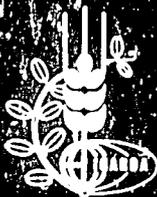


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**HIGH - ELEVATION  
RESEARCH IN PAKISTAN:  
THE MART/AZRI PROJECT**

Annual Report for 1986



## ICARDA high elevation research in Pakistan

### - The MART/AZRI Project

#### Summary

This project was formally launched at the Arid Zone Research Institute, Quetta with funding by USAID in late August 1985.

The project has two major objectives - institution building of AZRI and the development of a dryland agricultural research program.

In Baluchistan the principal dryland agricultural activity is livestock management on rangelands with subsistence cropping of wheat being a secondary activity. The rainfall experienced in N. Baluchistan is irregular and averages 200-300 mm per annum. Crop failure of wheat can be expected 3-4 years out of ten under dryland conditions.

The AZRI building was in poor condition in 1985 but has been completely renovated and upgraded in the last twelve months. 0.7 million dollars worth of equipment is expected to arrive in the next 3 months.

The 1985-86 season proved to have very badly distributed precipitation and crop growth was in general very poor. Forage legumes and lentils were more successful than cereals in germplasm trials. A small positive response to fertilizer, probably from  $P_2O_5$ , was observed in agronomy trials. Though the results of the 1985-86 cropping trials were disappointing they do serve as a reference point for the likely outcome of the type of dry conditions experienced in N. Baluchistan at least two years in ten.

Two major range management and livestock improvements stations have been established at Tomagh and Zarchi and approximately 300 head of sheep and goats have been purchased for experimental purposes. An animal nutrition unit has been developed at AZRI.

Close cooperative links have been established between AZRI and provincial agricultural research organizations. Similarly, the project has received substantial support from ICARDA core programs.

Training of AZRI staff is a major project activity and considerable resources have been invested in this area in 1985-86 and planned for 1986-87.

Detailed research plans for the germplasm evaluation, agronomy, range/livestock, farming systems and extension groups at AZRI for the 1986-87 growth season are detailed in the main text.

## ICARDA High Elevation Research in Pakistan

### - the MART/AZRI Project

This project was formally launched at the Arid Zone Research Institute, Quetta under funding by USAID in late August 1985. The team consisted of a germplasm evaluation specialist, a range management/livestock specialist and an agronomist. Two positions remained unfilled - farming systems specialist and extension/communication specialist. These two positions were subsequently filled in August and October 1986 respectively.

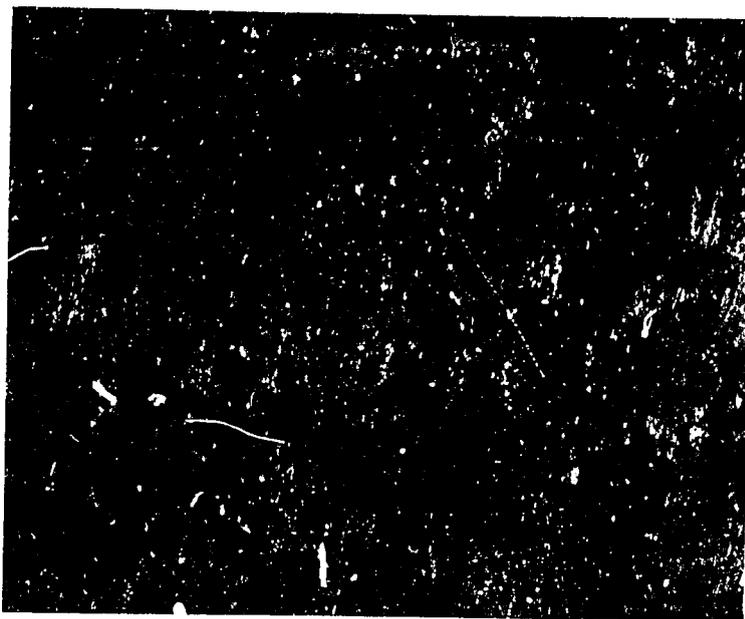
In brief, the project has two major objectives - (1) to assist in the development and strengthening of the research capacity of the federal Arid Zone Research Institute (AZRI) through building development, equipment supply and training of local staff and associated collaborators from provincial agricultural agencies; (2) to formulate and instigate a research program for the AZRI in relevant aspects of dryland agriculture and to assist the local extension agencies in preparing materials for the transfer of AZRI generated technology.

