Characteristics, management practices and peoples' preferences for local cows and exotic crossbreeds in Baltistan, Pakistan

Ghulam Raza
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(Picture in page iii shows Khaplu, study site)
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By
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A thesis submitted in partial fulfillment for the award of Master of Science in Management of Natural Resources and Sustainable Agriculture (MNRSA)

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June, 2007
Declaration

I Ghulam Raza do hereby declare the originality of my work and whole-heartedly acknowledge the use of all materials other than my own work. This work has not been submitted to any other University than Norwegian University of life Sciences (UMB) for any type of academic degree or publication.

Ghulam Raza
Signature……………………
Date………………………….
Place………………………….
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Abstract

This study explored and documented local knowledge about the characteristics, management practices and preference for local cows, which are local cattle, and Zomo (Zomo is female hybrid and is the Product of Yak cross with Local cattle) and crossbreeds of Jersey and Friesian (Product of Exotic bull of Jersey and Friesian cross with local cattle) in Khaplu, Northern Areas of Pakistan. Furthermore, the study presents information regarding the adoption of the crossbreeds and their effects on peoples’ livelihood in the area. The study was carried out in three villages of Khaplu, namely Gharbuchung (upper village), Hatchi (middle village) and Kraming (lower village). From each village 30% of the total households were randomly selected for interview. The findings of study indicated that milk production from the crossbreed cows was double that of the local cows. The market demand of crossbreed cows was also high. Crossbreeds of Jersey was the most preferred and adopted breeds compared to crossbreeds of Friesian because of relative advantages of being disease resistant, having better feeding habit and high market demand. The crossbreeds were adapted to the local conditions of management system to a certain extent, making more people in the study area to adopt them. On the other hand, their feeding habit (demand for more feed) has made the people dependent on market to buy fodder, which they considered as a major challenge for their livestock production. Nevertheless, the people in study area still favour of keeping the crossbreeds because of their high production to meet the demand of large family size in the households. High incomes due to off-farming activities and market opportunities to buy fodder also seem to favour the adoption of crossbreeds. The local breeds were perceived to have good feeding habits and quality products; especially the Zomo was most preferred because of its high quality and tasty butter. The local cattle and crossbreed of Friesian were less preferred breeds because of low production of local cattle and excessive feeding habit of Friesian.

The introduction of crossbreeds in the study area has improved the livelihoods of the people through increased production of milk and producing valuable calves. However, the population of local breeds has decreased due to continuous crossbreeding of local cattle and its offspring with exotic bull, which may lead to genetic erosion of local breeds in the study area. Given a wide range of indigenous knowledge, perceptions and preferences that the farmers have demonstrated during this study provides a room for professionals, development workers to work with these local people on balancing these two scenarios.
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1. Background
Agriculture contributes approximately 21% to the Gross Domestic Product (GDP) of Pakistan. Livestock production contributes 49% of the total GDP produced in the agricultural sector of the country. Livestock production plays an important role in rural socio-economic systems. It represents 35-40% of the total income generation of small farmers in Pakistan (Ministry of Food 2007).

Livestock production plays an important role for the livelihoods in Northern Areas of Pakistan. All farmers in the study area are involved in livestock production activities, which have a key role in household’s economy. According to AKRSP (2000), 60% of income comes from livestock and agriculture, rising up to 84% for the poorest families in Northern Area. Wright et al. (2007), stated that the socioeconomic reasons of keeping livestock in Northern Areas are milk, dung, butter, meat, transport, income, fiber, draught, and traditions. The milking cows reared traditionally in the area include, Zomo (Product of Yak crossed with Local cattle), and Local cattle, which are mainly non-descripted, breed due to high diversity. According to Wardeh (1989: cited in Khan 2003), the local cattle are relatively small sized, weighing 200-220 kilograms and on average produce 1.5 liters of milk per cow per day. According to Schure (1995), they appear to belong to the Bos taurus, with an European origin. Mannie (2004), reported that the local cattle yield on average 4 liters of milk per cow per day. Most of the local cattle are small with short legs and miscellaneous colored and hairy coats. The cattle normally reach maturity at 3-4 years, but it depends on nutritional status. The milk yields are 300 kilograms per lactation. The calving interval is more than 24 months (Khan 2003).

According to Jianlin et al. (2003), the domestic Yak (Bos gruniens) is found from 2000-5000 meter above sea level (m a.s.l.) in the cold and semi humid climate of Himalayas. The study area, Khaplu, is located 2560 meter above sea level, and the Yak and its hybrids are found here as well. The male is called Yak and female is called Yakmo in the area. Zomo (female) is the product of crossing Yak with local cattle. The Zomo is fertile and produces more milk with higher fat content than local cattle and is therefore used for milk and butter production. The male hybrid is called Zo, which is sterile and is used for
draught activities or meat production. Jianlin et al. (2003), also stated that the systematic crossing of yak with other cattle has been recommended and practiced for many years, and the Yak has been crossed with common cattle (*Bos taurus*) for at least 3000 years. According to Zhang (2000), female hybrids of Yak (Zomo) are important source of milk and dairy products. These hybrids are mainly produced in the cattle producing, cold areas of Gansu and Sichuan China. First crosses between Yak and common cattle adapt well to the condition in which they are used, displaying good characteristics of both parental types, including resistance to a harsh environment and improved productivity. Backcrosses compared to cattle are less adapted to the environment and their productivity is lower than in Yaks, probably due to reduced heterosis.

In our study area, local cattle and Zomo have been well adapted to the environment for a long time. But the production of milk by both local cattle and Zomo were not sufficient for the growing population in the area. According to Oldenbroek (1999), the worldwide human population is expected to grow more than 50% until 2030. Therefore, genetic improvement of farm animal is the most viable approach to meet the increasing demand for food from animal origin. Tulachan and Neupane (1999), stated that development efforts have been geared towards improving animal breeds to increase incomes and improve the living standards of mountains farmers through white revolutions. The following section presents one of such efforts.

1.1. Introduction of improved exotic bull in the study area

Aga Khan Rural Support Programme (AKRSP) introduced the improved exotic bull of Jersey and Friesian in the study area for crossbreeding with local cattle to increase the milk production through genetic improvement. Aga Khan Rural Support Program (AKRSP) is a private non-governmental organization (NGO) established by the Aga Khan Foundation, to help and improve the quality of life of the people of Northern Areas of Pakistan. The Program started to work in Northern Areas of Pakistan in December 1982 as an integrated rural development program. In 1986, the AKRSP started its work in

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1 Heterosis is the increased strength of different characteristics in hybrids.
Gilgit and Baltistan. Currently, it is working in all six district of Northern Areas (AKRSP 1996).

AKRSP has made efforts to increase the productivity of animals both for subsistence consumption and for market sale through the genetic improvement program, which involves the crossbreeding of local cattle with improved exotic bull of Jersey and Friesian (AKRSP 1996). The improved exotic bulls were introduced by AKRSP in Baltistan, in Skardu district, from 1989. But in Khaplu the first improved exotic bull was introduced in 1994, in different village organizations (Vos\(^2\)).

Since the introduction of improved exotic bulls of Jersey and Friesian in the study area, most of the people crossed their local cattle with the improved exotic bull. As a result, the crossbreeds of Jersey and Friesian are produced which are adopted by the people in the area. The people praise these crossbreeds for their relative high milk production but some farmers have not adopted the crossbreeds. This study has investigated the adoption and non-adoption of crossbreeds, through the study of their characteristics, management practices, and preferences of people towards these crossbreeds\(^3\) (Jersey and Friesian), and local breeds\(^4\) (Zomo\(^5\) and Local cattle). The study has also examined the effects on local breeds and the subsequent impacts on livelihoods of people due to the introduction of crossbreeds in the study area.

1.2. Significance of study

The study is important as it identifies the reasons of adoption and non-adoption of crossbreeds in the study area, and helps to understand the actual need of people and their preferences for the different breeds based on their characteristics and management practices. The study also shows the effects on local breeds (Local cattle and Zomo) due to adoption of crossbreeds, which is important for the conservation of local breeds in future.

\(^2\) Vos means the village organization formed by AKRSP in different villages. All the interventions and different activities are carried out through this village organization in villages.

\(^3\) Crossbreeds or crossbreed cows in this study means exotic crossbreeds of Jersey and Friesian (which is product of crossing between exotic bull of Jersey and Friesian with Local cattle), which is also referred to Jersey, and Friesian in this study.

\(^4\) Local breeds or local cows referred to Local cattle and Zomo.

\(^5\) Zomo is also crossbreed of Local cattle with Yak but in this study it is referred by its name Zomo.
It also shows the impact of breed improvement program in area for the livelihoods and the challenges that arise from the introduction of crossbreeds. All these are important for the future planning of the government and NGOs in running breed improvement programs in the area and for other intervention activities conducted to improve agricultural production and consequently the livelihoods of the local people.

1.3. Objectives and Research questions

- To study the characteristics, management practices and preferences to the local breeds and cross breeds.

1. What are the characteristics of local breeds and crossbreeds?

2. What different production and management practices used or persist for the local and crossbreeds?

3. What are local peoples’ preferences between local breeds and crossbreeds?

- To understand the reason of adoption and non-adopt of crossbreeds in the study area, and their consequences on livelihoods.

