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Diagnosis of Crops, Livestock and Forestry  
Production Constraints and Potential Research  
Opportunities in Kanak Valley, Balochistan  
**A FARMING SYSTEMS PERSPECTIVE**

**AGRICULTURAL ECONOMICS RESEARCH UNIT  
(PARC)  
AGRICULTURE RESEARCH INSTITUTE  
SARIAB - QUETTA**

**DIAGNOSIS OF CROPS, LIVESTOCK AND FORESTRY  
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OPPORTUNITIES IN KANAK VALLEY, BALOCHISTAN  
A FARMING SYSTEMS PERSPECTIVE**

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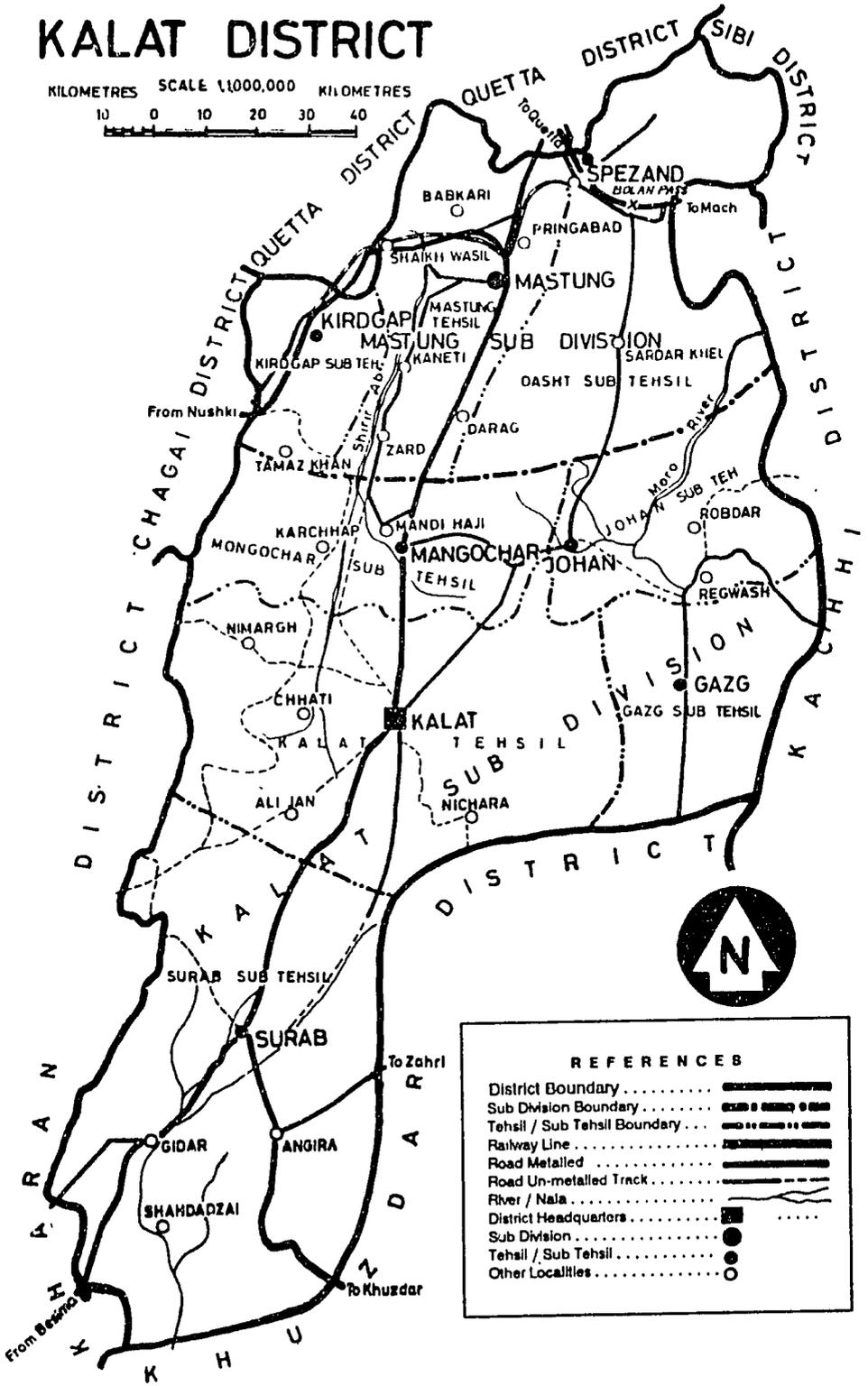
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# KALAT DISTRICT

KILOMETRES SCALE 1:1,000,000 KILOMETRES



REFERENCES	
District Boundary	—————
Sub Division Boundary	.....
Tehsil / Sub Tehsil Boundary	.....
Railway Line	—————
Road Metalled	—————
Road Un-metalled Track	.....
River / Nala	~~~~~
District Headquarters	■
Sub Division	●
Tehsil / Sub Tehsil	○
Other Localities	○

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## **I. INTRODUCTION**

The national coordinator of Pakistan Agricultural Research Council (PARC) with the aid of an advisor from the Management of Agricultural Research and Technology (MART) project, is responsible for coordinating and supporting the Farming Systems Research (FSR) projects in the four provinces of Pakistan. The scientists of the provincial and federal research departments and agricultural universities are closely involved in these projects.

