultural Economics			1	Sheep production practices in households

National workshops

National workshops were organized in October 2008 in the three countries. The progress in project implementation was discussed and the workplans for the next year presented by the principal investigators for each theme. Some farmers participated in the meetings. In Kazakhstan and Kyrgyzstan and Tajikistan representatives of the Ministry of Agriculture were present.

Training and field days with farmers

Knowledge sharing with farmers in the form of training and field days are reported under each activity.

2 Pakistan

2.1 Theme 1: Socioeconomics

Rainfed and irrigated research sites

2.1.1 Activity 1: Baseline Study of smallholder feed-livestock production systems at the rainfed and irrigated sites

Location: Rainfed site: Lodhay village, Tehsil Gujar Khan; Irrigated site: Chak No. 74 SB & Chak No. 105 SB villages

Objectives:
The specific objectives of the study are:

- to collect data on pre-identified and verifiable indicators for short-term and long-term impact assessments
- to specify the nature and types of the integrated feed-livestock production system
- to estimate share of livestock in the livelihood of small farmers
- to estimate poverty profile of small farmers practicing different feed-livestock production systems
- to develop empirical basis for recommending policy interventions, institutional changes and up-scaling validated feed-livestock development packages.

Activities at both sites:
Data collection from the three project villages (Lodhay**,** Chak No. 74 SB and Chak No. 105 SB was started during the last week of January 2008 and completed by end February 2008.
A comprehensive and thoroughly pretested questionnaire was used on pre-determined feed-livestock project impact indicators. A framework is developed to conduct a focused study considering important process and outputs from project interventions including feeding cost, feed availabilities, balanced feeding, milk productivity, milk processing, marketing margins, resource conservation, attitude and behaviour, organization, gender considerations, gross margins, price and production risk, poverty profile and income inequalities.
The results will be presented in a technical report. A draft report was prepared by July 2008 but the final version has not been completed. Here only a brief description of the sample will be given.

Results from Lodhay village (rainfed site):
The socioeconomic status of (participating and non- participating households) was compared by selected general attributes, such as age, experience, family size, operational holding of the farm manager and gender division of labor (Table 1). The majority of the farmers are small farmers having average land holdings of 8.8 acres. Both male and female are working jointly for livestock and agricultural activities. The table also shows that the farmers participating in the project have more land and more labor although the difference was not significant.

Table 1. General attributes of the interviewed households at Lodhay

	Participants	Non-Participant	Controlled	All	Sig.
No of farms	25	19	18	62	
Farm Manager Age (years)	36	51	40	42	0.531
Manager Experience (years)	7	17	19	21	0.043
Education (years)	9	7	7	8	0.030
Family Size (no)	7	9	8	7	0.200
Operational Holding (acres)	12.38 (10.25)	8.60 (5.64)	3.65 (2.32)	8.84 (8.04)	0.465
Males Working on Farm (no)	1.7 (1.1)	1.8 (0.5)	1.3 (0.5)	1.6 (0.8)	0.058
Females Working on Farm (no)	0.8 (1.0)	0.5 (0.7)	0.6 (1.0)	0.6 (0.9)	0.600
Permanent Hired Labor (no)	0.6 (1.1)	0.17 (0.5)	0.0 (0.0)	0.3 (0.8)	0.110

*Figures in parenthesis in the lower rows are standard deviations

Results from Chak No. 74 SB & Chak No. 105 SB villages (irrigated site):
Besides the project villages Chak No. 74/SB and 105/SB, two control villages Chak 72/SB and 100/SB were selected considering production systems and market access.
Four types of production systems were identified by cluster analysis (Ward Method) based on land holdings, milk sales and herd size and other characteristics. Four production systems were defined (Table 2):

- Subsistence Dairy Farmers
- Semi Subsistence Dairy Farmers
- Semi Commercial Dairy Farmers
- Commercial Dairy Farmers.

Table 2. Proportion of different dairy production systems (%) in the villages

Village Name	Subsistence	Semi-Subsistence	Semi-Commercial	Commercial	All	Sig.
74-SB	72.2 (13)*	31.6 (12)	26.5 (9)	5.0 (1)	31.8 (35)	0.000
105-SB	27.8 (5)	13.2 (5)	35.3 (12)	65.0 (13)	31.8 (35)	
72-SB	-	34.2 (13)	17.6 (6)	5.0 (1)	18.2 (20)	
100-SB	-	21.1 (8)	20.6 (7)	25.0 (5)	18.2 (20)	
Total Farmers (no)	18	38	34	20	110	

*Figures in parenthesis are number of interviewed households in this category

Most of the farmer attributes like farm manager's age, education and experience were almost same across the production systems. However there were significant differences in average farm size between the systems (Table 3).

Table 3. General Attributes of the dairy Production Systems

	Subsistence	Semi-Subsistence	Semi-Commercial	Commercial	All	Sig.
Farm Manager Age (years)	53	51	54	52	53	0.782
Manager Experience (years)	21	24	27	21	24	0.295
Education (years)	5	5	5	6	5	0.653
Family Size (no)	9	6	8	6	7	0.130
Farm Size (ac)	7.7 (3.4)	5.2 (3.1)	8.3 (5.9)	11.9 (5.8)	7.8 (5.2)	0.000

2.1.2 Activity 1.2 Economic Evaluation of Feed-Livestock Production Technologies at the rainfed and irrigated sites

Location: Rainfed site: Lodhay village, Tehsil Gujar Khan; Irrigated site: Chak No. 74 SB & Chak No. 105 SB villages

Objectives:

- to evaluate economic viability of the technological interventions tested by all components of the project.
- to examine the compatibility of project interventions with the farm situations and rural livelihood strategies.
- to understand farmers' perceptions of the adoption of project interventions.
- to provide feed back to the concerned scientists and development departments.

Activities:
Data from research experiments and demonstration plots were collected through involving collaborating scientists, communities and development practitioners. Data were also collected from participating and non-participating farmers to solicit their perceived and observed benefits and costs of the technologies as well as their opinions on its potential adoption in different farm situations.
An ongoing assessment scheme with questionnaires to capture all relevant information was developed and has been implemented in Lodhay. This activity has not been implemented at the irrigated site. The main variables included in the questionnaire were adoption status of the intervention, labor problem associated with the intervention and chances of success of the given intervention including on the experimental results.

Summary of perception of the community on tested technologies in Lodhay village (rainfed site):

Ongoing Assessment of improved forages and hay making intervention
No of participating farmers in the interventions: 12 (forages) and 6 (hay)
The farming community showed high satisfaction with the improved fodder and hay intervention as they clearly observed increased availability of fodder for their animals. The productivity of the animals was increased with the availability of green fodder and during the lean period.

Ongoing Assessment of fattening intervention
No of participating farmers: 6
Overall people appreciated the fattening intervention and wanted to participate in this activity. However, as the results of the fattening trials were inconclusive and no increase in performance could be reached through improved feeding, the community expressed their dissatisfaction about the outcome. Hence, keeping in view the high interest of the farmers in this activity and the problems in implementation of this trial, it is suggested that the experiment should be repeated in a revised format and understand the scientific reasons why the improved nutritional package has not produced the desired results.

Ongoing Assessment of Milking Trials
No of participating farmers: 7
The preference for this intervention was high. The results from the feeding experiment showed a slight increase in milk yield but the community was not completely satisfied. The people were not sure if this slight increase in milk was due to the improved feeding practices or other reasons. Hence, to further confirm the results and also to completely satisfy the farming community, it is important to repeat this experiment.

Ongoing Assessment of Guar Fodder Hay Intervention
No of participating farmers: 12
An improved variety of Guar fodder was disseminated to fill the fodder gap in the lean period. Majority of the farmers 85% participating and non participating farmers has appreciated the Hay Intervention. Both the participating and fellow farmers have shown their interest to participate in the next season. The results of the ongoing assessment indicate that the guar intervention for hay making will be adopted and sustained in the village.