4. Why are crossbreeds adopted or not adopted by the people in the area?

5. How adaptive are the crossbreeds to the climate and feed availability in the area?

6. What changes have come on livelihood of the local people due to introduction of crossbreeds in the study area?

- To study the effects on local breeds due to adoption of crossbreeds in the area.

7. What are the effects on local breeds due to introduction of crossbreeds in the study area?
2. Study Area

2.1 Northern Areas of Pakistan

The Northern Areas of Pakistan has an area of 72496 km² and an estimated population of 1.5 million inhabitants. It has six districts namely Gilgit, Diamer, Ghizer, Astore, Skardu, and Ghanche (Wikipedia 2007b). The Northern areas of Pakistan have been isolated from rest of the country until the construction of Karakorum highway in 1982. The highway crosses the Northern Area from north to south connecting Islamabad with China and other important cities in Northern Areas. Due to this highway the Northern Areas has opened up both for trade and tourism, and more interactions became apparent with the rest of Pakistan (Mannheim & Winter 1999). The Skardu and Ghanche districts are called Baltistan, where the local language is Balti. Baltistan is a land of towering mountains and has the world second highest peak of mountain K-2. The Karakorum ranges lies all along its northern boundary.

The climate of Baltistan is dry and cold in winter and warmer in summer. The temperature remains below freezing point during November to February. The mean minimum and maximum temperature during the month of January are $-8^\circ \text{C}$ and $-3^\circ \text{C}$ respectively. The mean minimum and maximum temperature during the hottest month of July are about $17^\circ \text{C}$ and $31^\circ \text{C}$, respectively. The annual precipitation is 198 mm (Government of Pakistan 2001).

Most of the people in the area are engaged in subsistence agriculture and livestock farming. The average land holding size is 0.21 acre as compared to the national average of 11.5 acre. The average household size is 7.5. The cattle population in Baltistan is 106867 (Government of Pakistan 2001).
2.2. Study site

The study site Khaplu, is located 35° 10' 0 North, 76° 19' 60 East, at 2,560 meter above sea level. It is the capital town of the Ghangche district of Northern Pakistan and lies 103 km east of Skardu town. The total population of the district is 88366 inhabitants (Wikipedia 2007a). The population of Khaplu is 11000 inhabitants and 1840 households (AKRSP 2006).


Figure 1: Map of Ghanche district showing the study site, Khaplu.
3. Methodology

3.1. Site selection
The study site Khaplu was selected, because all the people in Khaplu are involved in subsistence farming activities including livestock rearing and have a good indigenous knowledge about livestock. The people in this valley also have different types of breeds of our research interest such as local cattle, Zomo, cross breeds of Jersey and Friesian. Furthermore AKRSP has been working in Khaplu for breed improvement program.

3.2. Sampling
Khaplu is steep flowing Ghanche stream from top to bottom and ended in Shyoke River (See picture on page iii). For the purpose of this study, the Khaplu valley was stratified transversely into three different zones according to their altitudes (upper, middle, lower zone). This was done in order to see if there are any differences in crossbreed adoptions, management practices and preferences between villages across agro-ecological variations. Village Gharbuchung (2700 m.a.s.l) from the upper zone, village Hatchi (2400 m.a.s.l) from the middle zone, and village Kraming (2100 m.a.s.l) from the lower zone were selected for the study. These villages were selected purposely because they are prominent for livestock rearing in the area and also have good knowledge about livestock rearing.

Simple random sampling was used to select households from each selected village (Bryman 2004). The upper village (Gharbuchung) consists of 76 households whereas, the middle village (Hatchi) has 75 households, 23 households were selected from each village. The lower village Kraming has 81 households and 25 households were selected for the interview, this making the total sample size 71 households. This shows 30% of sampling intensity from each village.
3.3. Data Collection

3.3.1. Primary data
The interviews were carried out by using structured and semi-structured questionnaires to collect both qualitative and quantitative data. The questionnaire had both open ended and closed ended questions (See appendix 1). The questionnaire included questions about the characteristics and management practices of the different breeds of interests and local people’s preferences for them. It also included the information about the household characteristics of the respondents such as family size, age, sex, education, occupation and number of animals owned by the respondents.

Key informants interviews were held with some “experienced livestock farmers” and AKRSP staff (See appendix 2). They were asked questions about the characteristics of local cows and crossbreeds’, management practices, and preferences for the different breeds.

To verify the information given by respondents, crosschecking was done with other respondents’ data throughout the data collection period. Doing this improved the validity and reliability of the data collected. The information given by respondents and key informants were also compared which also improved the validity and reliability of the research.

Field observations were also made to gather information and cross check.

3.3.2 Secondary data
Secondary data was collected mainly from reports of AKRSP and different offices at national, regional and district levels. Other literatures were also used for the discussion of the study.
3.4. Data analysis

All the data collected from the questionnaires were coded and entered into Microsoft Excel spread sheet. The data were analyzed by using SPSS for mean, percentages, and frequencies, for characteristics, management practices and preferences to different breeds, and effects on local breeds. The percentage of improvements on livelihoods due to introduction of crossbreeds was also analyzed. Microsoft excel was used to make graphs and tables.
4. Results and Discussion

4.1. Characteristics of sample households

The average size of a household in the study area was 10 members and the average age of the respondents was 48 years in study area. 53% of the respondents were illiterate and 14% of them had primary education (Figure 2). It was observed that the educated households had crossbreeds as compared to uneducated households. This is probably because of awareness due to education or may be the higher financial status of educated families.

![Figure 2: Educational status of the respondents](image_url)

All the households in the area were involved in subsistence agricultural farming and livestock rearing. Other economic activities included government jobs, casual labor and local businesses. About 47% of the respondents interviewed were mainly farmers, 16% of them were government employees, and 15% of them were doing business and 19% of the respondents were housewives.
The number of cows in the households on average was 2 cows in the study area (See Table 1). But according to Streefland (1995), in Khaplu valley there was 4 heads of cows on average in 1995. This indicates the population of cows seems to be decreasing. This may be because of adoption of crossbreeds, or it may be people are more involved in off farming activities.

It was observed that the households who owned Jersey\textsuperscript{6} and Friesian\textsuperscript{7} seemed to be better off than the households with local breeds. The households who owned Zomo\textsuperscript{8} were mostly dependent on farming activities compared to the households owning other breeds. Only 8\% of the households sold butter in the study area and they own Zomo. This may be because the butter of Zomo is more desirable. The objective of breed improvement program was to increase the production for home consumption and for market sale. But it was not usual to sell the butter from crossbreeds. This may be because the butter from crossbreeds is not preferred as compared to butter from Zomo, or it may also be the households who have crossbreeds are better off and they do not need to sell the butter for income generation. As the households who owned Zomo were mostly farmers and dependent on farming incomes, it is likely that they sell butter for their income generation.

It was also observed that some farmers could not afford to feed the crossbreed and this was reason why they had local cows. The upper villagers (Gharbuchung) had more Zomo and local cattle as compared to other villagers. The middle villagers (Hatchi) had crossbreeds of Friesian and Jersey and the lower villagers (Kraming) had mostly crossbreeds of Jersey and Zomo (Table 1). The people in the lower village Kraming also kept Zomo because they had grazing pasture upper side of the village in the mountains called Hltamu Broq.

\textsuperscript{6} Jersey means the cross breed of Jersey which is the product of crossing between exotic bull of Jersey with local cattle.
\textsuperscript{7} Friesian means the crossbreed of Friesian, which is the product of crossing between exotic bull of Friesian with local cattle.
\textsuperscript{8} Zomo is the product of crossing of Yak with local cattle.
Table 1: Percentage of households with different breeds and mean number of cows per household, by village

<table>
<thead>
<tr>
<th>Villages</th>
<th>Mean number of cows per household and standard deviation (std)*</th>
<th>Percentage of households with different breeds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Jersey</td>
</tr>
<tr>
<td>Gharbuchung (Upper village)</td>
<td>2.35 (1.5)*</td>
<td>56</td>
</tr>
<tr>
<td>Hatchi (Middle village)</td>
<td>1.78 (0.9)*</td>
<td>69</td>
</tr>
<tr>
<td>Kraming (Lower village)</td>
<td>2.12 (1.24)*</td>
<td>92</td>
</tr>
</tbody>
</table>

During field observation it seemed that the crossbreeds were adopted mostly by better off people. An experienced farmer from village Gharbuchung said: “I can not keep these crossbreeds. I rather would like to keep two local cows instead of this crossbreed; our local cows leaves some for other animals, for sheep and goat when it eats. But this crossbreed eats all, so I cannot keep any other animals even the chicken. I had more number of cows, some sheep and goats, now I have only one crossbreed of Friesian”

This means the introduction of crossbreeds affects the diversity of livestock in the households and the number of animals reared in the household. The farmer had more number of local cows and other small animals like sheep and goats, but now he cannot keep those animals because of crossbreeds, which need more feed and makes it difficult for the farmer to own other animals. Chander (1995), in explaining the reason for the failure to keep crossbreeds in northern state of India, also stated that the farmers in mountainous regions in India faced difficulties like feed and fodder shortages and diseases when starting to maintain crossbreed cows. The farmers prefer to keep indigenous cattle, as they are less demanding and less prone to diseases.
As we can see from Table 1, a large share of the farmers in the upper village Gharbuchung owns local cattle and Zomo. As a result have the highest (2.35) average number of cows compared to other villages Htchi, (1.78), and Kraming, (2.12) where the majority do not own local cattle (See Table1). But in Kraming there is also higher number of Zomo that’s why their average number of animals is also higher. This indicates that the villagers who owned local breeds were able to increase the number of cows owned on average due to less feed requirements of the local breeds than the crossbreeds. However, how economically beneficial this could be as compared to keeping a few number of the crossbreeds has to be substantiated, which is a focus of the following subsequent sections.