The FSR activities in Balochistan were started in 1988. The scientists from the Agricultural Research Institute (ARI), Adaptive Research Program (ARP), Livestock & Forestry Departments, Agricultural Economic Research Unit (AERU) and the Arid Zone Research Institute (AZRI) are collaborating in the research activities.

An informal survey of the Kanak Valley (Kalat District), the FSR targeted area in Balochistan was conducted by an interdisciplinary team of scientists (economists, agronomist, forest officer, and livestock specialists) from October 23 - 26, 1989.

One way to identify the researchable problems is to conduct a diagnostic, information-gathering survey with a farming systems perspective (IRRI, 1986). The two key elements of a diagnostic survey are that it can be carried out rapidly and that it is interdisciplinary (Nagy et al., 1987).

The purpose of this paper is to:

- (1) describe the procedure that was adopted by the interdisciplinary team of scientists and
- (2) present the important findings of the diagnostic survey.

First, the description and the outline of how the diagnostic survey was conducted is presented. Then, secondary data gathering and informal survey stages are collected on crops, the livestock industry and forest of Balochistan, are then described. After this, the major diagnostic survey information is

summarized. In the end, the hypotheses are developed about the major research opportunities that may exist for the cropping systems, livestock industry and social forestry in the targeted area as well as in similar areas of Balochistan.

## II. DESCRIPTION AND OUTLINE OF THE DIAGNOSTIC SURVEY

The objective of the diagnostic and information gathering phase is:

- (1) to describe and better understand the production and marketing constraints and priority problems of farmers and herders,
- (2) to make hypotheses about major research opportunities, and
- (3) to collect information that will be useful in designing and conducting the farmer-managed trials.

The informal survey was carried out in two stages. In the first stage, the secondary data and information were gathered. In the second stage, diagnostic exploratory survey of farmers, herders and key informants was conducted.

### A. Secondary Data and Information Gathering

Secondary data on socio-economic aspects, climate, crops, livestock and forestry in Kalat district of Balochistan, were collected from provincially and federally published sources. The data on villages, population and landholdings, and a map of the Kalat District, were gathered from the Patwari (the village accountant) at the Mastung tehsil office. The list of villages as well as a rough sketch of the valley was prepared with the help of the field assistant of the area so that the key informants and the participating scientists could better understand the situation.

### B. Description of the Informal Survey

The aim of the diagnostic survey of the targeted area was to rapidly gather information from the farmers, livestock raisers and key informants. The interdisciplinary team included economists, agronomist, forest and livestock specialists. The informal survey was conducted for four days in the north, middle and southern villages of the Kanak Valley. Several groups of farmers and herders were interviewed. A list of guideline questions, prepared with the help of secondary data and previous experiences, were used during the informal survey. The guideline questions are presented in Appendix A.

Another procedure adopted was, one to two scientists continued probing the farmers and key informants, while others, sitting behind in the background, kept a record of the information obtained. However, minimum

notes were taken during the interviews. After conducting one to two long interviews, the members of the interdisciplinary team then discussed among themselves the aspects about which more information were needed. Sometimes, new questions were added for additional interviewing. Then the team moved to the next village and several more farmers were interviewed focusing specially on the new questions.

In the afternoon, before starting back to the research station, the team discussed the possible technological interventions and other research opportunities that could increase the productivity of the crops and the livestock industry of farmers and livestock raisers.

### **III. SECONDARY DATA AND INFORMATION ON CROP, LIVESTOCK AND FORESTS**

#### **A. The Importance of Crops**

Agriculture is the mainstay of the economy of Balochistan. Forty-five percent of the GDP comes from this sector and 67% of the provincial population is involved in agriculture and the other related activities. Out of the total geographical area of 34.72 million hectares, about 1.47 million hectares are ploughed under irrigation sources. Ninety seven percent of farmers of rainfed and irrigated areas of Balochistan grow wheat for food security (Nagy et al. 1989). Wheat being the staple food of people of Balochistan has always been the main component of the cropping system. In 1987-88, 183 thousand hectares were under wheat crop which form 69 percent of the total cropped area under Rabi crops. The other important crops, according to the area under cultivation are: fruits, fodder, barley, sorghum, onion, potato and vegetables.