2.2 Theme 2: Forage Production

Rainfed research site, Lodhay village

2.2.1 Activity 2.1: Participatory on-farm evaluation and dissemination of winter cereal legume mixtures and technologies in crop – livestock systems.

Location: Rainfed site: Lodhay village, Tehsil Gujar Khan

Objective:
The objectives of this activity are
- to evaluate the performance of different cereal-legume forage crops under rainfed conditions
- to disseminate and demonstrate the latest best improved package of forage mixtures

- to provide complementary practical on-farm participatory training and capacity building of researchers and farmers.

Activities:
Table 4 gives an overview of the subactivities carried out in 2008 under this activity:

Table 4. Overview of sub-activities in 2008

Sub-activities	J	F	M	A	M	J	J	A	S	O	N	D
Mixture of winter cereal and legume (oats + vetch) with 18 farmers.	x	x	x	x						x	x	x
Comparison of vetch lines for fodder yield	x	x	x	x						x	x	x
Comparison of winter fodder species/varieties for fodder yield	x	x	x	x						x	x	x
Mixture of summer cereals and legumes (sorghum + guar and millet + guar)							X	x	x	x		

Subactivity 1: Evaluation of mixture of winter cereal and legume (oats + vetch)

High yielding varieties of oat and vetch fodder crops were provided to 18 participating farmers by the project and compared with local varieties.
Sowing date: First week of November 2007
Harvest dates: 26.02.08, 14.03.08 and 02.04.08
The improved intervention (oats and vetch mixture) produced 79 % more green fodder yield than the farmer's traditional practice (Figure 1). The comparison of different harvest dates for the oat and vetch mixture showed that maximum mean green fodder yield of 72.9 t/ha was recorded when harvesting was delayed to the first week of April (02/04/2008). A high variation between farmers in the average yield of oats and vetch mixture per harvest date was observed ranging from 69.7 t/ha to 50.2 t/ha green biomass.

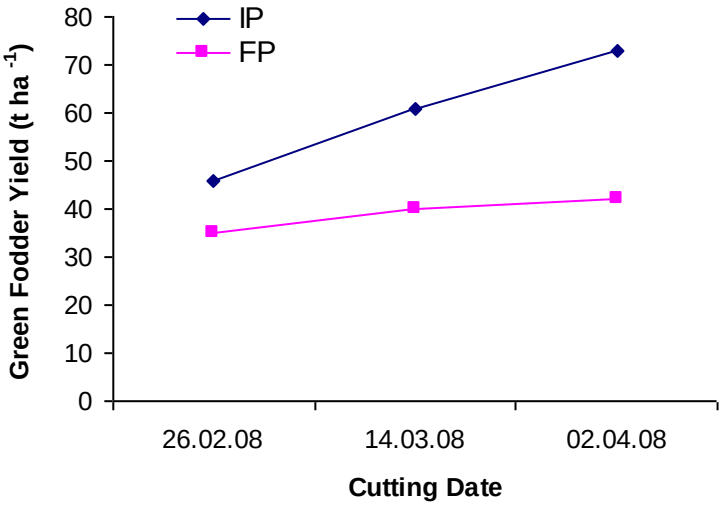

Figure 1. Comparison of green fodder yield (t/ha) between improved practice vs farmers practice at different cutting stages.

Subactivity 2: Comparison of vetch varieties for fodder yield under medium rainfall

Sowing date: 13.11.2007
Eight vetch lines were tested for green fodder yield during winter season 2007/2008. The vetch line "Selection 2090" produced the highest quantity of green fodder and dry matter of 11.8 and 2.3 t/ha, respectively, closely followed by Selection 2616 and 2560; while the lowest green fodder and dry matter yields of 7.7 and 1.4 t/ha, respectively were recorded from Selection 2025.

Subactivity 3: Comparison of winter fodder species/varieties for fodder yield

Oat, barley, wheat, triticale, Brassica and vetch were compared. Two varieties of Brassica and of the cereals (except Triticale) were included in the experiment. The results show that among cereal fodder crops, both oats varieties PD2-LV65 and Scott recorded the highest green fodder and dry matter yields (Table 5). Triticale c.v. Bhakkar and vetch produced the lowest green fodder and dry matter yields. Brassica was second best in green fodder but not in terms of dry matter yield.

Table 5. Comparison of winter fodder crop/varieties for fodder yield

Name of species/ variety	Green fodder yield (t/ha)	Dry matter yield (t/ha)
1. Oats cv. PD2-LV65	42.50	11.80
2. Oats cv. Scott	37.60	10.66
3. Wheat cv. C-591	24.30	6.34
4. Wheat cv. 2K050	22.70	6.35
5. Barley cv. Snober-96	30.50	8.54
6. Barley cv. Jau-83	26.90	7.32
7. Triticale cv. Bhakkar	20.10	5.69
8. Brassica cv. Chakwal Sarson	33.70	5.87
9. Brassica cv. 03CBN004	30.50	5.23
10. Vetch cv. Languedock	15.00	2.67
LSD (0.05)	**1.84**	**0.287**
CV (%)	**3.79**	**2.38**

Subactivity 4: Evaluation of mixture of summer cereals and legume

Summer cereals and mixtures of summer cereals and legumes (sorghum/guar and millet/guar) were grown by 38 farmers.
Sowing time: first week of July 2008
Yields were recorded from 12 project farmers. Table 6 shows that the treatments did not differ statistically in green and dry fodder yields. However millet alone and millet/Guar mixture showed the highest green fodder yields, while the highest dry matter yields were recorded for summer cereal alone (millet and sorghum).
The cereal-legume mixtures were processed for hay and fed to livestock in feeding trials.

Table 6. Green and dry fodder yield (t/ha) of sorghum, millet and guar grown alone or in mixtures

Treatment/intervention	Green fodder yield (t/ha)	Dry matter Yield (t/ha)
Sorghum alone	29.37	8.20
Millet alone	31.25	8.70
Guar alone	25.82	5.51
Sorghum + Guar	27.07	6.02
Millet + Guar	31.45	6.89
LSD (0.05) CV (%)	ns 25.59	ns 3.51

Additional experiments carried out by master students of agronomy at the Arid University of Rawalpindi

Mr. Muhammad Nadeem: Evaluation of winter cereal-vetch mixtures for fodder yield and quality under rainfed conditions
In the winter season 2007/2008 yield and quality oat, wheat, barley, vetch and ceral/vetch mixtures harvested at different physiological stages were compared.

Mr. Adeel Anwar: Performance of non traditional winter legumes with oat for forage yield and soil health under rainfed conditions in winter season

Yields and quality of three non-traditional winter legumes i.e common vetch (Vicia sativa L.), medics (Medicago polymorpha L.) and Senji (Melilotus indica L.) were compared in pure stands and in mixtures at a ratio of 50:50 with oats on station.

Adnan Zahid: Effect of cutting and post-cutting intervals on Hydrogen Cyanide contents in Sorghum forage under rainfed conditions

Sorghum (*Sorghum bicolor* L. Moench) forage is an important source of livestock fed either green or dry during Kharif season but there is a risk associated with this fodder as it contains hydrogen cyanide (HCN). The study compared the HCN levels of sorghum cut at different maturity stages and fed after drying for different time intervals.

2.2.2 Activity 2.2: Development of green fodder selling enterprise using dug-well irrigation

Location: Rainfed site: Lodhay village, Tehsil Gujar Khan

Seeds of maize variety S-2002 were distributed to three farmers, namely Mr. Nazakat, Mr. Banaris and Mr. Lal Hussain. The total area under maize cultivation for Mr. Nazakat was 2 kanal, for Mr. Lal Hussain 4 kanal, and for Mr. Banaras 1.5 kanal. The number of irrigations was six for Mr. Nazakat and two for the others. Mr. Nazkat also used a higher seed rate than the other two farmers (72 kg, 50 kg and 56 kg acre^{-1}, respectively). Sowing in the three farms took place from end April till mid May 2008; the seeds were broadcasted. All farmers achieved a net benefit with this activity but the net incomes and yields differed considerably (Table 7 and 8).