#### Baluchistan's physical environment

In the 1985-86 growth season the team's activities were largely confined to the northern upland section of Baluchistan. This consists of a series of mountainous ridges of an inhospitable nature and intervening fairly narrow valleys. The valley bottoms range in elevation generally from 1000-2000 m. Livestock rearing of sheep, goats and camels is the principal non-irrigated agricultural activity. There is no broad-acre dryland agriculture per se, but where slope and soil conditions are favourable, wheat is grown in an extensive minimum input manner. In a strict dryland agricultural system (Kushkaba) crop failure is expected about 4 years in ten. Where summer rainfall can be channeled from stream beds onto dammed fields, providing a single pre-cropping irrigation, crop yields are enhanced and the risk of failure is somewhat reduced.

In the extremely cold period December, January and February most livestock are unable to be supported on rangeland vegetation and to avoid this feed deficit period migrate along with a substantial portion of the agricultural population to low lying plain areas of Baluchistan, the Punjab and NW Frontier Province.

The rainfall regime is variable across N. Baluchistan. Annual averages are between 200-300 mm generally and a variable proportion of this total may fall as intense showers in summer or as a mixture of snow and rain in the mid winter period.



*PHYSICAL ENVIRONMENT OF UPLAND BALUCHISTAN*

The Arid Zone Research Institute

At the start of the project the principal AZRI building was in poor condition and incomplete after about ten years. The laboratories were partially furnished and extremely deficient in equipment. Staff numbers were inadequate and the level of technical competence was poor.

The arrival of a new Director and Deputy Director for AZRI and the commitment of substantial funds from the Pakistan Agricultural Research Council and the MART project has transformed the position. The main structure is repaired, laboratories are being completely refurnished, an auditorium and library have been completed, roads, garages, equipment stores, animal sheds, gas pipeline and a 24 unit staff housing colony have been constructed.

This physical development has now permitted AZRI to channel resources into the development of a research program and staff numbers and technical competence have been enhanced. The major equipment procurement has been badly delayed but is expected in the next six months and includes about 0.7 million US dollars worth of agricultural and laboratory equipment. Sixteen vehicles were supplied to AZRI by the MART project.



*ARID ZONE RESEARCH INSTITUTE BUILDING*

Work Plans 1985-86

The underlying concepts behind research activities in the 1985-86 season were:

- a) Can improved management of rangelands and livestock reduce pressure on the extremely overgrazed natural rangelands?
- b) Are the overgrazed rangelands capable of recovery without complex reseeding operations?
- c) In what way can greater stability and enhancement be brought to the economic returns from present cropping practices by improved agronomy?
- d) Can a greater supply of animal feed from introduced forage legumes, dual purpose legumes and barley be beneficial to the cropping and livestock systems.

Summary of results 1965-86

A) Germplasm Evaluation Specialist

The physical environmental conditions experienced in the 1985/86 growing season proved to impose a very severe stress on both exotic and local germplasm material. Particularly hard hit were the small grain cereals as in almost all cases premature maturity was enforced prior to competent grain formation. Emergence in most species occurred in late February following October dry planting and the first rains capable of causing germination in mid December when air temperatures were extremely low. The effective length of the growing period was less than 90 days in most cases. As a result only species capable of very rapid maturity achieved a measurable grain yield. Both grain yields and total above-ground dry matter production were low, averages for the best cultivars being in the region of 0.2 and 0.5 t/ha. As such, though differences between cultivars were of scientific interest, in agricultural terms production levels were close to the borderline of crop failure.

In the evaluation of exotic forage legume species some lines of Vicia ervillia, Vicia dasycarpa, Vicia sativa, Vicia narbonensis and Lathyrus sativa showed some promise and managed to achieve maturity in periods ranging between 70 and 87 days. These are species not currently grown as agricultural crops in Baluchistan and their success in comparison to the local lentil check is of some interest.