#### **B. The Importance of Livestock**

The livestock sector contributes an estimated 30% of the GDP of Balochistan (Khan, 1988). Nagy et. al. 1989) have described the importance of sheep and goats. Sheep (11.1 million) and goats (7.3 million), the major livestock in Balochistan, represent 47.7 and 24.36% respectively, of the national livestock numbers and 56 and 37% of all the provincial livestock numbers, respectively (excluding poultry). Both sheep and goat numbers have increased substantially since 1955 exhibiting annual growth rates of 7.2% and 7.8%, respectively. Balochistan exports mutton to other provinces, with most of these exports going to the Karachi market (data not available). At present there are about 4.3 sheep and goats per person in Balochistan and only 0.38 sheep and goats per person in the remaining three provinces of Pakistan.

### **C. Importance of Forests**

Pakistan has 4% of the area under forests. This percentage is too low as compared with an optimum desired level of 20 to 25%. Out of 34.72 million hectares of total area of Balochistan, 1.09 million hectares is under forest which forms only 3% of the total area. Thus, the situation is more deteriorated in case of Balochistan.

Forests protect the soil from wind and water erosion, act as natural wind breaks, absorb the impact of heavy rainfall, reduce run-off and moderate the flow of streams. They have a special role in increasing agricultural production because in addition to protecting the land and water resources, the forests offer a supplementary source of income. Thus, there is a need for launching a large social forestry program to mobilize the resources of the rural communities and create new forest resources.

The social forestry program aims at direct involvement of close association of rural population in the development of forest. It motivates and encourages the farmers to grow trees on the agricultural or unused land under the guidance of the forest staff. In fact, planting of trees and agricultural crop can go together under this program. To prevent the trees from depressing the crop yields, they can be planted around the agricultural lands or on borders. The social forestry program will arise the consciousness of farming community that afforestation and planting of trees is as important as crop and livestock farming.

Trees and plants provide fodder for livestock. This fodder, usually shoots, foliage and fruits, is often available even when grasslands have dried out. It can be either gathered and fed to animals in stalls, or livestock are allowed to browse directly.

Similarly trees and plants can also be a source of firewood and can save a lot of time of rural women, traditionally responsible for family wood supplies and have to trek many kilometers each day just to meet minimum needs.

Social forestry trials have been started under the Balochistan FSR program in the target area which will work as demonstration centers for other farmers of the area. Multipurpose and fast growing trees and shrubs (such as mulberry and fourwing saltbush) should be introduced which will provide fodder for livestock as well as firewood for domestic use.

## **Climate**

Situated in the desert belt between 25°N and 32°N Balochistan has an arid or semi-arid climate. Kalat district (29°2'N and 66°32'E) has been classified as continental semi-arid Mediterranean, where rainfall varies from 200 to 350 mm. Rainfall generally occurs in two seasons: Winter (November to March/April) as a result of western disturbances in the anticyclonic system extending from Siberia to Iran; and Summer (July to September/October) as a result of monsoon storms originating in the Bay of Bengal and the Arabian Sea (Rees et al., 1986). Minimum temperatures are frequently below freezing from mid-November to the end of January with maximum temperatures in June and July from 30 to 35°C. The principal land use in Kalat District is rangeland grazing, dry land cropping and irrigated cropping.

## **IV. DIAGNOSTIC SURVEY INFORMATION**

### **A. Natural Environment**

Kanak Valley is oblong in shape and surrounded by the Kanak series mountains in the north of the RCD (Regional Cooperation for Development) highway and in the south-west by Quetta. The valley is located in union council Dringar, Mastung tehsil of Kalat District. Total area of Kanak valley is 31,362 acres which is about 3 percent of the district area. The altitude of the targeted area varies from 1750 to 1800 meters from south to northwards.

### **B. Main Features of the Socio-economic Environment, Social Organization, Leadership and Decision making**

Kanak valley, the FSR targeted area is situated in the Brahvi/Baloch region of highland Balochistan. It is very important to mention the tribal organizational structure and leadership pattern to understand the access to resources and control over benefits. The following table summarizes the organizational structure of the Brahvi/Baloch tribe.

**Table 1.** Brahvi/Ba'loch tribal organization and leadership pattern

Group Title	Organization	Leadership
Tribe	Qaum/Tuman	Sardar/Tomandar
Clan	Tak/Takkar/Shakh	Takkari/Mokaddam
Section	Taal/Shalwar	Takkari Mokaddam
Lineage	Khalk/Tabar	Motabar/Sufaid Reesh
Sub-lineage	Ora/Log/Kahol	Mastar/Balla

Conflicts between the individuals and groups within the tribe (clan, section, lineage or sub-lineage) are solved through Jirga (the council of elders). The petty matters are solved by the village heads called Takkaris or Mokaddams but the tribe level disputes are decided by the Jirga headed by the Sardar or chief.

### Land Tenure

The valley is organized by tribes and sub-tribes. Apart from major landlords (such as Raisani, Mengal and Muhammad Shahi), a farmer's holding, on average, ranges from 5 to 50 acres. Thus, the majority of the holdings belong to the small farmers.