Table 7. Agronomic data from participating farmers

Farmer Name	No. of Plants	Average plant height (m)	Leaf weight (g)	Stem weight (g)	Leaf stem Ratio	Yield (Mounds /canal)
Mr. Nazakat	5	2.60	62.0	241.4	0.25	119.3
Mr. Banaras	5	2.13	43.3	153.9	0.21	66.6
M. Lal Hussain	5	1.22	41.2	129.1	0.32	35.3

Table 8. Cost Benefit Ratio (Rs acre^{-1})

Farmers	Income (Rs)	Costs (Rs)	Net benefits (Rs)
Farmer 1 (Nazakat)	119300	53600	65700
Farmer 2 (Banaras)	66608	38400	28208
Farmer 3 (Lal Hussain)	51278	25800	25478

Irrigated research site, Sarghoda

2.2.3 Activity 2: Comparison of yield and nutritional value of improved winter and summer fodder crops and varieties with local fodder crops; seed production; preservation/conservation of fodder crops through hay and silage making and cultivation of multi-cut hybrids for lean periods

Location: Irrigated site: Chak No. 74 SB & Chak No. 105 SB villages

Objective:

The objectives of this activity were:

- To evaluate the green fodder yield of newly improved varieties as compared to local varieties being cultivated in the area.

- To evaluate the performance of different cereal/legume crop combinations under irrigated conditions.
- To test the quality (DM, CP, CF, EE, Ashes and NFE) of different forage crops and their mixtures.
- To make hay and silage for lean periods
- To test different seed production techniques to increase farmer's income.
- To demonstrate and disseminate the latest best improved package of forage mixtures.
- Complementary practical and on farm participatory training and capacity building of the farmers.

Activities undertaken*:*

- Improving green fodder yield through cultivation of improved high yielding species and varieties of winter and summer cereals and legumes
- Improving fodder quality through cultivation of cereal-legume crop mixes
- Improving farmer's income through green fodder selling enterprises
- Promoting seed production of improved varieties of fodder crops on farmers' fields.

Subactivity 1: Evaluation of winter fodder crops

During winter 2007/2008, 15 farmers each in 74/SB and 105/SB were provided with seeds of improved berseem and oats fodder varieties for planting as pure stands and as cereal-legume mixtures on 15 acres in each village in comparison with 15 farmers using local varieties and practices in each village as control. The sowing of winter fodder crops in both villages was completed during October-November 2007. The following treatments were studied as pure stands and their combinations in both the villages:

Treatments	Crops
T1	Improved Berseem
T2	Improved Oats
T3	Improved Berseem and oats
T4	Berseem (farmer's varieties and farming practice)
T5	Oats (farmer's varieties and farming practice)

Rainfall during the whole winter season was only 56 mm in February. Germination, plant height, root to shoot ratio and finally green fodder yield were recorded.
Germination ranged from 78-92% in the two villages (Table 9 and 10). The highest green fodder yields of 219 t/ha and 225 t/ha were recorded from the mixture of improved varieties of oats and berseem in Chak 74/SB and 105/SB respectively, followed by a yield of 171 t/ha and 169 t/ha produced by pure stands of improved oats variety in Chak no 74/SB and 105/SB, respectively. Lowest yields were obtained from local varieties and farmer's practice (97.5 and 100.6 t/ha from local berseem and 70.3 and 66.8 t/ha from local oats in Chak 74SB and 105/SB, respectively). The improved berseem produced 75% and 68% and the improved oat variety 39% and 60% higher green fodder yields than the local varieties in Chak 74/SB and 105/SB, respectively. The good germination rates and increased heights in improved varieties contributed towards the high green fodder yield.

Table 9. Germination, morphological characteristics and fodder yield from winter fodder crops recorded from multiple cuts in Chak no 74/SB

Treatment	Germination (%)	Plant Height(cm)	Root:shoot	GFY (t/ha) in 4-5 cuts	Total GFY (t/ha)
T1: Berseem	85.25	33.08, 42.30, 37.50, 39.10, 32.25	1:2.43, 1:3.20, 1:2.10, 1:1.90, 1:1.80	26.50, 37.50, 42.25, 38.50, 28.40	171.2
T2: Oats	92.24	110.34	1:5.43	97.6	97.6
T3: Berseem +oats	86.63 + 88.89	30.94, 42.40 + 72.89, 35.50+ 52.40, 39.40, 27.80	1:2.40, 1:3.65 + 1:4.35, 1:3.20 +1:3.25, 1:2.40, 1:1.75	22.10, 71.30, 62.30, 38.00, 25.25	219.0
T4: Berseem local	84.22	41.11	1:2.75, 1:3.75, 1:3.40, 1:2.25	18.00, 28.00, 32.00, 19.50	97.5
T5: Oats local	87.65	89	1:4.25	70.30	70.3

Table 10. Germination, morphological characteristics and fodder yield from winter fodder crops recorded from multiple cuts in Chak no 105/SB

Treatment	Germination (%)	Plant Height(cm)	Root:shoot	GFY (t/ha) in 4-5 cuts	Total GFY (t/ha)
T1: Berseem	89.35	35.88, 46.35, 48.25, 34.40, 20.35	1: 3.10, 1:3.35, 1:2.70, 1:2.90, 1:1.80	22.80, 37.80, 42.75, 39.30 26.40	169.1
T2: Oats	92.24	108.34	1:5.33	106.6	106.6
T3: Berseem + Oats	88.63 + 84.89	38.94, 45.50 + 75.90, 38.50+ 56.00, 34.40, 24.60	1: 2.55, 1:3.40 + 1:4.22, 1:3.10 + 1:3.80, 1:2.34, 1:1.15	25.50, 81.33, 58.40, 35.00, 25.00	225.2
T4: Berseem local	83.22	39.11, 42.00, 36.00, 21.00	1: 3.55, 1:3.54, 1:2.54, 1:1.20	15.40, 27.00, 24.50, 21.20 12.50	100.6
T5: Oats local	78.65	71.66	1:4.10	66.8	66.8

Subactivity 2: Green fodder selling enterprise

Green fodder obtained from different treatments was sold to the nearest town market and to other livestock keepers within the village. The maximum net income from the sale of green fodder to the town market in Chak No. 74/SB was received from the berseem and oats mixture (134,363 Rs/ha) followed by improved berseem variety (98,531 Rs/ha) whereas the lowest income (21,850 Rs/ha) was obtained from the sale of local oats (Table 11). The same trends were observed in Chak 105/SB with only small differences in net income per ha (Table 12).

Table 11. Income (Rs) from sales of green fodder to the town market in Chak No. 74/SB

Treatment	Crops	Total expenditure per ha	GFY (t/ha)	Gross Income per ha	Net Income per ha
T1	Berseem	31369	173	129900	98531
T2	Oats	30875	98	73200	42325
T3	Berseem + Oats	29887	219	164250	134363
T4	Berseem local	22675	98	73125	50450
T5	Oats local	30875	70	52725	21850

Table 12. Income (Rs) from sales of green fodder to the town market in Chak No. 105/SB

Treatment	Crops	Total expenditure per ha	GFY (t/ha)	Gross Income per ha	Net Income per ha
T1	Berseem	31369	169	126750	95381
T2	Oats	30875	106	79500	48625
T3	Berseem+ Oats	29887	225	168750	138863
T4	Berseem local	22675	100	75000	52325
T5	Oats local	30875	66	49500	18625

For the green fodder sold to livestock holders in both villages prices were set per canal (0.05 ha). Despite the fact that by selling fodder to the neighboring farmers, the costs for cutting, loading and transportation were saved, this practice generated lower income than selling in the market in both villages (Table 13 and 14). However, the same trends in incomes generated from the different forages were observed for selling within the village as for selling to the town market in both villages.