4.2. Characteristics of local breeds and crossbreeds

The average milk yield by crossbreeds of Jersey and Frisian cows were reported to be double as compared to Zomo and local cattle. Jersey was reported to give 8.16 liters of milk per day; Friesian reported to give 8.44 liters per day (See Table 2). Schure (1995), found that milk yield from crossbreed cow was 9.5 liters per day in Gilgit District of Northern Areas. This difference of 1 liter might be because of feeding opportunities or climatic conditions between two Districts. The Zomo was reported to give 4.68 liters and the local cattle reported to give 4.31 liters of milk per day respectively. The increase in milk production is important to the people for their household consumption because the members in household are high as shown in Section 4.1. Devendra (2006), also stated that animal production trends are influenced by strong demand-led factors such as population growth, urbanization, income growth and changing consumer preferences.

The average butter yield from 10 liters of milk was highest in Zomo (Table 2) as compared to other breeds. The butter is very important because the people in the area are used to drink tea with milk and butter (Payoo Cha).

According to the respondents, the age of puberty of Jersey was lowest (29.75 months) as compared to other breeds Friesian (42.46), Zomo (39.17) and local cattle (40.87) months. The early age of puberty of Jersey reduces the 10-month cost of feeding which is economically important, because the feed shortage is the main challenge in the area.
The price of the crossbreed cows was Rupees\(^9\) (Rs) 27100 at puberty age for Jersey while, that of Frisian was Rs 27600, local cattle Rs 15000, and Zomo Rs 20000. The higher price of crossbreeds is probably because crossbreeds adapted in the area and market demand for crossbreeds have increased.

Table 2, also showed that lactation period of Jersey was 10.7 month while that for Friesian was 11.4 months. Schure (1995), also found the lactation period of crossbreed to be 10.6 months in Gilgit District of Northern Areas. The calving interval is the period between two calving. The average calving interval of crossbreed of Friesian was 13 months and Jersey was 12.36 months, but Schure (1995) found that it was 20 months for the crossbreeds in Gilgit. This difference in calving interval might be because feeding has improved or farmers become more skilled in detecting heat symptom in animals through the trainings done by AKRSP. So the farmers take the crossbreeds to the bull for mating as earliest.

<table>
<thead>
<tr>
<th>Breeds</th>
<th>Jersey</th>
<th>Zomo</th>
<th>Friesian</th>
<th>Local cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average milk yield (liters)</td>
<td>8.16</td>
<td>4.68</td>
<td>8.44</td>
<td>4.31</td>
</tr>
<tr>
<td>Average lactation period (months)</td>
<td>10.7</td>
<td>10.5</td>
<td>11.42</td>
<td>9.88</td>
</tr>
<tr>
<td>Average calving interval (months)</td>
<td>12.36</td>
<td>13</td>
<td>13</td>
<td>11.87</td>
</tr>
<tr>
<td>Average age of puberty (months)</td>
<td>29.75</td>
<td>39.17</td>
<td>42.46</td>
<td>40.87</td>
</tr>
<tr>
<td>Average price at puberty (Rupees)</td>
<td>27100</td>
<td>20000</td>
<td>27600</td>
<td>15000</td>
</tr>
<tr>
<td>Average butter yield in 10 liters of milk (kg)</td>
<td>0.76</td>
<td>1.05</td>
<td>0.62</td>
<td>0.58</td>
</tr>
</tbody>
</table>

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\(^9\) Rupees (Rs) is the currency of Pakistan, 1 Rs is equal to .016 USD.
4.2.1 Respondents’ general perceptions about local breeds and crossbreeds

Table 3 shows that the general perception of the respondents about the crossbreed of Jersey and Frisian were high producers of milk with 93% of respondents for Jersey, and 91% respondents for Frisian, said the production of milk is high in crossbreeds. But only 2.8% of the respondents perceived that local cattle were high producers and none of the respondents perceived Zomo as high producers. On the other hand, Zomo and local cattle were perceived to have good feeding habits\textsuperscript{10} and gave good quality butter. The results showed that 57% of the respondents said Zomo has good quality butter and 40% of the respondents said that milk from local cattle has good quality butter. None of the respondents perceived crossbreed has quality butter. The characteristics that the farmers perceived about crossbreeds are that, they eat more than local cows and the butter quality is not good as compared to local cows. But still the people praise the crossbreeds, probably because people want to fulfill their household consumption requirements for their large family size even though the quality is not good. People are going towards quantity rather than quality and this might be a result of population pressure in the area.

Table 3: General perceptions of respondents about different breeds

<table>
<thead>
<tr>
<th>Characteristics of breeds</th>
<th>General perceptions about different breeds (% of respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jersey</td>
</tr>
<tr>
<td>Good feeding habit</td>
<td>2.8</td>
</tr>
<tr>
<td>High fertility</td>
<td>2.8</td>
</tr>
<tr>
<td>High production of milk</td>
<td>93</td>
</tr>
<tr>
<td>Conducive to climate</td>
<td>0</td>
</tr>
<tr>
<td>Long lactation period</td>
<td>1.4</td>
</tr>
<tr>
<td>Good butter quality</td>
<td>0</td>
</tr>
<tr>
<td>Easy management</td>
<td>0</td>
</tr>
</tbody>
</table>

\textsuperscript{10} Good feeding habit means eating less, because of shortage of fodder those animals eating less are perceived as good feeding habit animals in the study area.
4.3. Adaptability of crossbreeds to climate and feed availability

About half (51%) of the respondents said crossbreeds were adaptable to climate whereas 49% answered they were less adaptable to climatic condition. About 42% of the respondents said the available feed was favorable for crossbreeds while 55% of the respondents said the available feed was less favorable for crossbreeds. In general, above 95% of the respondents in the area believed that the crossbreeds are likely to adapt the cold weather. But crossbreeds seems to consume more feed, this is probably the reason why 55% of the respondents said that crossbreeds are less adaptable to available feed and even some farmers said that crossbreeds were not adaptable at all (See figure 3).

![Figure 3: Adaptability of crossbreeds to climate and available feed.](image-url)
4.4. Management practices and indigenous knowledge

4.4.1. Partnership (Barpa)

Barpa (partnership) is a traditional system of sharing animals in partnership between farmers. In this system one farmer gives the animals to another farmer in exchange of some butter per lactation. The barpa cow will be equally owned between two farmers. If the barpa cow slaughtered the meat will also be equally half. The amount of butter per lactation given to the partner is different in each valleys of the area. In the study area the amount of butter specified was 3 kilograms per lactation period for local cattle and it was 4 kilograms per lactation period for Zomo. There was no difference in the amount of butter for barpa of local cattle and crossbreeds. The crossbreeds were considered the same as local cattle for barpa. This is because the butter yield of crossbreeds is less than Zomo (though the milk production is high) in a crossbreed that’s why the amount of butter specified is same with local cattle. The barpa is also a coping mechanism for the shortage of fodder in the area. It is partnership of mutual benefit, one partner gets cows and another partner gets some butter without feeding the cow. The offspring of the barpa cow will also be equally owned and shared as parental cow. Only 38% of the households in the study area were engaged in barpa system. About 21% of the respondents were involved in barpa for Jersey, followed by 14% for Zomo, 8.5% for local cattle and 1.4% for the Frisian. The participation of a considerable number of farmers in barpa system for Jersey could probably be one of the reasons for the wide spread adoption of crossbreed of Jersey in the area.

4.4.2. Grazing patterns

Fodder availability is a major challenge in the area and traditional way to handle this challenge is to send the cattle up in the high pasture land for grazing during summer. About 50% of the respondents sent their animals on high pasture for an average of 3 months. About 32% of respondents sent Zomo on high pasture for grazing while 12% of the respondents sent crossbreed of Jersey, 7% of the respondents sent crossbreed of Frisian, and 9% of the respondents sent the local cattle on high pastures. This indicates that proportion of households who sent their crossbreeds on high pasture for grazing are
small compared to those who sent Zomo. Although there is a general understanding that crossbreeds are less adaptive to the conditions in the high mountains of pasturelands, but there are still some households who sent the crossbreeds of Jersey to the high pasture land. This may be because the crossbreeds have adapted to grazing on high pastures of the area with the passage of time. But according to Tulachan and Partap (1998), the exotic crossbreeds were not adapted to move in Terrain Mountains in mountainous regions of Hindu Kush Himalayas in India and Nepal. This may be because of differences in mountainous regions from place to place. The study area may have easy terrains to move for the crossbreeds compared to other places of Himalayas in Nepal and India.

To send on high pasture is mostly dependent on the economic conditions of the household to reduce the feeding pressure. According to key informants, many households used to send their animals to high pastureland due to their full dependence on agriculture at earlier times. Currently, this is different because some people got jobs and some of them went to another cities for work. Some people have even started to work as a casual worker because they found it more profitable than doing farming. One old farmer said: “I am old now and I can not go to Broq (summer pasture in the mountains) and my son do not want to go to Broq that is why he went to Karachi to do work”. These factors could be the reason for why we do not see high percentage of the households sending their cows to upland pastures. Or they could have adopted some other strategies of feeding their animals at the spot, which is assessed in the following section (Section 4.4.3).