The tenancy arrangement in the area is that the landowner receives two-thirds of the total produce and the rest one-third goes to the tenant at will. All the physical inputs are provided by the landowner except the farm labor which is provided by the tenant. If the landowner owns a tubewell or an open-surface well and crops are irrigated by it, one-seventh part of the total produce is separated for the landowner as the water charges.

### Labour

There seems no labor shortages in the targeted area. October and November are the peak labor demanding months when harvesting of onion, potato and fruit crops are in full swing. Family labor is also engaged frequently (women and children). On the other hand, farmers also extend mutual help during the planting and harvesting seasons. The women and children of the

related families and those from the same tribe and section are also employed for harvesting the potato and onion crops. The women and children of the nomad families are hired for weeding the onion and potato crops. They are paid 10 rupees plus five kilograms of crop (onion or potato) and the grass collected during the weeding operations per day per laborer.

### **Machinery**

Only the large farmers (25 or more acres) of the area possess tractors, threshers and tube-well, and small farmers hire these machinery services for agricultural operations in the specific seasons. The tubewell water is sold at the rate of Rs.1000-1500 per 24 hours. The hiring rate of tractor is Rs.60 per hour and Rs.120-140 per hour for both tractor and thresher.

### **Roads**

The area is well connected with metallic and shingled roads. The shingle road leads to every village of the area while the distance of the suburb villages from the metallic road ranges from 0 to 10 kilometers. The Dringar Railway Station connects the area with railway transportation. Moreover, the local buses provide daily transport to and from Quetta and Mastung cities.

### **Cash**

Availability of cash and credit is one of the major constraints of the area. Neither agricultural nor a commercial bank branch or cooperative society are located in the targeted area. Being a religious community, the farmers of the area are against any kind of loans given on the basis of interest. However, they were very eager to join a cooperative society that could provide agricultural machinery and other physical inputs at the time of need and allow them to pay after harvesting of the crops. In emergency situations, the animals are sold or money is borrowed informally from fellow farmers.

### **Services**

The area consists of 40 villages inhabited by 25 to 500 households in each. Total population, according to population census of 1981 is 17,462 persons. A joint family system like other rural areas of the province forms the average family size as big as 10. The larger villages like Sirajzai (village of Nawab Raisani), Dringar and Gharibabad have the basic services like schools, telephones, post offices etc. The union council office of the area is in Dringar, which is also connected by the railway (Quetta-Noshki) line. Similarly, a health clinic, a veterinary dispensary, a livestock assistant office, and a boys' high school are available at Sirajzai. Only two villages in the area have girls' primary schools. The only field assistant cannot cover the vast area of the

valley. Similarly, the veterinary dispensary is insufficient for the livestock population of the area. The farmers complained the unavailability of the veterinary medicines especially during the peak disease attacking months.

### C. Information on Crops

#### **Soils**

The soils of the area are classified (FAO system) as lithosols (very shallow) on mountain slopes, and strongly calcareous alluvial vermosols in the valley bottoms (homogenized and porous to about 100 cm depth, sandy loams to loamy clays, pH 8.0 to 8.3, 8 to 20% lime, low organic matter, low in N and P contents). (Rafiq, 1976). Soil texture in the valley bottoms vary from sandy loams to loam clay, with the property of forming strong crusts following wetting.

A total of 18 samples of soils, collected randomly from the areas of selected villages in Kanak valley, were tested in the Soil Chemistry Section of Agriculture Research Institute (ARI), Balochistan. The Kanak is developed in stream alluvium derived from limestones and shales and occupies nearly a level position on level plains. The soil is deep, moderate calcareous, electric conductivity ranging from 0.35 to 0.52 ds/m, CaCO<sub>3</sub> 11 to 22% (ave. 14%), organic matter ranging from 0.16 to 0.79% (ave. 0.45%) and pH value from 7.6 to 8.1 (ave. 7.8).

The results show that the soil is deficient in Nitrogen and Phosphorus but sufficient in Potassium. The organic matter contents are very low.

#### **Water Resources**

All the Karezes of Kalat district, including the Kanak valley, have gone dry. The three available sources of irrigation water are tubewell, open-surface-wells and rains. Since the average rainfall is not more than 350 mm in the district, the farmers of the area have to depend mostly upon the first two sources. Farmers of the area say that the present supply of water is less than the total demand due to which the land owners are unable to cultivate their total holdings. Farmers were observed watering their orchards just after harvesting the fruits when there seemed no need of it. Thus, the water-management techniques could solve the water shortage problem, at least partially if not totally.