Although the income earned from the sale of green fodder to the town market was much higher than compared to sales in the village, the farmers prefer to sell the fodder to the neighboring livestock producers because of lack of facilities and the extra labour involved in cutting, loading and transportation when selling to the town market.

Table 13. Income (Rs) from selling green fodder to livestock keepers in the village Chak No. 74/SB.

Tr.	Crops	Total expenditure/ ha	Sale Rate/ Kanal (0.05 ha)	Gross Income/ha	Net Income / ha
T1	Berseem	17043	3500	69160	52117
T2	Oats	17043	2000	39520	22477
T3	Berseem+ Oats	17537	3700	73112	55575
T4	Berseem local	12795	2000	39520	26725
T5	Oats local	17043	1000	19760	2717

Table 14. Income (Rs) from selling green fodder to livestock keepers in the village Chak No. 105/SB

Treatments	Crops	Total expenditure/ ha	Sale Rate/Kanal (0.05 ha)	Gross Income/ ha	Net Income/ ha
T1	Berseem	17043	3100	61256	44213
T2	Oats	17043	1800	35568	18525
T3	Berseem + Oats	17537	3400	67184	49647
T4	Berseem local	12795	1600	31616	18821
T5	Oats local	17043	1000	19760	2717

Subactivity 3. Village seed production of improved winter crop varieties

During winter 2007, four farmers in each of the two villages with an area of one acre each were selected and provided with seeds of improved berseem and oats for seed multiplication. Thus, in each village four acres were sown to produce the seeds of improved fodder crop / varieties for sustainable seed production and making seeds locally available. In Chak No. 74/SB 160 kg berseem seed and 1100 kg oats seed were produced which will be sufficient to plant an area of 53 and 69 acres of berseem and oats respectively in the coming season (Table 15). Similarly, 220 kg of berseem and 1300 kg of oats seed were produced in Chak No.105/SB, sufficient for an area of 73 and 81 acres of berseem and oats respectively (Table 16).

Table 15. Seed produced on farmer's field at Chak No.74/SB

Crop	Area sown	Seed produced	Seed yield/acre	Seed sufficient for an area of
Berseem	2 acre	320 kg	160 kg	53 acres
Oats	2 acre	2200 kg	1100 kg	69 acres

Table 16. Seed produced on farmer's field at Chak No.105/SB

Crop	Area sown	Seed produced	Seed yield/acre	Seed sufficient for an area of
Berseem	2 acre	440 kg	220 kg	73 acres
Oats	2 acre	2600 kg	1300 kg	81 acres

The net income received from berseem and oat seed production was Rs 91637/acre and Rs 49480/ acre from oats seed at Chak 74/SB (Table 17) while the income in Chak 105/SB was Rs 98553/acre and 61832 Rs/acre from berseem and oats crops respectively (Table 18).

Table 17. Income from oat and berseem seed crop at Chak No.74/SB

Crop	Price /kg (Rs)	Seed Yield / acre	Income/acre (Rs)	Expenditures/ acre (Rs)	Net income/ acre (Rs)
Berseem	100	395 kg	39520 (seed) 69160 (fodder)	17043	91637
Oats	25	2717 kg	67925	18440	49480

Table 18. Income from oat and berseem seed crop at Chak No.105/SB

Crop	Price /kg (Rs)	Seed Yield / acre	Income/acre (Rs)	Expenditures/ acre (Rs)	Net income/ acre (Rs)
Berseem	100	543 kg	54340 (seed) 61256 (fodder)	17043	98553
Oats	25/-	3211 kg	80275	18440	61832

Subactivity 4: Hay production from winter crops

Hay making was carried out with seven farmers with an area of 16 canal (0.81 ha) of berseem and 18 kanals (0.91 ha) of Oats in Chak 74/SB and with six farmers having an area of 9 canal (0.46 ha) of berseem and 12 kanals (0.61 ha) of oats in Chak 105/SB. The results showed that out of 353 t green fodder of berseem 64 t hay were produced in Chak 74/SB; in the case of oats, 36 t of hay were produced from 128 t green fodder (Table 19). In Chak 105/SB 20 t berseem and 16 t of oat hay were produced from 77 and 47 t of green fodder respectively (Table 20). Oats produced a higher percentage of hay compared to berseem crop.

Table19. Hay making from oat and berseem at different farmers' fields in Chak no.74/SB

Crop	Area harvested (Kanals)	Green fodder yield		Hay yield (tonnes)
		Yield (t/ha)	Total yield (t)	
Berseem	6	170	127	24
Berseem	5	176	110	19
Berseem	5	185	116	21
Oats	7	80	70	19
Oats	5	96	60	17
Oats	3	90	34	10
Oats	3	90	34	9

Table 20. Hay making from oat and berseem at different farmers' fields in Chak no.105/SB

Crop	Area harvested (Kanals)	Green fodder yield		Hay yield (tonnes)
		Yield (t/ha)	Total yield (t)	
Berseem	4	162	33	8
Berseem	3	170	26	7
Berseem	2	181	18	5
Oats	5	70	18	6
Oats	4	86	17	6
Oats	3	76	12	4

Subactivity 5: Fodder crop production for the lean period in May and June

December and January in winter as well as May and June in summer are considered lean fodder months during the year round. To address the problem of summer lean period, three fodder crops Maize, Sorghum-Sudan grass hybrid, Mott grass and the local variety of sorghum as control were sown during the month of March with ten farmers selected each in village 74/SB and 105/SB, to evaluate the performance of these forage crops under irrigated conditions of Sargodha.

Treatments	Crops
T1	Improved Maize crop variety
T2	Improved sorghum-sudan grass hybrid variety
T3	Improved Mott grass variety
T4	Local sorghum variety

The experiment showed that in both villages Mott grass produced a highest green fodder yield (average of 133 t/ha) followed by sorghum-sudan (S-S) hybrid (80 t/ha, Table 21). The lowest green fodder yield of 32 t/ha was produced by local sorghum. Maize and sorghum produced one cut only whereas Mott grass and S-S hybrid gave multi cuts and thus produced higher yields than the single

cut crops. It is important to note that the records for comparison of green fodder yield were taken in the same period of time namely July to August.

Table 21. Germination and green fodder yields of summer fodder crops in both villages

Treatment	Crop	ChakNo.74/SB		ChakNo.105/SB		Average	
		Germination (%)	GFY (t/ha)	Germination (%)	GFY (t/ha)	Germination (%)	GFY (t/ha)
T1	Maize	85.3	72	78.4	62	81.8	67.0
T2	S-S hybrid	88.2	85	65.3	74	76.8	79.5
T3	Mott grass	86.6	125	84.7	141	85.6	133.0
T4	Local Sorghum	84.2	35	77.2	28	80.7	31.5

The net income calculated for the different fodder crops showed that the income received from the sale of S-S hybrid was higher than for all other crops (Table 22). Maize generated the second highest net income while among the tested improved crops the lowest income was received from Mott grass fodder, the highest yielding species.

Table 22. Income (Rs) from sale of green fodder from different summer fodder crops

Treat-ment	Crop	Price/canal	Income/Acre	Exp/Acre	Net income/ acre
T1	Maize	2000	16000	7000	9000
T2	S-S hybrid	3200	25600	8000	17600
T3	Mott grass	1250	10000	4000	6000
T4	Local sorghum	600	4800	4000	800

Subactivity 6: Evaluation of summer fodder crops in 2008

During July-August (summer) fifteen farmers with an area of one acre each were selected from both villages and were provided with seeds of improved fodder crop varieties such as sorghum, pearl millet, maize and cowpeas for planting in pure stands and as cereal-legume mixtures. The total area in each village for improved fodder production was 15 acres and an additional 15 farmers participated as control also with an area of almost fifteen acres.