*VICIA DASYCARPA - ANNUAL SOWN FORAGE LEGUME*

Seven separate lentil nurseries were planted at AZRI farm. Of these nurseries only one line exceeded the local small seed check. This was ILL 5699 AZRI selection 1984-85, and this was only the case for total dry matter production. The implication of these results suggest that in harsh years improved exotic lentils are unlikely to out-perform the local material. One reason for this appears to be the longer effective growing period achieved by the local small seeded cultivar owing to a distinctly earlier pattern of emergence. Screening for germplasm with an ability to emerge at low temperatures will be a potentially useful tool for future selection work.

In the cereal nurseries, which failed to reach maturity at AZRI farm, the local white breadwheat, as in the lentil experience showed a much earlier and higher percentage of emergence than was observed for the exotic material. In such a short growing season, as was experienced, this factor may be of a critical nature in drought avoidance and careful attention will be paid to this in the following season.

Though the results of the 1985-86 nurseries were in general disappointing, they do serve as a valuable reference point for the likely outcome of the type of dry conditions experienced in Quetta, at least two years in ten.

#### B) Agronomist

A series of agronomy trials were planned and initiated in September 1985 and planted into dry soil in October/November. The trials were designed to incorporate a wide range of agronomic practices and were conducted on farmers' fields, supervised by scientists (technician-managed). Areas of research were: (1) Water conservation: (a) Ridge v. flat planting; (b) Deep moldboard tillage v. shallow chisel tillage (local practice). (2) Soil fertility: (a) Response to N, P<sub>2</sub>O<sub>5</sub> and K fertilizer; (b) Response to weeding; (c) Long-term effects of P<sub>2</sub>O<sub>5</sub> fertilizer; (d) Comparison of various two-year crop rotations. (3) Wheat production: (a) Comparison of a number of local varieties from Baluchistan and the recommended "improved" variety "Zarghoon"; (b) Response to compound fertilizer. (4) Barley production: (a) Comparison of exotic and local varieties; (b) Response to fertilizer. (5) Lentil and forage legume production: (a) Effects of weeding, pest and disease control; (b) Comparison of exotic and local varieties.

Rainfall did not occur until mid-December by which time temperatures were too low for proper germination. Emergence and good crop growth started in early February 1986. Good rainfall in February was not sustained, with little in March and no rain subsequently. The promising early crop growth was consequently followed by severe water stress and low grain yields. Preliminary analyses of results indicates that even in these harsh conditions phosphate fertilizer consistently increased



*AGRONOMY TRIALS MASTUNG 1985/86*

wheat yields by 20%. "Improved" varieties of wheat and barley did not yield more than the local varieties but neither did they yield less. This is encouraging as they may be expected to out-yield the local varieties in good conditions. Exotic lentils performed substantially worse than the local material and new material will be tested in the coming year. Forage legumes (*Vicia* species) performed comparatively well in these harsh conditions and if they also perform comparatively well in good conditions could be a valuable introduction to the cropping system.

C) Range management/livestock specialist

Work plans prepared for the AZRI range-livestock research program in late 1985, and further refined in early 1986, placed major emphasis on the establishment of facilities on a large area of land allocated to AZRI on the Maslakh Range, some 30 km west of Quetta. Plans to conduct research at Maslakh had to be canceled in late March due to deterioration of security conditions for all AZRI staff working in an isolated area close to the border with Afghanistan.

An intensive search was conducted to find suitable alternative field research sites. Security, grazing control, water availability and ecological factors were critical in the evaluation of candidate locations. Range areas were examined in Quetta, Pishin, Kalat, Chagai and Loralai Districts. After careful consideration two sites were selected which satisfied the essential criteria: Zarchi in Kalat District and Tomagh in Loralai District. By June 1986 development and operational plans had been established and construction of physical facilities had started at both sites.

#### Development and Operation of Research Facilities

Zarchi Range-Livestock Research Station, located 20 km northwest of Kalat.

Facilities include a headquarters block with housing for station personnel and all-season shelter for approximately 125 research animals. Water is piped to the headquarters from a nearby spring. Three range exclosures, fenced treatment plots, and designated grazing areas will facilitate several different range-livestock studies. Fifty sheep and 50 goats are maintained at Zarchi for the grazing studies.