#### **Cropping Pattern**

Wheat, cumin and barley are the main Rabi crops, and onion, potato, and vegetables are the major Kharif crops of the targeted area. Onion, cumin and



Visit of the field officer in target area



Improved variety of Wheat raised in the target area

Fruits generally grown in the target area

vegetables are intercropped. Onion, potato and wheat are the most important food and cash crops of the targeted area. The following cropping pattern is commonly practiced in the valley:

Onion - Wheat - Fallow - Wheat/Cumin with Onion  
 Potato - Wheat - Fallow - Fallow - Onion or Potato  
 Wheat - Fallow -Wheat - Barley  
 Wheat - Sorghum or maize - barley or wheat  
 Vegetables - wheat - Fallow - Wheat

### **Fruits**

Only 3 to 48% of the farmers have orchards, but the trend of growing fruit trees is increasing rapidly in the area. The principal fruit trees are apple (golden delicious, red delicious, mushhadi, amri and kashmiri) peach, plum and apricot. Apple is the most common fruit which is mostly harvested from September to November and marketed in Quetta and Karachi or sold with the local contractors. Vegetables, and lucern, are grown as intercrops in the young orchards. Codling moth, stem borer, stem cracking, short-hole borer, mites and aphid are the common insects and pests of the fruits in the targeted area. Observations indicated that orchards of the area are in very poor condition. No proper management of trees is practiced in the area. The informal survey team visited six orchards which needed pruning, training, weeding, and other operations related to management.

### **Fodder**

The fodder production is inadequate for livestock needs of the area. Winter feed shortages are serious constraints to the livestock production in the valley. Lucern, maize, hay, barley straw, leaves of onion, potato crops and dry leaves of the trees are main sources of fodder for the livestock. First one to two growths of wheat and barley (khasil) are cut and fed or grazed by the animals during the severe winter months. Some herders collect camel thorns and beat the dry heaps to make straw to be mixed with wheat straw. The mixture is fed to sheep, goats, bullocks and particularly to camels. The dry leaves of orchards are purchased by the flock owners for grazing in the orchards. For this, sheep herds are preferred because they cause less damage to tree shoots.

### **Source of Seed**

The local variety of wheat called *sore Big* (red seed) is popular among the farmers because of its fodder and cold tolerance characteristics and less number of irrigations as compared to improved cultivates. The farmers of the targeted area know little about other recommended varieties and this needs

more attention of the extension department. Potato seeds are imported from Quetta, Sukkur and Okara, and the seeds for onion are purchased from the local farmers or Quetta and Mastung markets. The progressive farmers of the area are also a source of seed for onion, potato and vegetables. Sometimes, the potato seed brought from the Quetta and Sukkur markets, is a poor quality due to which either the yield is very low or the whole crop is destroyed. Some farmers of the area get potato seeds from commission agents at Quetta on loan and the cost is returned after harvesting of crop.

## Seed Rate

The recommended seed rate and the planting techniques play a crucial role in increasing the yields of the crops. The farmers of the targeted area use the following seed rates.

**Table 2. Commonly used and recommended seed rates**

<b>Crop</b>	<b>Seed Rate Used by Farmers (Kg/Acre)</b>	<b>Recommended (Kg/Acre)</b>
Wheat (local)	30 - 35	40 - 50
Potato	1000 - 2000	2000 - 3000
Onion	4 - 5	5 - 6
Cumin	4 - 5	5 - 6
Lucern	4 - 5	5 - 6

It is important to note that a low seed rate may result in low yields of the crops. Similarly, weed population is found increased in low seed rated fields. The sowing is done by the broadcasting method except for the potato which is sown on the ridges.

## Fertilizer

Fertilizer is not applied at the optimum time in the target area. Potato, onion, wheat and fruits are the crops which receive some quantity of fertilizer. An unbalanced fertilizer is generally applied in the valley. The following table summarizes the fertilizer application practices in the Kanak Valley.

**Table 3. Fertilizer application and number of irrigation**

Crop	Fertilizer Use (bags/acre)	Number of Irrigation
Wheat	Urea: 1 bag	3 - 5
Potato	DAP: 2 bags & Urea: 2 bags	10 - 15
Onion	DAP: 2 bags & Urea: 2 bags	10 - 15
Barley	Urea: -	3 - 5

## Planting Time

Rabi and Kharif are the two cropping seasons in Kanak valley. The following table summarizes the planting and harvesting times of the different crops according to the information collected from the farmers and key informants.

**Table 4. Planting times of major Rabi and Kharif crops**

CROPS	Season of Planting	Harvesting
<b>Rabi Crops</b>		
Wheat	Oct.25 - Dec.31	June - July
Barley	Nov.- Dec.	May - June
Cumin	Jan.- March 15	May - June
<b>Kharif Crops</b>		
Potato	March - April May - June	July - August Oct. - Nov.
Onion	March 15 - April 15	Oct. - Nov.
Fruit Trees	January - February	June - Sept.

In contrast to other areas of the district, the farmers of Kanak valley start potato sowing in June and harvest in November. The reason for this late sowing is that they have to crop on the same fields after wheat harvesting. This is perhaps, due to land shortage in the area.