4.4.3. Feeds and feeding
According to Khan (2003), in Northern Areas, people traditionally derive 70% of feed resources for their livestock from wheat straw and maize stover whereas 7% is obtained from Lucerne hay in winter. Farmers in this area are aware of the need of maximum quantity as well as quality fodder and thus therefore grow the tall wheat varieties to get the maximum fodder. The farmers also sow the cereals seeds thicker, which is three times more than the recommended seed-sowing rate to permit the thinning for green fodder and to increase straw fodders. There are multipurpose trees whose leaves and shoots provide supplementary fodder. Our findings indicated that the major challenge for livestock
rearing is shortage of fodder especially during winter. To overcome this problem about 90% of the respondents bought concentrates like wheat from the market for their livestock. The majority of the respondents said that they do not have sufficient fodder for entire year from their own land and pastures, raising a need to buy fodder from the market. About 84% of the households from lower village Kraming were buying fodder from market while only 17% of the households from the upper village Gharbuchung needed to buy fodder from the market. This could be because of more local breeds in the upper village Gharbuchung than in other villages, as local cattle eat less compared to crossbreeds. The difference could also be that the lower village Kraming has more number of jersey than upper village Gharbuchung, or it may be because farmers in lower village Kraming have an easy access to market to buy fodder being located near to market area.

In middle village Hatchi, an experienced key informant said that in this village farmers used to have sufficient fodder because they have more and better grassland and cultivable land in Hanjore broq (upper side of the village) as compared to other villages. But the findings from this study showed that 52% of the household in Hatchi did not have sufficient fodder and they were dependent on market to buy fodder to feed a large number of the Friesian breeds. The highest number of Friesian in this village is because the Friesian bull was introduced in this village in the very beginning. The findings also showed that the feeding habits of crossbreed of Frisian do not perceived as a good feeding habit (See Table 3). So, the adoption of Friesian might have led these villagers to dependent on market to buy fodder.

4.4.4. Common types of concentrate feeding
All the respondents used locally available concentrates for their cows. There was no difference on types of concentrates offered for different breeds. None of the households made silage, or urea treated block although AKRSP had emphasized on making such type of feed for the crossbreeds to fulfill their nutritional requirements. Quantity of concentrates fed to the crossbreeds was more than the amount fed to the local breeds. The main source of concentrates were local khal (apricot seed cake) used by 87% of the
respondents, wheat flour used by 87%, dried turnips used by 84%, and barley flour used by 64% of the respondents for their animals. Fermented grains were used by 14% of the respondents during routine feeding for their animals, but during pregnancy it was used by 54% of the respondents, because it was believed among farmers that this will increase the size of udder and increased the milk yields. About 84% of the respondents used dried turnip during routine feeding, but it was used only by 23% of the respondents during pregnancy. The reason was that, farmers believed that dried turnip increases the size of fetus and cause difficult birth (Dystokia). Farmers also used other type of feed sources like vegetable by products, wheat bran, oils, eggs, and buckwheat for their animals. People used the same feeds for the local cows and crossbreeds depending on the availability of feed. In this way, probably the crossbreeds are adapted in the local feeding systems.

4.4.5. Average amount of feeding and times

The main sources of fodder were hay and straw. Beside these, byproducts of vegetables, residues of food from kitchen, and tree leaves were also fed to animals. Farmers fed hay and straw 3 times a day for each breed. Schure (1995), found the same in Gilgit district of Northern areas. The concentrates were given 2 times a day, in the morning and evening. It was reported that the amount of concentrates fed for Zomo, and local cattle were about 2kg per day. For Jersey, it was 3 kg and for Friesian 4 kg. When we see the amount of hay, straw and other byproducts fed to different breeds, it was about 15kg/day for Friesian, 11kg/day for jersey, 9kg/day for Zomo, and 8kg/day for local cattle. The amount of feed was more for the Frisian as compared to Jersey. This could be the reason for all the respondents to disfavor the feeding habit of the Friesian regardless of their high production of milk. This could also be a reason for low adoption rate of Frisian crossbreeds as compared to crossbreeds of Jersey in the study area. About the Zomo, the finding shows that they needs relatively higher feed than local cattle. None of the respondents perceived Zomo as easy for management as compared to local cattle.
4.4.6. Housing

The study area is very cold in winter and all the households usually have two floor houses. The ground floor usually used for keeping animals and to store feed. All the respondents practiced semi-open housing (half covered shed) for their animals during summer, but during winter all of them practiced close housing (full covered house). It is observed that the cross breeds needed more space and warmer house in winter because these breeds are relatively sensitive to cold weather than local cattle and Zomo. As reported by 49% of the respondents the cross breeds are less adaptive to climatic condition of the area. Some of the farmers said that they have increased the size of house of an animal and made a warmer and bigger house when they got the crossbreeds. Some farmers said that they used to give a piece of apricot seed cake to all animals at night to keep the animals warmer during winters.

4.4.7. Breeding

The objective of breed improvement program by AKRSP was to increase the productivity of animals both for subsistence consumption and for market sale through genetic improvement programs involving the cross breeding of local cattle with improved exotic bulls of Jersey and Friesian (AKRSP 1996).

Table 1 showed that the household with crossbreed of Jersey is more than local breeds in each village which means farmers are increasingly adopting the crossbreed cows. This high adoption of crossbreeds in the area have decreases the local breeds in the household significantly.

Both the exotic cross breeds and Zomo are produced by the crossing of exotic bull and Yak with local cattle respectively. The local cattle which is the base for producing these two hybrid breeds have some good characters and are well adapted to the area. If the current situation of continuous cross breeding of exotic bull with crossbreeds cows and its offspring persists, the characteristics of exotic bull will increase in the offsprings of crossbreeds, and the characteristics of local cattle will reduce in the offsprings of crossbreeds through generation by generation. Which may lead to erosion of some valuable genes of local cattle. This breeding process may also affects the number of
Zomo, when number of local cattle reduced the number of Zomo will also be reduced because Zomo is the product of Yak crossing with local cattle. All the respondents in the study area expressed that the population of local cows is decreasing. This breeding process may result into loss of some good character of local breeds, which are better adaptable in the area.

4.4.8. Common livestock diseases and their treatments
According to key informants and field observations, foot and mouth disease (FMD) was most common disease in the area. About 88% of respondents also reported that FMD was the most common disease. According to key informants, all types of breeds were affected by FMD and the crossbreeds were more susceptible than other breeds for FMD. Digestive problems, diarrhea, indigestion, bloat, ectoparasite and constipation were also common among all types of breeds but crossbreeds were more susceptible to these problems compared to local cows. The crossbreeds mostly had mastitis problem, Dystokia (difficult birth) endoparasite and retention of placenta as compared to the local breeds. Tulachan and Neupane (1999), also stated that crossbreeds of Jersey are more susceptible to diseases than indigenous cattle due to nutritional stress in Himalayas. Reproductive problems anoestrus, infertility, was major problem in Frisian as compared to jersey in the study area. About 21% of respondents in the study area reported that their animals got sick more than 3 times a year while 76% of the respondent reported less than 3 times a year. 25% of households treated their animals with the help of village expert and 47% treated their animals through veterinary services. According to a village expert the local breeds are more responsive to traditional treatment than crossbreeds. He usually treats the local breeds but those who have crossbreeds go to veterinary hospital or market to buy veterinary medicines. Crossbreed owners rarely come to him for treatment. This could be because the crossbreeds are more valuable than local breeds and farmers do not want to take risk because some farmers do not rely on local treatments, or the farmers who have crossbreeds are more aware of veterinary medicine.

Only 12% of respondents in the study area vaccinated their animals by livestock specialist trained by AKRSP or government services. Mostly the households who vaccinated their animals were well aware of the importance of vaccines because they
were well informed by livestock specialist in the villages. Most of the people using veterinary services were in the middle village Hatchi that is near to veterinary hospital and they have easy access to hospital. These villagers mostly have crossbreeds of Friesian, which is more susceptible to disease than other breeds that could also be the reason of higher vaccination in this village.

It was observed that farmers who had crossbreeds went to hospital or veterinary store more frequently; because the perceptions of people about the crossbreeds were that they are not resistant to disease. That is why they choose the veterinary medicines for their animal because farmers believed that veterinary medicine are more reliable than traditional treatments. On the other hand, people with local cattle usually use traditional treatments. The perception of people about local breed is that it is resistant to disease and it recovers without using any veterinary medicines. The households who had local breeds were relatively poor than the households who owned crossbreeds. So, may be the farmers with local breeds relying on traditional treatment, because the traditional medicine is cheaper than veterinary medicines. But the farmers with crossbreeds were relied on veterinary medicines; this may be because they are able to buy veterinary medicines. It was also observed that traditional treatments were not specific for specific disease but the village expert used similar type and mixture of treatments for various types of diseases. Traditionally, the symptoms were also considered as a disease, for example fever is a disease traditionally but it is a symptom of disease medically. The treatments were mostly for the systems based and clinical signs, like digestive system and signs related to digestion, respiratory system and signs related to respiration. According to McCorkle (1986: cited in Swaleh 1999), globally stock raisers classify most of the diseases according to their prominent clinical signs. The recovery from administration of traditional treatments was not very well defined, but most of the farmers and the village expert said that the animal recovered very fast. In study area traditional treatment was used by 25% of the households and 47% of the households used veterinary medicines to treat their sick animals and the rest remained untreated. The ratio of using veterinary medicine was higher than traditional treatment due to high number of crossbreeds in the area for which the households usually rely on veterinary medicines. The result shows that
the trend of people towards veterinary medicine has increased due to introduction of crossbreeds in the area. It is also because of the extension services by AKRSP and access of veterinary medicine in market and veterinary hospitals influence, and enables farmers to use veterinary medicines.