Treatments	Crops
T1	Sorghum + Pearl millet + Maize + Cowpeas
T2	Sorghum+ Pearl millet
T3	Maize alone
T4	Sorghum local

In the two villages the germination rate ranged from 80-92 %; the plant height ranged from 132-282 cm in sorghum, 225-257 cm in pearl millet, 182-196 cm in maize and 95-116 cm in cowpeas depending on the treatment (Table 23 and 24). As to be expected better crop establishment and greater plant heights resulted in higher green fodder yields. The highest green fodder yield of 104 and 92 t/ha in Chak 74/SB and 105/SB respectively was obtained a mixture of sorghum + millet + maize + cowpea followed by sorghum + pearl millet (78 and 74 t/ha). The lowest yields of 52 and 42 t/ha in Chak 74/SB and 105/SB respectively were obtained from farmer's variety and practice. The yields from mixed crops were higher than from pure stands. The mixture of cereal and legumes produced 29% higher yields than the mix of cereals, which is probably the result of nitrogen fixation by the legume crop benefiting the companion crops.

Table 23. Germination, plant height and green fodder yield in Chak No. 105/SB

Treatment	**Crop**	**Germination (%)**	**Plant height (cm)**	**GFY (t ha^{-1})**
T1	Sorghum + Pearl millet + Maize + Cowpeas	92	272+235+182+116	104
T2	Sorghum + Pearl millet	90	282+238	78
T3	Maize alone	91	182	72
T4	Sorghum (farmer's practice)	86	132	52

Table 24. Germination, plant height and green fodder yield in Chak No. 74/SB

Treatment	Crop	Germination (%)	Plant height (cm)	GFY (t ha^{-1})
T1	Sorghum + Pearl millet + Maize + Cowpeas	87	267+225+174 +95	92
T2	Sorghum + pearl millet	90	277 + 257	74
T3	Maize alone	85	196	66
T4	Sorghum (farmer's variety and practice)	80	132	42

Subactivity 7: Seed production for summer crops

In addition to fodder yield trials, an area of four acres in each village was planted for seed production of improved varieties. During summer 2008, four farmers each in 74/SB and 105/SB were provided with seed of improved varieties of sorghum, pearl millet, cowpeas and maize in order to increase the seed availability in the villages and to motivate the farming community toward sustainable seed production. In Chak 74/SB,161 kg sorghum seed, 240 kg pearl millet seed, 1000 kg maize seed and 450 kg cowpea seed were produced which will be sufficient for sowing of 20, 50, 25 and 28 acres of sorghum, pearl millet, maize and cowpeas respectively in the next summer season, available at the farmers' door step (Table 25). In Chak105/SB, 160 kg sorghum seed, 135 kg pearl millet seed, 585 kg maize seed and 169 kg cowpeas seed were produced sufficient for areas of 20, 27, 15 and 11 acres of sorghum, pearl millet, maize and cowpeas respectively (Table 26).

Table 25. Seed Produced in village Chaka No.74/SB from different summer fodder crops

Crop	Area sown	Seed produced	Seed yield/Acre	Seed sufficient for area of
Sorghum	3 canal	161 kg	430 kg	20 Acres
Pearl millet	4 canal	240 kg	480 kg	50 Acres
Maize	8 canal	1000 kg	1000 kg	25 Acres
Cowpeas	6 canal	450 kg	600 kg	28 Acres

Table 26. Seed Produced in village Chaka No.105/SB from different summer fodder crops

Crop	Area sown	Seed produced	Seed yield/Acre	Seed sufficient for area of
Sorghum	4 canal	160 kgs	320 kegs	20 Acres
Pearl millet	4 canal	135 kegs	270 kegs	27Acres
Maize	6 canal	585 kegs	780 Kgs	15 Acres
Cowpeas	3 canal	169 kegs	450 Kgs	11 Acres

Subactivity 8: Winter fodder crops in the season 2008/2009

During Winter 2008/2009, twenty one farmers selected in 74/SB and eighteen farmers in 105/SB were provided with seeds of improved fodder crop varieties such as berseem and oats for planting an area of 15 acres in each village for seed multiplication. Similarly, ten farmers in each village were provided seed of berseem and oats for hay making over an area of ten acres in each village. The winter fodder crops were planted in October/November 2008.

Treatments	Crops
For Seed production	
T1	Improved Berseem
T2	Improved Oats
For Hay making	
T1	Improved Berseem
T2	Improved Oats
T3	Improved + Oats

All treatments showed satisfactory germination (Table 27).

Table 27. Germination recorded in winter fodder crops at both project sites in Sargodha

Treatments	Crops	Germination (%)		
For Seed production		Chaka No. 74/SB	Chaka No. 105/SB	Av. of both villages
T1	Improved	93	92	93
T2	Improved Oats	95	88	92
For Hay making				
T1	Improved	89	91	90
T2	Improved Oats	91	93	92
T3	Improved + Oats	94	96	95

2.3 Theme 3: Livestock Productivity

Rainfed research site, Lodhay village

2.3.1 Activity 3: Evaluation of effect of feeding improved fodder crop varieties and concentrates on milk yield and quality in buffalos and cows and on meat production

Location: Lodhay village, Tehsil Gujar Khan

Objective:
The objectives are:

- to assess the effect of feeding improved fodder crops compared to local fodder crops on milk production of buffalos
- to balance the ration for livestock through concentrates, low cost and rich in protein.
- to asses the effect of different rations on fat percentage and SNF
- to asses the effect of different improved fodder crops concentrates on fattening of meat animals.

Subactivity 1: Feedlot fattening of buffalo and cattle calves

This activity was carried out with 14 farmers. Fattening with conventional concentrate was compared with an improved concentrate mixture using locally available feed ingredients. Measurements taken were feed intake, weight gain and net benefits. No significant differences in net benefits were found. We assume that might have been due to the fact that the improved concentrates were fed to both test and control animals as the treatments were compared within farms.
As the farmers showed a high interest in this activity the experiment will be repeated during February-March 2009 but this time control and experimental animals will be kept by different farmers.

Subactivity.2: Feeding trial on buffalos for milk production

Lactating animals were fed with cereal-guar hay and oats-vetch during the fodder scarcity periods. The improved hay was compared with traditional roughage i.e. wheat straw. This activity was carried out with 10 farmers. Originally it was planned to include 12 to 18 farmers, but not enough farmers with suitable animals could be identified. Feed intake, milk production and costs of feed taken were assessed. The improved feeding led to an additional net income of about US$1 per head per day.

An additional experiment with lactating animals kept by 13 farmers compared conventional concentrates with an improved concentrate mixture. Feed intake, milk production, costs and benefits were measured. The improved feeding led to an extra income of about US$1.25 per head per day. However, there were some doubts about the results as again some control animals may have received improved concentrates. The activity will also be repeated during the month of February to March 2009.

The data from all feeding experiments conducted in the project still need to be fully statistically analyzed to complete the full technical report on feeding experiments. Perception of the farmers on activities 3.1 and 3.2 were documented through Activity 1.2.

2.3.2 Activity 4: Adding value to livestock products through preservation and processing of milk

Objective:
The specific objective is to disseminate options for market oriented milk production with regard to milk quality and value added dairy products through improved milk hygiene, milk preservation and milk processing.