## Weeding

Weeds are the most severe problem of the targeted area. No weedicides and herbicides are used by the farmers. Perhaps farmers know little about the effects of weeds on yield, but they do understand the benefits of the weeds. The weeds of the onion, potato and wheat crops are stored as winter feed for sheep and goats. Another factor is that annual labor is hired at the nominal wage rate (Rs.10-15/day) by allowing them to take away the collected weeds for their animals at the end of the day. Thus, they have not to pay wages in monetary terms. The important weeds found in the area are summarized in the following table.

**Table 5. The main weeds of the targeted area crops**

Botanical Name	Common Name	Local Name
Alhaji murikum	Camel thorn	Shinze
Lepidium draba	-	Gerbusht
Convolvulus arvensis	Bind weed	Wakarwali
Cuscuta reflexa	Dodder	Akash bel
Orobanche aegyptica	Broom rape	Sooz gul
Euphorbia helioscopia	Chhatri dodak	Palti bey
Plantago Major	-	Lagri Ghas
Chenopodium album	Bathu	Sarmi
Avena fatua	Wil oat	Gandam Gao
Rumex dentatus	-	Jangli Palik
Cynodon dactylon	Bermuda grass	Chap bey
Sophora alopecuriodes	-	Bandakh
Sisymbrio irio	-	Khoob kalan
Sonchus oleraceous	Pili dodak	Palti bey
Helletropium europium	Poput	Oont charo



Social foresting of the target area



Chlorosis effect on apples



Bark splitting disease on apples

#### **D. Information on Livestock**

According to the census of 1986, the total livestock population of Kalat District is given in table 5.

**Table 6. Livestock population of Kalat district**

<b>Livestock</b>	<b>Numbers</b>
Sheep	12,19,872
Goats	6,38,692
Camels	28,410
Buffalo	213
Poultry	21,08,78

The major livestock raised in the district are sheep and goats which form 88% of the total livestock population (except poultry). The farmers raise livestock for store of wealth as well as risk aversion. The following table summarizes the selected informal survey information on sheep and goats.

**Table 7. Selected informal survey information on sheep and goats, Kanak Valley Balochistan.**

<b>Characteristics</b>	<b>Information</b>
Enterprise type	Crop/Livestock/Orchards
Livestock breeds	
Sheep	Balochi
Goats	Local mixed / nondescriptive, Barbari and Kamori
Sheep/goat ratio	60 / 40
Herd Size:	
Land Owners	20 - 60
Herders	30 - 200
Breeding male/female ratio	1: 40 - 50
Lambing rate	65 - 70%
Kidding rate	70 - 80%
Twinning rate	
Balochi sheep	2 - 3%
Barbari & Kamori goats	70 - 80%
Lambing months	March - April
Breeding age	14 - 18 months

contd....

**Table 7. (contd...) Selected informal survey information on sheep and goats, Kanak Valley Balochistan.**

Characteristics	Information
Shearing:	
Local	March - April (once a year)
Migratory	October/November and March/April (twice a year)
Castration	Yes
Fodder	Green fodder of lucern, sorghum, barley and wheat, and dry straw of lucern, sorghum, wheat, barley & dry leaves of onion, potato and trees.
Feed shortage months	November - March
% farmers who use supp. feed:	10 - 30%
Water quality	Good
Watering per day	1 - 2 times
Use of vet. services	25 - 30%
Housing	Open in summer and closed in winter by unhygienic.
Abortions	3 - 4%
Predators	Wolves
Migration	Sibi and Kachhi regions
Livestock Income Proportion:	
Land	10 - 20%
Animal raisers	65 - 70%

The informal survey information on livestock are summarized in Table 1. Almost all the land owners of the Kanak valley raise livestock (generally sheep and goats).

Sheep and goats are flocked together. Sheep, in the flocks of the targeted area, belong to the Balochi breed and the goat breeds are the local mixed nondescriptive breed. Some farmers possess the Barbari and kamori breeds, well known for milk production and are imported from Sindh. The average liveweight of a Balochi ewe is between 20 and 25 kilograms while mature breeding rams may gain a weight of 40 to 45 kilograms. The average herd size in the area varies from 20 to 200 animals. The farm owners raise 20 to 60 animals, while herders may have as many as 200 animals, including the animals kept on tenancy. November to March are the severe winter months in which feed shortage problems are acute as well as the frequency of the diseases. There is only one veterinary dispensary working in the area. Due to the large area and scattered population of livestock, the veterinary services are only available to about 25 to 30% of the flocks. The farmers who practice mixed enterprises, get 10 to 20 percent of their income from livestock. However, the herders share of their total income from livestock is as high as 65 to 70 percent of their total income. Family members generally herd their flocks but some owners hire full time herders. Herders say that their flocks graze as far as 2 to 4 kilometers from the watering points. The flocks are grazed on the fallow fields and on the rangelands of northern and southern parts of the valley or on the areas at the bottom of the mountains. The rangelands are not controlled in any way. The herders generally choose the better grazing sites first and move frequently from one area to another. This results in overgrazing and deforestation.