**4.4.9. Traditional treatments of common livestock diseases in study area**

Box 1 summarizes the common livestock diseases and traditional treatments in study area, as practiced by the village ‘experts’ and/or the farmers themselves.

**Box 1: Common livestock diseases and traditional treatments in the study area**

<table>
<thead>
<tr>
<th>Common livestock disease</th>
<th>Traditional treatments/indigenous knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foot and Mouth disease (Khachoo Nad)</strong></td>
<td>Foot and Mouth disease was most common disease in the study area. For the treatment of this disease, farmers give flour or wheat bran with salt on rough carpets for the sick animal. Some farmers give the dried turnip to animals, and this helped to rupture the lesion on their mouth, and animals recovered quickly. For the foot, they keep their animal in places where animals urinated, according to their perception the lesions on foot ruptures when the animal is stand in such places and the animal recovers fast. According to Abu-Rabia (1983), Bedouins also used urine as disinfectants. Some experts also sprayed the salted water on foot.</td>
</tr>
<tr>
<td><strong>Diarrhoea</strong></td>
<td>Some farmers give fresh butter orally and others use fennel (Badian). The barley straw is also fed to cure diarrhoea.</td>
</tr>
<tr>
<td><strong>Ectoparasites (Sno shik)</strong></td>
<td>The ectoparasites mostly were mange, ticks and lice. For the treatment of ectoparasites, direct use of dung on the skin or oil on skin is believed to reduce the parasites on the animal’s body.</td>
</tr>
<tr>
<td><strong>Bloat or Tympany (Hltowa ghbospa)</strong></td>
<td>For the bloat, farmers use ginger and fennel, boiled in water and given to sick animal. But some farmers give fresh butter and milk for the same symptoms. <strong>Fever (Chhamba):</strong> Green tea with fennel and black pepper are given to animals suffering from fever, which is very effective.</td>
</tr>
<tr>
<td>Condition</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Blood related disease (Khraqnad)</td>
<td>Small cuts on the ear of animal to bleed, which believed to recover the animal very fast. Blood outlets are used for various type of diseases. The perception of village expert was that due to blood outlets, new blood would be formed in the body that cures the disease and animal becomes stronger.</td>
</tr>
<tr>
<td>Weaknesses (Micklonnga)</td>
<td>The perceptions of weaknesses among experts were different. Some experts believed that the weaknesses are not only due to feed shortage but also because of fighting among animals. Others believed that the weaknesses are because of an outgrowth of white layer inside the lower eyelids that caused weaknesses. For the treatment of such weaknesses, they cut inside the lower eyelid of animals with sharp blade, and put some salt on lower eyelids later. The village experts said that this treatment is very efficient for weak animals.</td>
</tr>
<tr>
<td>Indigestion and constipation</td>
<td>Fennel and hot milk are given to animals and some experts use Ajwain (Naqpo shoto) for indigestion and constipations.</td>
</tr>
<tr>
<td>Stomach pain (Hltonad)</td>
<td>Farmers use tarqan, a plant growing at very high altitudes on mountains, against stomach pain. According to the village experts, this was very effective for stomach pain and digestive related problems.</td>
</tr>
<tr>
<td>Retention of placenta (Shamakhatpa)</td>
<td>Carrot leaf is given to the animal, which helps the expulsion of placenta.</td>
</tr>
<tr>
<td>Respiratory Problems: cough and pneumonia (Khoqpha)</td>
<td>Zafaran, a yellowish flower, is fed to the animals, which is thought to be very effective for the respiratory associated diseases.</td>
</tr>
<tr>
<td>Wounds</td>
<td>A leaf of Artemessia plant (Kho burasy) is applied on wound, which recovers the wound quickly. This treatment was very popular among all the village experts in the study area. But according to Abu-Rabia (1983), Bedouins (Arab nomadic pastoralists) used artemissia for heavy cough, strengthening of stomach and uterus.</td>
</tr>
<tr>
<td>Repeat heating (Lzawa)</td>
<td>Farmers cut on the lower part of vagina (clitoris) with very sharp blades, which were very effective for the repeat heating.</td>
</tr>
</tbody>
</table>
4.4.10. Household division of labor in livestock management

The figure 4 shows that wives in the households carried out all the activities regarding animal management. The husbands usually did the breeding and decision making on selling or buying of animals. However the graph shows that wives were also involved in deciding to sell and buying of animals. The breeding was done 90% by husbands and 10% by children. Although most of the daily management activities were done by women, none of them were involved in breeding of animals this is because culturally the breeding of animal is supposed to do by man. Tulachan and Neupane (1999), also stated that women played significant role in raising and caring for livestock in Hindu Kush Himalayas. During our fieldwork, some women complained that the workload on them has increased because of the introduction of cross breeds. According to them crossbreeds need more care and feed than the local breeds.

According to a woman from village Kraming, she weeds the crop fields and gives green weeding fodder to cattle during summer. For the local cattle she only needed to weed in the crop field once a day, only in the morning time, and this amount of fodder was enough for two times (morning and evening) feeding. Now, the crossbreeds need more fodder so she has to go to crop field twice a day, in the morning and evening, to collect the green fodder from the cropfield, and this is very tiresome for her and for all women in the area. But she was very happy with the milk production of crossbreeds. Schure (1995), also found increased workload on women due to introduction of crossbreeds in Northern Areas of Gilgit.

Regardless of the wife’s burden to carry out most of livestock management activities, the lion share of income from the sale of livestock products goes to husband (Figure 4).
4.5. Preferences of people to local cows and crossbreeds

Table 4 indicates that the crossbreed of Jersey was preferred by majority (59.2%) of the respondents as their first preference followed by Zomo (19.7%), Friesian (12.7%) and local cattle (8.5%). As their second preferences, 25% of the respondents preferred Zomo followed by Jersey (21%), local cattle (16%), and Friesian (15%). If we sum 1st and 2nd preferences, Jersey is the most preferred breed (80%), followed by Zomo (45%) while Friesian (28%) and local cattle (25%) are less preferred breeds.

Table 4: Primary and secondary preferences of respondents for different breeds (%)
4.5.1. Reason of preferences for different breeds

Table 5 shows some major factors such as milk, feeding habit of the animal, calf value, and butter quality that may probably affect the breed preferences of the farmers in the study area. According to the reasons provided during our interview, about 75% of the respondents preferred Jersey because of its high milk yield. The amount of milk produced is important for the households to meet their home consumption needs. About 34% of the respondents mentioned calf value as a reason for their preference for Jersey because calf value generates income to the households. This income was used by respondents for their household expenditures and buying fodder to their animals. About 59% of the respondents preferred Zomo because of its feeding habit and 48% of the respondents for its butter quality. Butter is very important factor for the people in the area and this is why Zomo is second most preferred breed by the people though the milk yield is less than the crossbreeds of Friesian. The Jersey was also preferred by 14% of respondents for its butter quality, but none of the respondents preferred Friesian for its butter quality. Ouma, et al. (2004), stated that in developing countries many important functions of livestock are embedded in their traits that include “functions and products”.

Table 5 also shows that the respondents preferred breeds for more than one characteristics and Jersey has the highest preference for both high milk yields, calf value. This could be the reason for this crossbreed to be the most preferred and adopted breed in the area. The Zomo has two preferred characteristics, feeding habits and butter quality, which is the reason for being the second most preferred breed.

Table 5: Reason of preferences given by respondents for different breeds (%)

<table>
<thead>
<tr>
<th>Reasons*</th>
<th>Jersey</th>
<th>Zomo</th>
<th>Friesian</th>
<th>Local cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>74.6</td>
<td>4.2</td>
<td>56.3</td>
<td>2.8</td>
</tr>
<tr>
<td>Feeding habit</td>
<td>9.9</td>
<td>59.2</td>
<td>2.8</td>
<td>66.2</td>
</tr>
<tr>
<td>Calf value</td>
<td>33.8</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Butter quality</td>
<td>14.1</td>
<td>47.9</td>
<td>0</td>
<td>1.4</td>
</tr>
<tr>
<td>Others</td>
<td>5.6</td>
<td>4.2</td>
<td>0</td>
<td>2.8</td>
</tr>
</tbody>
</table>

* The percentage is not additive to 100 in column, because it is more than 100 when a respondent has given more than one reasons for preferring a breed, and is less than 100 if some households did not give reasons for their preference of a breed.
4.5.2. Ranking of different breeds for some characteristics

Table 5 showed reasons as mentioned by the farmers for their preferences for a given breed. To know their preferences in depth if it is based on characteristics of breeds, certain characteristics of different breeds were given to the respondents and were asked to indicate their primary preferences about each breed (Table 6). Some respondents were unable to rank between two breeds for some of the characteristics. For example, many respondents indicated both Friesian and Jersey as their primary preference for the milk yield, making the percentage not additive to 100 row wise (Table 6). Friesian was ranked first for body weight (84%), milk yield and growth rate (66%), and slaughter value (63%). While crossbreed of jersey was ranked first for its market demand (87%) and fertility (60%), about 43% of the respondents indicated Jersey also as their primary preferences both for milk yield and growth rate.