Subactivity 1: Survey on price structure of milk and yoghurt

At the start of the project the milk price was Rs. 20 to 22 (paid to the farmers /producer by the middleman in the vilalge) which increased to Rs. 23 to 24 per liter in winter 2007-08. By March/April 2008 there was a further 10 to 15% increase in the price paid to the farmers for raw milk. By August/September 2008, the price of raw milk was Rs. 28 to 30 per liter, and in December 2008 the price had increased to Rs. 30 to 34 per liter. Price for the yoghurt, called Dahi, was between Rs. 30 and 35 per kg in the nearby town market in winter 2007/2008; in summer 2008 the price of yoghurt sold by big national or multinational was Rs. 68 to 80 per kg.
As price of raw milk has been steadily increasing, there is relatively little interest of the farmers in commercial value addition activities. Also there are technical problems as required premises with power, water and gas connection are not available. However, the women are interested in training on preparation of dairy products for their own consumption and the village market.

Subactivity 2: Hygienic Milk Production and Mastitis Control Program

The facilitator in Lodhay was specifically trained in the use, application and interpretation of California Mastitis Test (CMT) kits. The kits are being used in the project area for the purpose of identifying udders or udder quarters infected with subclinical mastitis (SCM) on regular basis. Presently 11 farmers are participating in this activity with a collective herd size of about 75 animals (Table 28); the test is being regularly performed on 30 to 35 lactating animals to assess the effect of teat dips. About 60 to 70% animals, especially buffaloes, have been found positive for SCM (mild to moderate) in one or two quarters. The incidence of SCM is lower in cows (40 to 50 % of the animals).

Table 28. Farmers and their animals under CMT program to detect SCM.

S #	**Farmers**	**Cow**	**Buffalo**	**Total**
1.	Amar Sajjad	4	7	11
2.	Liaqat	3	3	6
3.	Javed	3	2	5
4.	Muhammad Hanif (home)	-	2	2
5.	Nazakat	1	1	2
6.	Omer	2	-	2
7.	Arshad	1	-	1
8.	Shahid Mahmood	-	1	1
9.	Babar	1	-	1
10.	Ajmal Nawaz	-	1	1
11.	Amjad	-	1	1
	Total	15	18	33

Teat cups with antiseptic dips were given to 18 selected farmers (Table 29), with an overall herd size of 88 animals, to help them to prevent mastitis and improve milk quality and productivity of animals. The dips are being regularly used and the status of SCM is being monitored at specified intervals. Various practical training sessions on the use of antiseptic dips, CMT kit and clean milk production practices were held with the selected farmers (Table 30). None of animals in the “treatment group” (60 to 75 animals; the number varies due to selling/purchasing of animals) were reported clinically positive whereas three animals in the control group (30 to 40 animals) were reported positive and one quarter of the udder of each of the three animals was reported to be lost permanently. Personal hygiene of the milker has also been explained to the participants as a contributory factor to clean milk production. Eleven selected farmers were briefed about hygienic milking. They were provided with textile udder towels, of which the use was demonstrated and the impact on the milk quality was explained.

Table 29. Farmers and number of their animals under teat dip program**.**

Farmers	Teat cups	Cow	Buffalo	Total
Amar Sajjad	3	4	7	11
Liaqat	4	9	12	21
Javed	2	5	3	8
Muhammad Hanif (farm)	1	3	4	9
Nazakat	1	1	1	2
Omer	1	2	-	2
Arshad	1	1	-	1
Shahid Mahmood	1	-	1	1
Babar	1	1	-	1
Ajmal Nawaz	1	-	1	1
Amjad	1	-	1	1
Saqab Karim	1	1	2	3
Anwar Sadat	1	1	1	2
Abdul Hussein	1	1	4	5
Ameer Hussein	1	-	1	1
Wasim	1	-	1	1
Imtiaz	1	-	1	1
Irfan	1	-	2	2
Total	24	28	38	66

Five sessions were especially arranged for women on practical aspects of dairy product preparation at household level so that good quality products can be achieved. The products prepared were plain and flavored yoghurt (mango, strawberry and mixed flavors). The plain yoghurt was converted into fruit yoghurt of banana, strawberry and apple varieties. Now many households, apart from community members are relishing these quality products, particularly plain yoghurt which is being prepared on regular basis. Further to that two sessions on perception and product evaluations were also held.
A young educated farmer selected by the community received hands-on training in three sessions at the National Agricultural Research Centre in Islamabad. The training focused on pasteurization of milk and its packing, plain and flavored yoghurt preparation and marketing and analysis of economic return on these products.

Table 30. Knowledge exchange sessions with the community members of Lodhay village in 2008

Dates	Content of the session	Type of Session	Place & No. of Participants*
25/01/08	Use of CMT kit	Practical Training	Lodhay, 1M
31/01/08	Use of teat dips	Practical Training	Lodhay, 4M
14/02/08	Use of CMT kit and teat dips	Practical Training	Lodhay, 4M
28/02/08	Milk hygiene/clean milk harvesting methodology	Practical Training	Lodhay, 4M
16/04/08	Milk hygiene/clean milk harvest/ use of teat dips	Practical Training	Lodhay, 7M
18/04/08	Use of CMT kit/clean milk harvest/use of teat dips	Practical Training	Lodhay, 7M
21/04/08	Dairy product preparation / Discussion on 'Manual'	Training & Knowledge Exchange	Lodhay, 3F
03/05/08	Dairy product preparation at household level.	Practical Training & Knowledge Exchange	Lodhay, 2F; 1M
04/05/08	Dairy product preparation and its evaluation	Practical Training & Knowledge Exchange	Lodhay, 3F; 1M
18/06/08	Market visit /survey for business entry.	Knowledge Exchange / Awareness	Lodhay, 2M
29/06/08	Market linkage activity by introducing	Knowledge Exchange /	Lodhay, 2M

Dates	Content of the session	Type of Session	Place & No. of Participants*
	product samples.	Awareness	
18/07/08	Dairy product preparation at household level.	Practical Training	Lodhay, 14F
19/07/08	Dairy product evaluation by sensorial means.	Knowledge Exchange	Lodhay, 1M
23-25/07/ 2008	Commercial preparation of dairy products.	Practical Training / Knowledge Exchange	NARC, 1M
21/08/08	Awareness/perception/future vision on project activities.	Knowledge Exchange	Lodhay, 10M
24/08/08	Dairy product preparation at household level.	Practical Training / Knowledge Exchange	Lodhay, 5F
27/09/08	Perception on dairy products, its evaluation and woman dairy product enterprise etc.	Knowledge Exchange /Awareness	Lodhay, 7F
30/11/08	Milk hygiene/clean milk harvest/ use of dips	Refresher on the milk hygiene	Lodhay, 4M
30/12/08	Use of CMT kit and teat dips / milk sampling	Dip preparation / dispensing	Lodhay, 7M

*M, male and F, female; NARC, National Agricultural Research Centre, Dairy Technology Program.

Microbial quality of milk was evaluated by aerobic plate count. Fifty samples from individual animals of selected farmers were tested and the average bacterial count appeared to be around 500 thousand, ranging from 220 to 790 thousand per ml of raw milk at the time of milking.
In addition fifty-five milk samples of individual animals of selected farmers were tested for their composition. Average total solids for buffalo milk were 16.5% and fat content 6.5%; the respective figures for cow milk were 14.5% and 4.7%.

Irrigated research site, Sarghoda

Location: Chak No. 74 SB and Chak No. 105 SB villages

2.3.3 Activity 3: Evaluation of effect of feeding different fodder crop varieties (green fodder and hay/silage) and concentrates on milk yield and quality in buffalos & cows and on meat production in buffalo and cow calves

Objective
The objective was to demonstrate effect of improved feeding on productivity of livestock**.**

Activities undertaken

- Effect of feeding mix of improved summer cereals (i.e. sorghum, millet, maize) and summer legumes (i.e. cowpeas) on milk production of cow and buffaloes and meat production in cattle calves
- Improved/balanced feed obtained from local market to be feed to buffaloes and cattle.