### **Diseases**

The flock owners of the targeted area mainly face economic losses due to endo and exp-parasitic and infectious diseases. Generally, the attack of these diseases is severe in the winter months (Nov-March), when there are limited sources for feeding and grazing. The animals are housed in the open courtyards, surrounded by the thorny bushes in the summer season and closed mudrooms in the winter season. All the animals are kept in one small room under unhygienic conditions which may contribute to the health problems. The main diseases and their general symptoms, as perceived by the farmers and herders of the area, are listed in the following table.

**Table 8. Sheep and goat diseases, common symptoms and season of their incidence.**

<b>Diseases</b>	<b>Season of severe attack</b>	<b>Symptoms</b>
1. Liverflude	Winter + Spring	Bottlejaw, Razorback & falling of wool in patches.
2. Lungsworm	All year	Severe coughing and weakness.
3. Wireworm	All year	Diarrhoea, loss of weight, anemic body condition and falling of wool.
4. Enterotoxaemia	Spring	Acute diarrhoea and dehydration.
5. Anthrax	Winter	Colicky pains and sudden death.
6. Paraplasmosis	Winter + Spring	Jaundice condition.
7. Sheep/Goat Pox	Autumn	Pox lesions of the hairless parts of the animal body.
8. Contagious Pleuropneumonia	Winter + Spring	Cough-ing and loss of body weight.

The mortality rate ranges from 5 to 12% and 7 to 15% among the sheep and goats, respectively. Only one veterinary dispensary is working in the area. The local stocks assistant is able to treat only 25 to 30% of the flocks, partially or completely. Farmers say that the medicines are generally out of stock. The veterinary doctor of the area explained that they try their best to treat the maximum animals but due to nonavailability of mobility facility and scattered population, only one-fourth of the population of the animals is able to be treated. The situation becomes more severe during the fall and spring seasons when there is a lot of pressure on the sheep and goat population due to migratory movements of flocks. Veterinary mobile camps are also organised casually in addition to the above mentioned regular services.

## **Feeding and Grazing**

Grazing time during the summer ranges from 10 to 12 hours excluding a rest period of 2 to 3 hours at mid-day. During the winter month, the grazing time varies from 5 to 6 hours daily. All the farmers graze Khasil (the first one to two growths of wheat and barley crops) during the winter months. November to March are the severe winter months when grazing is most difficult. Lucern, hay, barley straw, dry leaves of onion, potato crops and fruit trees are fed in the animals as supplemental feed. Flushing is usually not practiced; however, grains, oil and sometimes ghee is served but only to the sick and the pregnant ewes and breeding rams and bucks.

The farmers who have large flocks, hire the services of shepherds either on a monthly payment basis or on set terms and conditions for one breeding season. According to the monthly payment schedule, ten rupees plus daily meals, a pair of shoes and clothes as well as accommodation are provided by the flock owner. In case of tenancy terms and conditions, one out of ten lambs goes to the herder. In addition to the accommodation (if needed), daily meals are also given by the flock owner. During the lactating season, the udders of the sheep and goats are bagged to reserve one teat for self use and this may result into weaker health for the young animals and ultimately less resistance to the diseases. The first day Colostrum is not given to the offsprings and this deficiency in nutrition exposes the young to diseases.

## **Breeding**

The mating season usually starts with the start of the winter season (Oct - Nov) in order to have lambing during the pleasant season of spring (March - April), when some grazing material is generally available for the ewes, bucks and for their offsprings. The lambing and kidding rate is 65 to 70% and 70 to 80%, respectively. Twin births are reported only by the Kamori/Sumalani goat breed. This breed is well known for high milk production and is imported from Sindh in the area.

Breeding ewes and goats are usually disposed of after obtaining 4 to 6 lambs/kids from them while breeding rams are replaced after each 2 to 3 breeding seasons. Breeding rams are replaced by the young of the same flock which is the closed inbreeding method. Some undesirable breed characteristics in the offspring may be carried on with this method which may cause hereditary diseases. Unwanted rams are castrated at the age of 4 to 6 months, using the traditional methods which cause sometimes, sudden death. One breeding male is thought to be sufficient for 10 to 50 females.

## Marketing

The animals serve as a store of wealth and are sold when there is a shortage of food and cash for buying agricultural inputs or for necessities for some social occasions. No marketing facility is available in the area. The nearest markets are Quetta and Mastung. When a farmer has to sell one to two animals, he generally sells to the middle-men of the area. The sick animals are disposed off at very low prices. Culled and surplus stock is usually sold either on the occasion of Eid-ul-Azha or during the fall season when they are healthy enough to give the maximum return. The average price of sheep and goat is Rs.500 to 800 and 700 to 1000, respectively.