ZARCHI RANGE/LIVESTOCK RESEARCH STATION

Research program at Zarchi. This emphasizes the three basic range management problems, namely: stocking rates, kind of livestock grazed and season of grazing use. Experiments will evaluate both vegetation and animal responses to different grazing practices. Seeding trials will test the adaptability of different plant species and varieties for reseeding degraded rangelands and sub-marginal croplands in this region. Studies designed to examine health cover and nutritional aspects of range-livestock management are under consideration for 1987.

Tomagh Range-Livestock Research Station, located 15 km southwest of Sanjawi, in Loralai District.

Facilities include a headquarters block with housing for station personnel and all-season shelter for approximately 125 research animals. A spring at the headquarters has been improved, with water storage and piping in place, to enhance living and working conditions for the staff. Two range enclosures, fenced treatment plots and designated grazing blocks will facilitate several different range-livestock experiments. One hundred sheep and 25 goats are kept at Tomagh for various studies.

Research program at Tomagh. This includes a comparison of vegetation responses in a mixed shrubland-grassland range type to grazing by sheep and goats, evaluation of vegetation changes under different seasons of grazing use and measure of livestock responses to different health cover and feeding practices.



*PURCHASING SHEEP FOR TOMAGH RESEARCH STATION*

At the Arid Zone Research Institute headquarters at Quetta an Animal Nutrition Unit was established in 1986 with shelter and stall feeding for 50 sheep and a six pasture rangeland grazing block for vegetation response and animal performance studies. The research program largely involves animal responses to specific feeding regimes and health measures. An initial study on Baluchi ewes with contrasting nutritional and internal parasite control has been completed and results are being analysed.

Additionally at the AZRI HQ Quetta steps have been taken to start a herbarium collection of native range species. This will be further developed in the 1986-87 season.



*ANIMAL NUTRITION UNIT AT WORK - AZRI HQ QUETTA*

Establishment of Inter-relationship between AZRI and provincial agricultural research and development agencies

Initial major contacts were with the office of Chief Conservator of Forests (CCF) in Baluchistan, which is responsible for range management activities. In the search for suitable

range research areas with appropriate grazing control numerous forest preserve areas were offered and Tomagh was selected. The development of the range management research program has formed an extremely close liaison with the CCF's office and prospects for joint future developments are bright.

Similarly, the absence of suitable cropping land at AZRI has led, over the last twelve months, to a fruitful cooperation, particularly in the field of germplasm evaluation, with the staff of the provincial agricultural research institute at Sariab. All 1986-87 nurseries are planted at the Sariab station in close collaboration with counterpart staff. The allocation of counterpart staff between AZRI and ARI Sariab is an entirely new and potentially most productive innovation. Initial contacts with the provincial agricultural extension service have also proved to be fruitful. This area will be one of major cooperative contact in the future.

Cooperation in direct experiments with the livestock department has been slower to develop but their assistance has been invaluable in initial sheep purchases and backup veterinary support. For the first time in its history AZRI has livestock for research purposes. Its approximately 300 animals (sheep and goats) require considerable care and scope for joint future



*PROVINCIAL GOVERNMENT COOPERATION - VISIT OF SECRETARY AGRICULTURE, GOVERNMENT OF BALUCHISTAN TO JOINT PROVINCIAL/AZRI GERmplasm EVALUATION TRIALS*

experimentation with the livestock department on animal health care, nutrition, parasitology, reproduction and quality enhancement is considerable. Joint cooperative ventures with the livestock department extension agencies are presently under formulation. The recent arrival of the farming systems and extension/communication specialists to the AZRI team have already established working linkages with the extension department, the University of Baluchistan economics, sociology and geography departments and Pakistan radio/television.

### Trainings

There is considerable scope for in-house and associated agency staff training at AZRI. In 1985-86 one AZRI staff member was sent for long term training in animal nutrition to Utah State University. Four workshops were held on farming systems research methodology (in cooperation with FSP), range management research at Maslakh, introduction to biometrics and English language. Participants included staff from AZRI, Baluchistan provincial research agencies and representatives of the PARC and the other provinces of Pakistan. As a result of english language training five AZRI staff members achieved a pass in the TOEFL - a requirement for long term training in the USA.