Table 6 showed although, the Friesian were ranked first by majority of the respondents for the characters such as body weight, milk yield, growth rate, and slaughter value, but the respondents preferred the crossbreed of Jersey compared to Friesian (Table 4). This could be because the characteristics of Jersey such as market demand and fertility are more important for the respondents than those of the Friesian characteristics like body weight and slaughter value. Some of the good characteristics of Friesian like body weight may be seen as not important for some respondents who are facing shortage of fodder, because of high demand for feed. The people usually do not sell the animal as slaughter animal because it gets lower market price than selling as milking animal, and thus the slaughter value may not also affect their overall preferences for Jersey. For the milk yield Friesian was preferred over jersey but Table 5 showed that none of the respondents like the butter of Friesian, which is important for the people in the area. All these connected and embedded factors are probably the reasons for less adoption of Friesian compared to jersey. But the jersey was ranked to have better feeding behavior than the Friesian in addition to its highest rank for market demand, fertility, and considerable preference for its milk. These are considered most important for the people because the market demand generates money and good feeding habit reduces the pressure on fodder. This means not
only high milk production but also other characteristics such as butter quality and fertility are also important for the adoption.

When we compare with local breeds, Zomo was ranked highest by majority (75%) for longevity and disease resistance (71%). One farmer from village Gharbuchung said, “I had a Zomo which was 36 years old”. About 49% and 47% of the respondents also ranked this breed first for fertility and feeding behaviour respectively. Next to Zomo, about 27% of the respondents gave first rank to the local cattle because of their resistance to diseases and 23% for their feeding behaviour (Table 6)

Generally, farmers considered many factors together and Jersey had more desirable and important characters for them, leading to overall preference for the breed in the area. According to Ouma, et al. (2004), farmer preferences for cattle traits are influenced by various factors including production system, characteristics, and environmental conditions especially in relation to disease prevalence and availability of cattle feed. Oldenbroek (1999), stated that economic, social, and environmental developments are also the driving force for the selection of high productive breeds. This study also showed that the adoption and preferences of people for the improved breeds were also influenced by economic wealth of the people in the study area due to non-farming activities, like casual work, and jobs. Also the characteristics of breeds and the adaptation of crossbreeds in the local production system led the people in the area to adopt the crossbreeds.
4.5.3. Preferences and tastes

Table 7 shows that the preferences were also linked with tastes of milk, butter and meat. About 90% of the respondents preferred Zomo for the taste of milk, butter and meat. That could be the one reason that Zomo is second most preferred breed. None of the respondents preferred Friesian for the tastes of milk, meat, and butter as their primary preference. But some of the farmers preferred the milk, butter, and meat tastes of the jersey in Table 7, which might have also contributed, the overall preference of the Jersey in the area. From those who mentioned Jersey as their primary preference, 95% have already adopted them.

For the Friesian, other factors than high milk yield and growth rate were not preferable for the people in the study area.

Beside these, there were other factors that could also be the reasons of adoption of cross breeds, for example extension services, grazing on high pastures, and barpa system (discussed in section 4.4)
4.5.4. Preferences for each breeds among villages

Table 8 shows the preferences for each breed were different between three villages. In Kraming farmers were more dependent on market to buy fodder for their animals. 92% of the respondents have Jersey (Table 1), this could be because people are more oriented towards the market system where they have to pay more for the inputs and they earn or save more money as well. According to Sharma (1996: cited in Tulachan and Neupane 1999), the road networks and market opportunities, access and purchasing power for feed supplements, health care, are prerequisites for improved breeds. The income level of the farmers in transformed (Access to road and markets) areas is evidently higher than farmers in inaccessible areas. The study also showed that lower village Kraming has easy access to market compared to other villages, which could be the reason for high adoption of crossbreeds of Jersey in this village. About 40% of the farmers also have Zomo in this village, which showed that they are interested in earning and saving money but they also like the good quality butter of Zomo. The Zomo was preferred most in Kraming, for the reason that these villagers have the grazing pasture on the upper side of village where Zomo could graze.

The Friesian was most preferred in middle village Hatchi (30%) where 43% of the respondents have Friesian. This means even if some of the respondents have Friesian, this breed was not their first preference. Similarly, 69% of the respondents in this village owned jersey but only 60% reported jersey as their first preference. The preference for Friesian was higher in this middle village Hatchi than in other village. This could be because the Friesian bull was introduced in this village in the very beginning, and most of

<table>
<thead>
<tr>
<th>Breeds</th>
<th>Milk taste</th>
<th>Butter taste</th>
<th>Meat taste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jersey</td>
<td>7</td>
<td>4.2</td>
<td>4.24</td>
</tr>
<tr>
<td>Zomo</td>
<td>90.1</td>
<td>93</td>
<td>93</td>
</tr>
<tr>
<td>Friesian</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Local cattle</td>
<td>2.8</td>
<td>2.8</td>
<td>2.8</td>
</tr>
</tbody>
</table>
the people have crossed their cattle with the Friesian bull, leading to a high number of Friesian crossbreds in this village (See Table 8 and Table 1).

The local cattle were most preferred in upper village Gharbuchung, and Zomo was also 2nd most preferred in this village. The number of local breeds is also highest in this village (See table 1). It could be because of higher altitude, the Yak and its hybrids are usually found on higher altitudes. In general, these villagers are mostly farmers and dependent on livestock. It was also observed that living standards of the people in this village were comparatively lower than other villages. This indicates that the people may have less money and it is cheaper to have and keep local cattle and Zomo than crossbreeds, because it is cheaper to buy and feed requirement is less. This may be the reason that these villagers have more local breeds. Another reason could be due to lack of access to markets for buying fodder if they adopt crossbreeds that confine them with the local breeds. According Negi (1990: cited in Tulachan and Neupane 1999), crossbreeds of Jersey are to some extent succeeded in Himachal Pradesh in India where there is accessibility to markets and roads, while in some regions it is not successful despite of three decades of breed improvement programme. According to Joshi (1996: cited in Tulachan and Neupane 1999), private dairies started with improved breeds were failed in the mid hills of Nepal because of shortage of fodder and quality feed. This study also showed that crossbreeds are mostly adopted by people near the market area.

<table>
<thead>
<tr>
<th>Villages</th>
<th>Primary preference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jersey</td>
</tr>
<tr>
<td>Gharbuchung (Upper)</td>
<td>47.8</td>
</tr>
<tr>
<td>Hatchi (Middle)</td>
<td>60.9</td>
</tr>
<tr>
<td>Kraming (Lower)</td>
<td>68</td>
</tr>
</tbody>
</table>

Table 8: Primary preferences of respondents for different breed, by village
4.6. Changes on livelihood due to introduction of cross breeds

About 70% of the respondents said that milk production has been increased due to introduction of crossbreeds (Figure 5). According to a key informant from village Kraming, they used to buy powder milk from market, which was very expensive, and the quality was also not good. Now due to introduction of crossbreeds they have sufficient milk for home consumption and specially to make tea and butter. Children are also now healthier and happy with the crossbreeds, because they get enough milk to drink. The introduction of crossbreeds in the area has reduced the dependency on market to buy powder milk. Figure 5 shows 50% of the respondents reported that their income has been increased due to selling of high demanded and valuable calf of crossbreeds, which is worth with an average of Rs 27000 compared to local breeds that worth an average of Rs 15000 for local cattle and Rs 20000 for Zomo (See Table 2). According to a woman key informant from village Hatchi, she has the crossbreeds of jersey and she sells the calf of crossbreeds and gets about Rs 25000 for every calving. With this money, she buys the fodder for her cow and she still saves some money for household uses. About 21% of the respondents reported that their health especially child health has improved because of higher milk yields by crossbreeds (Figure 5). That is probably the reason that 87% of the respondents in the area are in favour of the introduction of crossbreeds while only 13% of the respondents were not in favour of crossbreeds by stating the expensiveness of the crossbreeds to buy and rear (feed).

The objective of breed improvement program was to improve the living standard of people of the area. As figure 5 shows, there has been increased production, which led to increased income leading to improvements in health. This improvement ultimately leads to better living standard of the people in the area, which is somehow achieved. On the other hand, this study also showed that breed improvement program raised some problems and issues such as deficiency in fodder and increased dependency on buying fodder for the crossbreeds.
Due to multiple responses by the respondents for the same character (improvements), the sums of all improvements are more than hundred.

Figure 5: Main changes on livelihoods due to introduction of crossbreeds in the area

4.7. Effects on the local breeds due to introduction of crossbreeds

All the respondents in study area said that the population of local cattle and Zomo is decreasing day by day. About 59% of the respondents in the study area were worried about the decreasing population of local cattle and Zomo. The reasons for being worried about the decreasing population of local breeds was mainly due to fear to lose good quality butter (31%) and good feeding habit of local breeds (18%). About (18%) of the respondents also considered the cultural values that are attached to the local breeds (Figure 6).