Wool is usually sold with local merchants at cheaper rates because no proper washing, cleaning and grading practices are adopted prior to shearing. Shearing is carried out by the flock owners with locally made scissors called Durkatch. A sheep may produce 750 to 1000 grams of wool per shearing while average production of hair per goat per year is 500 to 600 grams. There is generally a margin of 100 to 200 and 50 to 100 rupees in marketing the animals and wool, respectively in the local and the Quetta and Mastung markets.

Milk is never sold. Some big flock owners may preserve surplus whey into a hard substance locally called Kharood which is sold in the market and is available at a rate of Rs.20 to 30 per kg throughout the province.

### *E. Major Constraints and Priority Problems*

The major production constraints and priority problems facing the crops, livestock, horticulture and forestry of the targeted area are prioritized below:

#### **Crops**

1. Little knowledge about the high yielding varieties.
2. Low yield/production of crops.
3. Unbalanced use of inputs - low seed rate, fertilizer application and less number of irrigations.
4. Poor management practices - land leveling, weeds, insect and pest control.
5. Marketing - inadequate marketing facilities for inputs and outputs.
6. No credit facilities - non-institutional credit sources.
7. Energy crises - long loadshedding during winter season.

### **Livestock**

1. Nutritional deficit - feed shortages especially in the winter months due to very low productivity of rangelands and lack of readily available and cost effective supplemental feeds.
2. Animal diseases and health problems - high incidence of mortality and morbidity losses due to diseases and parasitism.
3. Poor flock management - breeding animals are not carefully selected, low male/female ratios and breeding times are not controlled. Consequently low birth rates.
4. No range-management - overgrazing and deforestation.
5. Housing - unhygienic condition overcrowded housing during severe winter months.

### **Social Forestry**

1. Little knowledge about the multi-purpose trees.
2. No campaign on social forestry.

### **Horticulture**

1. Fruit diseases especially apples and plum.
2. Poor management of fruit trees.

## **V. HYPOTHESIS ON MAJOR RESEARCH OPPORTUNITIES**

Hypotheses on major research opportunities can be developed on the basis of secondary data, informal survey information and the list of constraints and priority problems. The scientists of the interdisciplinary team were agreed upon the following interventions.

## Crops

1. Testing of recommended varieties of wheat, onion and potato along with local cultivates (with very low yields) with and without fertilizer, on the farmers fields.
2. Introduction of crop-management practices through the farmer-managed trials.
3. Fodder production - increasing fodder production by introducing new forage species such as barley, chick-pea and data, informal survey information and the list of constraints and priority problems. The scientists of the interdisciplinary team were agreed upon the following interventions.

## Livestock

1. Increasing the Nutritive Value of crop Residues - molasses blocks, mineral supplementation etc.
2. Disease and Veterinary Health Coverage - vaccination, drenching of sheep/goats against anthrax, liverfluke and external/internal parasites.
3. The flock management - on-farm animal trials which include a control (traditional practice) and improved management practices.

## Social Forestry

1. Introduction of multi-purpose and fast growing trees (mulberry, Russian olive, poplar, Eucalyptus, etc.) along the irrigation channels, paths and in small woodlots.
2. Planting of "fourwing saltbush" for farmers testing on their fields.

## Horticulture

1. Treatment of fruit trees against insect and pest diseases.
2. Management practices - Pruning, training and weeding as well as water-management.

## Extension

A well organized publicity campaign to educate farmers and herders explaining:

- i) Importance of high yielding cultivates,
- ii) crop, livestock and orchards management,
- iii) the benefits of trees on farmlands and objectives of social forestry, and
- iv) input-output use, their role in increasing productivity and consequent increase in farmers' income.

A one to two days field day, at the FSF area (Kanak valley), arranged with the close collaboration of participating farmers, scientists and the extension department staff, could be a good start. The scientists could train the area farmers in general and the cooperative farmers in special, in different management operations in crops, livestock, orchards and social forestry.

## VI. SUMMARY AND CONCLUSIONS

This paper describes crop, livestock and forestry diagnostic survey. The diagnostic survey was conducted into two phases: 1) the gathering of secondary data and information, and 2) an informal survey of farmers and herders by a multi-disciplinary team of scientists. The informal survey was undertaken at different sites of Kanak valley of Kalat District, Balochistan. The major aim of the diagnostic survey was to gather information on crops, livestock and forestry of the area and list the major production constraints. This led the multi-technological interventions and research opportunities that may exist.

Many technological interventions and research opportunities are pinpointed in crops, livestock, horticulture and social forestry under the farming systems perspective. These interventions seem socio-economically fit and can raise the income of the farmers of the area.

The next step is to collect input/output data on all interventions in collaboration with the scientists. Then, the proposed technological interventions should be scrutinized with respect to their economic profitability through traditional and synthesized improve farm budgets for all interventions (by the economists). This will further guide for future research thrusts.

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