At ICARDA, Aleppo three staff received medium term training in the fields of soil fertility, survey design (FSP) and management of forage crops (PFLP).

### Summary Research Plans 1986-87

#### A) Germplasm evaluation specialists

The results from the 1985-86 trials have indicated areas in which the germplasm evaluation program could be improved. Furthermore, our enhanced understanding of the farming environment in Baluchistan has led us to place more emphasis on a wider range of trials which attempt to cover the fairly diverse ecological zones found in the province.

Elevation is one of the principal factors causing this ecological diversity and we have selected sites covering a broadly representative range in altitude for central and northern Baluchistan. Sites are Khan Metarzai (2300 m), the Provincial Agricultural Research Institute farm at Sariab (1750 m) and Ferosabad near Khuzdar (1200 m) - in cooperation with the agronomy group.

The critical nature of the crop/environment interaction experienced in Baluchistan has led us to examine the influence of variable maturity period and seeding date on crop productivity and yield dependability. Therefore we have, where possible, split our nurseries into two maturity categories and these have been planted at two traditional seeding times - September/October and late January to early March (depending on elevation and soil moisture status).

We retain our emphasis (workplan 1985-86) on forage and dual purpose crops but feel now that a distinction between Selaba and Kushkaba cultivars is inappropriate. Environmental suitability and disease resistance remain primary screening criteria.

At our more distant experimental locations Khan Metarzai and Farosabad we are examining the following nurseries at two seeding dates.



*JOINT PROVINCIAL/AZRI FORAGE LEGUME NURSERY AT  
SARIAH FARM 1986/87*

1. Forage legume advance yield nursery.
2. Lentil small and large seeded advance yield nursery (high elevation).
3. Barley landrace observation nursery.

4. Breadwheat International yield nursery (high elevation).
5. Durumwheat International yield nursery (high elevation).
6. Cereal heat tolerance observation nursery (Farosabad only).
7. Breadwheat observation nursery (high elevation).
8. Durumwheat observation nursery (high elevation).

At Sariab experimental station near Quetta, we will be duplicating our outstanding nurseries and in addition planting additional material that requires detailed observation.

This material includes:

9. Breadwheat F<sub>2</sub> segregating populations.
10. Durumwheat F<sub>2</sub> segregating populations.
11. Durumwheat F<sub>4</sub> AZRI selection nursery.
12. Breadwheat F<sub>4</sub> AZRI selection nursery.
13. Breadwheat F<sub>5</sub> AZRI selection nursery.
14. Forage legume AZRI selection nursery.
15. Barley landrace yield trial.

We are extending our germplasm network contacts and have this year obtained rangeland species from the US and exotic Vicia species from Turkey. A herbarium facility is at present under construction and will be managed in collaboration with the range/livestock group.

#### B) Agronomist

1. Following on the 1985/86 program some improvements have been made in this year's work plan in response to new information and a better understanding of the farming environment of Baluchistan.

Three major areas have been selected for the agronomy trials, representative of three important ecological zones: (a) Dasht valley (Kalat District), approx. 30 km from Quetta, altitude 1500-1700 m; (b) Kovak (Kalat District), approx. 120 km from Quetta, 30 km from Mangochar, altitude 1900-2000 m; (c) Farosabad (Khuzdar District), approx. 380 km from Quetta, 10 km from Khuzdar, altitude 1200-1300 m (in cooperation with the germplasm group).

The different altitudes of each area ensure different temperature regimes and crop cycles: in Dasht winter crops are sown in late September/October and harvested in June; in Kovak crops should be sown 1 or 2 weeks earlier and harvested 1 or 2 weeks later; in Ferosabad crops should be sown 1 or 2 weeks later and harvested 3 or 4 weeks earlier. Each area is extensively farmed under kushkaba or sailaba conditions by large farming communities of subsistence farmers, usually with some sources of off-farm income. The trials thus have immediate applicability to farmer circumstances, serve a demonstration function and act as a focus for discussion of agricultural problems and practices.

Most of the trials will be repeated at each site. In Dasht valley, the trials will also be repeated in sailaba and kushkaba, to facilitate comparisons between these different types of land use.