In general, this study has indicated that although the people are in favor of introduction of crossbreeds in the area, but they are at the same time concerned about their local breeds for their characteristics that can not be compensated by the cross breeds. Their concern is consistent with what has been discussed in section 4.4.7, that the way how the cross breeding is taking place may lead to erosion of valuable local genes and associated good characters of the local cattle.
Figure 6: Characteristics of local breeds, which the farmers are afraid to lose

4.8. Major challenges for livestock rearing in the area

Figure 7 shows that about 65% of the respondents reported shortage of fodder was a main challenge for livestock rearing in the area. While 20% mentioned disease as a major challenge. About 10% considered cold weather as a challenge, and 5% mentioned daily management of the animal as a challenge for livestock rearing in the area.

It was observed that there is already a shortage of fodder, and has become more challenging due to introduction of crossbreeds that, require more feed compared to local breeds (Also see section 4.4.5). The people are becoming dependent on market for fodder. Tulachan and Neupane (1999), reported that the quality feed is challenge for rearing the improved crossbreeds in Himalayan region of Nepal where the shortage of fodder is also a problem.

The fact that 20% of respondents mentioned diseases as challenge for livestock rearing in the area coincides to our earlier finding that 21% of the respondents reported their animals being sick for more than 3 times a year (Section 4.4.8) indicates the severity of problem. As only 10% of the respondents mentioned cold weather as a challenge for livestock rearing in the area, its relative importance compared to feed shortage and diseases is low. This indicates crossbreeds are somehow adapted in the cold weather of the area with the passage of time.
In general the adoption of crossbreeds in the area improved the livelihood by providing sufficient yield of milk and valuable calves, but also led the people to dependent on market to buy fodder.

Figure 7: Major challenges of livestock production in Kaphlu
5. Conclusion
The study has analyzed characteristics of local breeds (Local cattle and Zomo) and crossbreeds of Jersey and Friesian being reared, associated management practices, indigenous knowledge, and peoples’ preferences to the breeds in Khaplu, Baltistan region of Pakistan.

Crossbreeds of jersey and Friesian were adopted by the people because of high milk yield. The average milk yield from crossbreeds of jersey and Frisian cows were double of local breeds Zomo and local cattle. The market demand, especially for Jersey, was also high compared to local breeds. The crossbreed of Jersey was the most adopted and preferred breed compared to Friesian because of market demand, and comparatively better feeding habit, fat content, disease resistant, fertility, age of puberty, taste of milk, butter and of being more adaptable in the local management system like barpa and grazing at high altitudes. This study has found that crossbreeds are somehow adapted to climate, feed availability and local management system. There was no difference on types of feeding for the crossbreeds and local cows except for the amount. The local breeds were perceived to have good feeding habits and gave quality products specially the butter of Zomo was highly preferred over all breeds, making it the second most preferred breed after crossbreed of Jersey. The Friesian and local cattle were less preferred breeds because of feeding habit of Friesian and low production of local cattle respectively.

The study found that people were in favor of introduction of crossbreeds in the area because it improved the livelihood of people by providing with sufficient milk, which improved health, especially that of children. The income has also increased due to valuable calves. It also reduced the dependency on buying powder milk from market although it increased the dependency of people on buying fodder from market, which was the main challenge. But still, people in the area have compromised to keep the crossbreeds because of some driving forces such as population pressure, economic growth, availability of jobs, changing trends from farming to non farming activities, and access to market to buy fodder for their animals.
The study has also shown that the population of local cows is decreasing in the study area and may result into erosion of local genes. The local breeds (Zomo and local cattle) have some good characteristics such as feeding habit, disease resistance and quality products. Some farmers were also worried about their local breeds, because of their special quality butter, feeding habits and cultural values. Although this study has shown that the people in study area have tremendous indigenous knowledge about the breeds, management practices, including breeding and traditional disease treatment, it seems that they do not have any creative idea more than fear regarding a threat to their local cows. This leaves a burning issue for the AKRSP staff and livestock breeders to think of ways to keep the balance between improved yield due to cross breeds and quality attributes of the local breeds. The findings of this study on management practices, perceptions and preferences of farmers about different breeds, and their characteristics, as they affect the livelihoods is an important piece of information for use in the future planning of breed improvement programme and similar interventions.
References


development. Accessed on World Wide Web: 
http://www.fao.org/docrep/x5862e/x5862e00.htm.


### QUESTIONNAIRE

<table>
<thead>
<tr>
<th>Questionnaire #</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Respondent</td>
<td></td>
</tr>
<tr>
<td>Name of the village</td>
<td></td>
</tr>
<tr>
<td>Date of Interview</td>
<td></td>
</tr>
<tr>
<td>Start time</td>
<td></td>
</tr>
<tr>
<td>Finish time</td>
<td></td>
</tr>
</tbody>
</table>
A- HOUSEHOLD DEMOGRAPHIC DATA

We would like to ask some questions about the people who are living/staying in this household at the moment.

<table>
<thead>
<tr>
<th>Number of people living in household, with household head</th>
<th>Status of respondent in the household</th>
<th>Sex (M/F)</th>
<th>Age</th>
<th>Tribe</th>
<th>Occupation/economic activity</th>
<th>Marital status</th>
<th>Highest level of education attained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td>Q4</td>
<td>Q5</td>
<td>Q6</td>
<td>Q7</td>
</tr>
</tbody>
</table>

Codes for Q2
1- Father
2- Mother
3- Son
4- Wife
5- Daughter
6- Grandchild
7- Cousin
8- Niece/nephew
9- Grand father
10- Brother
11- Others (specify)

Codes for Q6
0- None
1- Married
2- Single
3- Divorced
4- Widowed

Codes for Q5
1- Farmer
2- Fisher
3- Health personnel
4- Teacher
5- Secretary/clerk/Govt.Employee
6- Casual labourer
7- Business man
8- House wife

Codes for Q7
0- None
1- Primary
2- Junior primary
3- Middle
4- Matric
5- Intermediate
6- Graduate
7- Masters
### B. LIVESTOCK REARED BY THE HOUSEHOLD

<table>
<thead>
<tr>
<th>List of Livestock Reared and Quantities</th>
<th>Socio-economic importance of livestock in relation to local breeds (milking &amp; breeding)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals</td>
<td>Q8 Milk production (litres per day) in litters</td>
</tr>
<tr>
<td>Quantities</td>
<td>M.*(L)</td>
</tr>
<tr>
<td>Zomo</td>
<td></td>
</tr>
<tr>
<td>Zo</td>
<td></td>
</tr>
<tr>
<td>L. cow</td>
<td></td>
</tr>
<tr>
<td>L. Bull</td>
<td></td>
</tr>
<tr>
<td>Jersey Cow</td>
<td></td>
</tr>
<tr>
<td>J. Bull</td>
<td></td>
</tr>
<tr>
<td>Frisian</td>
<td></td>
</tr>
<tr>
<td>F. Bull</td>
<td></td>
</tr>
<tr>
<td>Yakamo</td>
<td></td>
</tr>
<tr>
<td>Yak</td>
<td></td>
</tr>
<tr>
<td>She Goat</td>
<td></td>
</tr>
<tr>
<td>He Goat</td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td></td>
</tr>
<tr>
<td>Ram</td>
<td></td>
</tr>
<tr>
<td>Donkey</td>
<td></td>
</tr>
</tbody>
</table>

*M. is Morning, E. is evening.

Q15 * most prefer =1, second most =2, third most prefer =3, fourth most prefer =4

Q16 Milk= 1, Meat =2, Feeding habit=3, Calf values=4, Butter Quality =5, others=6=…. Y/N, Yes=1, No=0
Q17 Did you do barpa? Y/N
Yes=1, No=0

Q18 Which type of animal is giving for barpa?
Jersey =1, Friesian, =2 L.Cow=3, Zomo=4, Y/N, Yes=1, No=0

Q19 How many given for barpa?

Q20 How many taken for barpa?

Q21 Why you are doing barpa (Reason)?
For Offspring=1, Butter=2, Difficult to rear (Reduce feeding expenses)=3, Others=4

Q22 How many and which type of animal do you sell for last three years?