Subactivity 1. Feeding experiment with improved summer crops in August-October 2008

In Chak no. 74/SB and Chak no. 105/SB three groups of animals were formed for the experiment: the first group was fed with green fodder from improved varieties of sorghum, pearl millet, maize and cow peas and supplemented with concentrates (balanced ration), the second was fed with green fodder from improved varieties of sorghum, pearl millet, maize and cowpeas supplemented with cotton seed cake (CSC) and the third group received fodder from local varieties and CSC.

Treatment	Feeds
1	Fodder of improved varieties + concentrate (balanced)
2	Fodder of improved varieties with cotton seed cake
3	Fodder of local varieties with cotton seed cake

The milk yield of animals in a similar lactation stage was compared. The highest daily milk yield of 8.8 liters in buffalos averaged over the two villages was recorded for feeding the balanced ration (table 31). With the ration an increase of 30.4% compared to the local feeding practice was achieved. The milk yields produced by improved fodders and CSC did not differ much (plus 7.5%) from feeding local varieties and CSC.

Table 31. Effect of feeding treatments on average daily milk yield of buffalos in both villages

Feeding group	No of animals	Av. milk yield (liters)	Increase (%)
Improved Fodder + Concentrate	29	8.67	+30.37
Improved Fodder with cotton seed cake	28	7.15	+7.51
Local Fodder with cotton seed cake	18	6.65	

The same trends were observed for the milk yields of cows; the difference between the second and the third treatment was slightly higher than for buffalos (Table 32). The milk yields of cows for all treatments were lower than for buffalos.

Table 32. Effect of feeding treatments on average daily milk yield of cows in both villages

Feeding group	No of animals	Av. milk yield (liters)	Increase (%)
Improved Fodder + Concentrate	12	6.60	+22.90
Improved Fodder var. with cotton seed cake	13	5.95	+10.80
Local Fodder with cotton seed cake	11	5.37	

The highest fat percentage (7.6%) was found in the milk of buffalos fed with the balanced ration followed by the improved fodder and CSC while local fodder and CSC showed the lowest fat content (Table 33).

Table 33. Effect of feeding treatments on average milk fat content of buffalos in both villages

Feeding group	No of animals	Fat (%)	Increase (%)
Improved Fodder + Concentrate	29	7.55	+20.60
Improved Fodder with cotton seed cake	28	6.48	+3.51
Local Fodder with cotton seed cake	18	6.26	

Subactivity 1. Feeding experiment with improved winter crops (berseem-oats) in January-March 2008

In both villages Chak No. 74/SB and 105/SB, three groups of animals were formed for the experiment: the first group was fed with green fodder of improved berseem and oats and supplemented with concentrates (balanced ration), the second group was fed with green fodder of improved varieties of berseem and oats and CSC and the third with local fodder varieties and CSC.

Treatment	Detail
1	Fodder of improved berseem and oats varieties plus concentrate (balanced ration)
2	Fodder of improved berseem and oats varieties plus cotton seed cake
3	Fodder of local berseem and oats varieties with cotton seed cake

As for the summer crops the highest milk yields in buffalos and cows were produced with the balanced ration of improved varieties plus concentrate (Table 34 and 35). While the treatment with improved varieties and CSC increased the milk yield in buffalos compared to local varieties and CSC, there was no difference in the milk yield in cattle.

Table 34. Effect of feeding treatments on average daily milk yield of buffalos in both villages

Feeding group	No of animals	Av. milk yield (liters)	Increase (%)
Improved fodder + concentrate (balanced)	29	9.79	+33.13
Improved Fodder with cotton seed cake	28	7.98	+8.50
Local Fodder with cotton seed cake	18	7.35	

Table 35. Effect of feeding treatments on average daily milk yield of cows in both villages

Feeding group	No of animals	Av. milk yield (liters)	Increase (%)
Improved fodder + concentrate (balanced)	22	11.45	+32.7
Improved Fodder Var. with cotton seed cake	13	8.63	-0.5
Local Fodder with cotton seed cake	11	8.67	

The highest fat content (7.5%) was found in the milk of buffalos fed with the balanced ration in Chak 105/SB followed by the improved fodder and CSC while local fodder and CSC showed the lowest fat content (6.3%), but the difference of local to improved varieties was only small (Table 33).

Table 36. Effect of feeding treatments on average milk fat content of buffalos in Chak No. 105/SB

Feeding group	No of animals	Fat (%)	Increase (%)
Improved fodder + concentrate (balanced)	15	7.48	+18.73
Improved Fodder Var. with cotton seed cake	16	6.65	+4.56
Local Fodder with cotton seed cake	10	6.30	

2.3.4 Activity 4: Adding value to livestock products through preservation and processing of milk

Objective:
The specific objective was to train village women groups in milk processing to produce high quality dairy products.

Activities:
Two female MSc students of the Dairy Technology Unit of the University of Faisalabad are responsible for building capacity at village level on milk processing and value addition of dairy products. In both villages, Chak No. 74SB and Chak No. 105 SB, the women associations have about 15 official members with an equal number of interested women attending the groups' meetings. They are not officially "registering" as part of the member group, mainly because of time constraints. The majority of women attending the group have low education. The trainings were carried out in two periods, i.e. during the months of February-May and August-October 2008. The required ingredients and processing methods have been well described.
The two village groups are able to produce a number of cottage-made dairy products that were chosen based on the interest of the women:

1. Flavored Milk (Chocolate)
2. Condensed Milk (Khoya)
3. Cottage Cheese
4. Whey Healthier
5. Peanut Butter
6. Yoghurt

An organoleptic assessment through visual examination, feeling and smelling during the supervision mission judged the products as more than satisfactory.

The trainers have been focusing their efforts on improving women's knowledge of safe collection, handling and processing of milk. The main bottleneck to generate cash income from this activity is finding sustainable market channels. The products are currently marketed by the husband or a male representative of the family who find it difficult to find customers and achieve good prices.

2.4 Theme 4: Knowledge exchange

Rainfed and irrigated sites

2.4.1 Activity 5: Enhancing knowledge exchange for increased feed and livestock production

Objectives:

- To disseminate fodder production technology among the farmer community
- To motivate the farmers to adopt improved varieties and improved agronomic practices
- To get feed back from the farmer community so that the problems can be solved.

Activities undertaken:

- On the job training of participating farmers in fodder crops production, hay making and feeding at both project sites
- One field/demonstration day organized by the project in Lodhay village was attended by the community members to discuss the interventions
- One formal and one informal training course on improved fodder varieties and production technologies during the reporting period including lectures and discussions were conducted in Lodhay village
- Two formal and about ten informal training courses on livestock feeding and productivity in general were held in Lodhay
- Formal and informal training of farmers and women groups in hygienic milking and value addition (increasing shelf life, dairy processing techniques) at both project sites (see Activity 4)
- Networks of collaboration have been developed at each site with different institutes working on fodder crops, livestock and dairy processing; monthly meetings of the project team are conducted
- Graduate students from socioeconomics, agronomy and dairy technology were involved in the project activities.
- Contacts with private seed companies and the Punjab Seed Corporation were established to improve fodder seed supply.
- The annual progress report was submitted in March 2009

The training courses for scientists (forage evaluation; integrated crop livestock production; experimental design and analysis; and scientific writing, reporting and data presentation) planned for the second half of 2008 were not conducted due to security problems in Pakistan and lack of skilled trainers.

3 Regional Activities

3.1 Activity 1: Regional (across site) analysis for Theme 1 "Socioeconomics" in Central Asia

The following milestones were foreseen for the reporting period in 2008 (please compare second annual progress report):

- Compile cross country data and fully document for analysis in English (data set available) by 30 July 2008
- Draft cross country analysis available by 30 November 2008

The conduction of the producer survey took longer than expected; the full datasets were available by September 2008. The analysis is still ongoing.
To support the cross-country analysis, originally three master students started to work on activities under Theme 1, two from Kazakhastn and one from Kyrgyzstan. However, the Kyrgyz student did not continue (compare Theme 4 under Central Asia).