Q23 How many and which type of animal do you buy for last three years?
C - Preference ranking for the ten different characteristics of each breed

<table>
<thead>
<tr>
<th>Q24 Criteria</th>
<th>Local cow</th>
<th>Zomo (F)</th>
<th>Jersey (F)</th>
<th>Friesian (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk yield</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body weight</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Growth rate</td>
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<tr>
<td>Fertility</td>
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<tr>
<td>Disease resistance</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Feeding behaviour</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Market demand</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Slaughter/butcher value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longevity</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Most prefer =1, second most =2, third most prefer =3, fourth most prefer =4
D - Preference ranking for the taste of milk of different breeds

<table>
<thead>
<tr>
<th>Q25 Criteria</th>
<th>Source of milk (types of breeds)</th>
<th>Jersey</th>
<th>Friesian</th>
<th>Zomo</th>
<th>Local cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat content</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market demand</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Others (mention)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

* Most prefer =1, second most =2, third most prefer =3, fourth most prefer =4

Preference ranking for the taste of butter of different breeds

<table>
<thead>
<tr>
<th>Q26 Criteria</th>
<th>Source of butter (types of breeds)</th>
<th>Jersey</th>
<th>Friesian</th>
<th>Zomo</th>
<th>Local cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market demand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (mention)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

* Most prefer =1, second most =2, third most prefer =3, fourth most prefer =4

Preference ranking for the taste of meat of different breeds

<table>
<thead>
<tr>
<th>Q27-Criteria</th>
<th>Source of meat (types of breeds)</th>
<th>Jersey</th>
<th>Friesian</th>
<th>Zomo</th>
<th>Local cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market demand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (mention)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

* most prefer =1, second most =2, third most prefer =3, fourth most prefer =4
E. Income table

<table>
<thead>
<tr>
<th>List of livestock</th>
<th>Home consumption</th>
<th>Usages of livestock</th>
<th>Sale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q28 Do you use butter for home consumption? Yes/No</td>
<td>Q30 Do you use milk for home consumption? Yes/No</td>
<td>Q31 Do you sell butter? Yes/No</td>
<td>Q34 Do you sell the milk? Yes/No</td>
</tr>
<tr>
<td>Q29 Butter produced per lactation period (kg)</td>
<td>Q32 Butter sold per lactation period (kg)</td>
<td>Q33 Price of butter per kg</td>
<td>Q35 Amount sold per day (litres)</td>
</tr>
<tr>
<td>Q36 Price of milk per litre</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Zomo
Local cow
Jersey
Frisian

Yes=1, No=0

Q37 Which type of breed do you sell?
Yes=1 for each breed, No=0 for each breed

Q 38 Do you sell the breed this year? Y/N

Q 39 How much amount do you get by selling the breed?

Q40 Do you sell the meat this year? Y/N

Q41 How much do you sell the meat?
Q 42 How much amount do you get by selling the meat?

Q 43 Do you sell the skin of animal? Y/N

Q 44 How much amount do you get by selling the skin?

Q 45 Are you selling the manure? Y/N

Q 46 Do you use the dung for fuel purpose? Y/N

Q 47 How much mounds of dung do you use per year?

F Expenses:

FEEDING

Q 48 Do you have sufficient fodder for your animals for entire year? Y/N

Q 49 How much fodder currently do you have in mounds (40 Kgs) Hay ________ Straw ________ Others

Q 50 How much fodder do you buy per year?
Hay________________Straw_____________Others_________
Q51 How much fodder do you sell per year? Hay.......................Straw
...................Others........

Q52 Why do you sell the fodder?
For hhs consumption=1, others=2

Q53 Do you graze your animal on high pasture? Y/N

Q54 How long do you graze your animal on high pasture? (Months)

Q55 Which animals do you sent on high pasture for grazing?
Jersey =1, Frisian =2, L Cow=3, Zomo=4, Y/N, Yes=1, No=0

Q56 For which animals do you do stall feeding at home?
Jersey =1, Frisian =2, L Cow=3, Zomo=4

Q57 For how long do you stall-feeding to the animal? (Months)

Q58 Do you use your own feed (concentrates) grains, etc? Y/N
Q59: Which types of concentrate do you use?
- Local Khal (Apricot by product)=1,
- Wheat Flour=2,
- Barley Flour=3,
- Fermented Grains=4,
- Dried Turnip=5,
- Oils=6,
- Egg=7,
- Vegetables=8,
- Wheat brawn=9,
- Others=10.
Y/N: Yes=1, No=0

Q60: How much concentrate do you use per day? (Kg)

Q61: How many times do you feed your animal per day?

Q62: How much do you feed your animal per feeding for each breed? (Kg)
   (a) Hay.......... (b) Straw..... (c) Others

Q63: How much grains do you use this year? (Mounds)

Q64: Do you buy feed from the market?
   Yes ☐
   No ☐

Q65: If yes, how much? (Mounds)

Q66: What is the main source of feeding? Hay /silage /straw
   Hay =1, Straw=2, Silage=3, Others=4
Q67 Which types of feeding do you gave during the pregnancy?
Local Khal (Apricot by product)=1, Wheat Flour=2, Barley Flour=3, Fermented Grains=4, Dried Turnip=5, Oils=6, Egg=7, Vegetables=8, Wheat brawn=9, Others=10...
Y/N Yes=1, No=0

G- HOUSING;

Q68 Which type of housing do you practice for your animal?

a) Summer

Close housing ___________ Open housing ________________ Semi open ___________

Close housing=1, Semi Open=2

b) Winter

Close housing ___________ Open housing ________________ Semi open ___________

Close housing=1, Semi Open housing=2, Y/N Yes=1, No=0

Q69 How much area do you need to keep your animal? Marla

_______________________________________________________________________

H. DISEASE

Q70 How often your animals get sick?

Often =1, Rare=2 (How many times per year?)

Q71 Did your animal get sick this year?

Yes □ No □

Yes=1, No=0
Q72 Which kind of diseases they got this year?

FMD=1, Foot
Rot=2, Diarrhoea=3, Constipation=4, Bloat=5, Nodules=6, Mange=7, Ret. placenta=8, Eye Disease=9, Fracture=10, Others=11…. Y/N Yes=1, No=0

Q73 How you treat them?

________________________________________________________

, Traditionally=1, Veterinary medicine=2, others=3

Q74 List down different type of disease in the area, from very common?

From most common=1 to 2, 3, 4, 5, ……… 10

Q75 By whom you treat them?

(a) By village expert (traditional healer)= 2 ………(b) by own=…(1) ……(c) veterinary services…=3 ……(d) Others……4 ………

Q76 How you treat them?

a) Traditional treatment for each disease ________________________________

b) Veterinary service (medicine ) for each disease

____________________________________________________________

____________________________________________________________

____________________________________________________________

C) Other ________________________________

Q77 which type of the above treatments do you use oftenly?

1 Traditional treatment% per year ________________________________

2 veterinary services% per year ________________________________

3 others % per year ________________________________
Q78 Do you vaccinate your animal? Y/N

Q79 If yes for which type of disease and by whom?
   
   By Own=1, Traditional Healer=2, Vet Services=3, Others=4 Y/N Yes=1,No=0

FMD=1, Enterotoximea=2, RP=3

I - HOUSEHOLD ACTIVITIES

Q80 Who is involved in looking after the animals

<table>
<thead>
<tr>
<th>Management work</th>
<th>Husband</th>
<th>Wife</th>
<th>Children</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Feeding to animal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Milking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Cleaning of shed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Who sell the Milk and butter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Who gets the money by selling milk and butter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Who does the breeding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g) Who does the housing of animal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h) Who makes the butter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Who decides to sell or buy the animal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Husband=1, Wife=2, Childrens=3, Others=4

Q81 What is the money use for?

J-CHALLENGES

Q82 What are the main challenges for livestock rearing in the area?

1. = Diseases………….2. = Feed shortage……………3. = Cold weather, 4=Daily management, 5=others………..

Q83 What do you think the possible solution to these challenges………………………………………..

Q84 Do you think about the extinction of the local breeds? Y/N

Q85 If yes why?

Feeding habit=1,Butter quality=2,Cultural value=3,Easy to buy=4,Climate friendly=5,Othersw=6 Y/N,Yes=1,No=0

K - INTRODUCTION OF CROSS BREED

Q86 What do you think about the introduction of crossbreed in the area?

Favour=1,Non Favour=2

Q87 What changes have come after the introduction of crossbreed in the area for livelihood?

Increase milk and butter availability (Inc production)=1,Increase income by calf value (Inc.income)=2,Improved health=3,

Q88 What are the effects on local cow due to introduction of cross breed?

Increased population=1,Decreased population=2,No effect=3

Q89 How conducive are the cross breeds to the climate?

Conducive=1,Less conducive=2,Not conducive=3
Q90 How conducive are the crossbreed to the feed availability in the area in relation to local cow?
   Conducive=1, Less conducive=2, Not conducive=3

Q91 Why you do not prefer the other breeds?
ZOMO=
   Basic investment=1, Daily expenses (feeding)=2, low production=3, Difficult management=4, others=5
LOCAL COW=
   Basic investment=1, Daily expenses (feeding)=2, low production=3, Difficult management=4, others=5
JERSEY=
   Basic investment=1, Daily expenses (feeding)=2, low production=3, Difficult management=4, others=5
FRISIAN=
   Basic investment=1, Daily expenses (feeding)=2, low production=3, Difficult management=4, others=5

Q92 What are the characteristics/feature of each breed, which make them differ from each other

Feeding habit=1, Fertility=2, High production=3, Conducive to climate=4, Docile$faithful=5, Long lactation=6, Good products, =7, Easy management=8
Appendix 2

Interview guide for key informants

What do you think about the introduction of crossbreeds in the area and what changes has come on livelihood?
What are the effects on local breeds due to introduction of crossbreeds?
What is the barpa system?
What is the feeding system in the area?
What changes has come in the feeding system due to introduction of crossbreeds?
Are you making silage or any other type of special feed for crossbreeds?
What type of feed do you give to your animals and how much for different breed?
What is the common disease in the area?
Which type of animal is susceptible to which disease?
How you treat them?
What are traditional treatments for common type of disease?
How it recovers the animals how you treat them traditionally?
What are the main challenges for livestock rearing in the area?
Who has the crossbreeds? And who has the local breeds?
Do crossbreeds are adaptable to climate and feed availability in the area?
What are the special characteristics of each breed?
Which breed do you favor most and why?