3.2 Activity 2: Capacity building: training of scientists in the area of integrated feed resources and livestock production at ICARDA and in the countries

Expected outputs in 2008 were:

- 1 month GIS training for three Tajik researchers at ICARDA in November 2007
- POs for Theme 2 and 3 trained in research methods and analysis for 15 days end 2007 or beginning 2008
- Training of PhD and master students writing their thesis on project related topics, will be scheduled when all students have been recruited
- Training courses on experimental design and analysis, and scientific writing and data presentation course training course for participating scientists in Pakistan
- Liba Brent (University of Wisconsin) will work with the Tajik team on value addition to fibre production through improved local processing and Joaquín Mueller from INTA, Argentina, will work with the Kyrgyz and Tajik teas on community based breeding schemes.

The second annual progress report stated that the training on GIS had to be postponed because funding by IAEA for two of the three Tajik researchers could not be obtained in 2007. In 2008 the director of the Tajik Soil institute changed and the GIS training was no longer a priority of the institute. Thus, the plan of training scientists of the soil institute on GIS was abandoned. Instead GIS based analysis on rangelands will be provided through Mounir Louhaichi, ICARDA rangeland scientist who has started to support the rangeland activities of the project since October 2008.
As stated in the second annual progress report the Professional Officers (PO) for Theme 2 and 3 received individual training at ICARDA HQ from 13-24 January 2008. The POs for Theme 2, Aziz Nurbekov visited ICARDA a second time in October 2008 to be trained on analyzing the forage related experiments. Key scientists in Central Asia involved in the project will be trained on the job. He also received a first introduction to the new techniques of rangeland assessment by Mounir Louhaichi which was repeated in the field in both sites in Tajikistan after the regional workshop in November 2008.
Instead of conducting formal training courses for the students in Central Asia and Pakistan, the students are co-supervised and supported by the POs in Central Asia. In Pakistan the socioeconomic students are being trained by Dr. Azeem Khan from PARC and professors from the University of Faisalabad and Rawalpindi, and the students involved in Theme 2 by Dr. Ansar, University of Rawalpindi.
Liba Brent continued working closely with the Tajik scientists and one PhD student on activity 16 at the Khojand project site and visited the site from 16 April-May 2008 and 7 October-12 November 2008. Joaquín Muller visited the project sites in Kyrgyzstan and in Khojand/Tajikistan from 25 October to 16 November 2008. He supervised the data collection and developed detailed plans for 2009 jointly with scientists and farmers for activities 10, 11 and 15 at each site.

3.3 Activity 3: Capacity building: English training of scientists to improve the international scientific exchange

The activity was conducted as planned anfd has been described in the Second Annual Progress Report.

3.4 Activity 4: Project supervision and interregional knowledge exchange: regional workshops and SCM

The expected outcomes were:

- SCM to be held in November or December 2008 in one of the participating countries or at ICARDA.
- At least one supervision visit of all PIs in both regions

The regional workshop discussing project results in Central Asia and Pakistan (25 November) and the second SCM on project planning and implementation (26 November) were conducted in Dushanbe/Tajikistan as Islamabad was not considered as safe. On the way to Dushanbe most participants took part in the field day in Khojand on 24 November. On 27 November a second field visit was arranged to the Dushanbe site.
The progress implementation in Central Asia was monitored by frequent visits of POs at strategic times in all three countries. The POs are being supervised and backstopped by ICARDA scientists who also visited the project sites. Aden Aw-Hassan visited Pakistan in April 2008 to develop the plan for socioeconomic evaluation jointly with the Pakistani counterparts. He and Mounir Louhaichi attented the regional workshop and the SCM to discuss project progress with all counterparts. Mounir Louhaichi (rangeland scientist) also visited the rangeland sites in Khojand and Dushabe after the workshop together with the project coordinator, Aziz Nurbekov and the principal investigator. The project coordinator visited Central Asia and Pakistan three times in 2008. She also presented ICARDA's livestock research in Central Asia at the International Conference "Agricultural Research Competence for Central Asia and the Caucasus – 10 years of CAC Program 1998-2008 on 16 September 2008 in Tashkent.
In addition the IFAD supervision mission, conducted from 13-28 April 2008 in Kyrgyzstan, Tajikistan and Pakistan, has evaluated the achievements of the project and made important recommendations (see IFAD Grant 816 Supervision report by Dr Antonio Rota for further information). The recommendations were used to amend the planned project activities in 2008/2009.

3.5 Activity 5: Web based knowledge exchange (Virtual information Center)

The training of resource persons in the partner institutes in Central Asia was completed during 2008. However, so far the training in Pakistan has not taken place due to the security situation in the second half of 2008. The project webpage (www.icarda.org/cac/livestock.asp) has been considerably improved by Sherzod Kosimov, our web designer in Tashkent office, however, the interactive spirit has not yet been achieved which is also due to the very limited capacity of the partner institutes except the veterinary branch of the Kyrgyz livestock institute. Liba Brent has been working on a special webpage for the activities related to value addition (adventureyarns.com) where she plans to include videos and other information. She has worked with Sherzod on her webpage during her stay at Tashkent in April 2008) to improve and integrate it into the project website.

III Problems during the reporting period and steps taken to remedy these problems

Central Asia

The quality of the annual progress reports has improved considerably due to the close interaction of the Professional Officers based in Tashkent office with our nation collaborators. Nevertheless, there are still delays and complications related to the translation from Russian to English.

Experimental designs are not always followed although they were clearly described in the agreed workplans and discussed in the planning meetings. In particular, the comparison between flocks with improved management and control flocks has not been implemented as planned (Activity 9, 11, 17).

Despite our efforts we have not been successful to integrate young scientists on Theme 2 Range and Forage production into our project activities in Central Asia.

Furthermore extreme weather conditions, such as long extremely cold winter in Tajikistan in 2007/2008, flooding in Akdala village/Kazakhstan in spring 2008 and a dry summer, jeopardized some of the project activities in Theme 2 and 3 (see Second annual progress report).

Pakistan

Sartaj Khan, our project coordinator, left NARC beginning of October 2008 to work as full-time project coordinator for FAO. This left a big gap in overall project coordination and in leading the forage production theme at the rainfed site. Due to the limited project funds, no full-time coordinator can be employed. Fortunately Dr. Ansar from Arid University, the supervisor of the master students involved in our project, has kindly agreed to take over project coordination and to oversee the forage activities till the end of the project.

In the feeding experiments where improved and control feeding was practiced in the same farm, we found that the farmers may have distributed improved feeds among all animals. Nevertheless, the farmers are highly interested in these activities (see activity 1.2), and therefore the experiments will be repeated in 2009 but keeping control and experimental animals on different farms. Often fewer animals as planned in the experimental design were found suitable to be included in the on-farm experiments.

Although a high dairy product quality was achieved through intensive training of two women groups at the irrigated project site, marketing the products remains a challenge and options were thoroughly discussed in the national planning workshop. This was also identified as the main issue to be strengthened during the remaining time of the project in the supervision mission.

IV Progress expected during the following reporting period

Year 2009 is the key period for completion of data collection, analysis and reporting on the project activities. It is expected that most field activities will be completed in fall 2009. The successful completion and quality of reports depends on the continued support and personal engagement of all involved national and international scientists.

Some issues deserve special attention in 2009:

- Ensuring completion of data collection, in particular required data for economic evaluation of interventions, and sound data analysis
- Organization of field days with a range of stakeholders
- Producing training material for successful interventions
- Finalizing webpage and refresh training of responsible “webmasters” at the partner institutes in CA and Pakistan.
- Preparation of technical advisory notes (TANs) of successful interventions and aspects of project implementation.