The trials are summarized below:

- a. Water Harvesting. All fields in Baluchistan are banded; principally to demarcate ownership, but also to prevent run-off, a feature that farmers are acutely aware of. The most productive form of water harvesting is the sailaba system of diversion of ephemeral stream flow. This is already extensively



*PLANTING AGRONOMY TRIALS 1986/87*

practised by local farmers and little further input is required or possible by this project. The valley bottom soils, which are principally kushkaba, are usually productive near to the bunds at the bottom of the slope only. The water harvesting experiment has been designed to rationalize this use of run-off/run-on within the field by treating half or two-thirds of the field to encourage run-off into the remaining cropped area. The treatment consists simply of heavy planking followed by spraying with water to induce crust-formation in these relatively heavy soils. If the economics of land use prove successful farmers could omit the spraying and simply rely on the first rainfall to induce crust-formation after planking.

- b. Tillage. Moldboard plowing has proven highly advantageous compared to spring-tine cultivation in barani areas of the Punjab and NWFP. This experiment has been designed to compare these two practices in Baluchistan conditions; also deep chisel plowing (lower draft energy requirements than moldboard) and subsoiling.
- c. Soil Fertility. The principal experiment is a relatively complex  $2^5$  factorial combination of treatment. This is a highly efficient design providing a maximum of information with a minimum of effort. Responses to N,  $P_2O_5$  and K fertilizer are sought at one level only, because in the highly variable rainfall environment of Baluchistan it is by no means certain that a consistent response to fertilizer will be found or that fertilizer use will be economically viable in dryland conditions. The aim of this experiment is essentially long-term, hoping to compare responses in wet and dry years and to evaluate the advisability of fertilizer use on a long-term basis with the help of rainfall models. Other experiments under this heading comprise a 2-year phased entry crop rotation to look at alternative ways of maintaining soil fertility, and a long-term evaluation of phosphate application. If the year should prove to be dry the phosphate fertilizer may not be utilized and will be available for the crop in subsequent years. This work will, in particular, be performed in association with the economics group.
- d. Wheat, Barley, Lentil and Legume Production. These experiments evaluate various 'best-bet' varieties with and without fertilizer, and with a variety of other factors: (1) wheat: seed-dressing to control seed-borne fungal diseases; (2) barley: date of planting (spring/autumn) and seed rate; (3) lentils and legumes: Rhizobia inoculation; phosphate fertilizer.

- e. **Planting Machinery Evaluation.** The idiosyncratic rainfall pattern of Baluchistan presents an unusual problem in planting technology: the important summer rains occur, if at all, in July/August, but this is too early to plant because of high temperatures. Farmers plow and plank the soil following the rain to form a seed-bed with a highly effective mulching layer of dry soil, and then plant in September/October. To do this they use the 'desi-plow' drawn by camel or oxen which has two actions: (1) it places the seed into moist soil at 10-15 cm depth; (2) it scoops the dry soil to either side in the form of ridges so that only 3-5 cm remains above the seed. A start has already been made, in collaboration with Naeem & Co., Faisalabad to develop suitable tractor drawn planters to simulate this seed placement and to develop multi-row animal-drawn planters. This work will be further developed in association with the extension and economics group.
- f. In this complex farming environment, crops are often cut two or three times for fodder, which may greatly increase the overall economic value of the crop at the expense of reduced grain yields. To evaluate this all plots will be divided in two; one half to receive cutting to simulate farmer practice; the other half to be allowed to grow undisturbed to maturity.
- g. Economic evaluations of all trials will be carried out with the collaboration of the Farming Systems Expert and AZRI Economics group.

C) Range management/livestock specialist

1. Zarchi Range-Livestock Research Station.

Research at Zarchi emphasize three basic range management problems, namely: Stocking rates, kind of livestock grazed, and season of grazing use. Experiments will evaluate both vegetation and animal responses to different grazing practices. Studies designed to examine health cover and nutritional aspect of range-livestock management are under consideration. Vegetation sampling will be done in November, April, and September. Livestock weights and other data will be obtained on a monthly basis. Grazing behavior observations will start in March.

2. Tomagh Range-Livestock Research Station

Research at Tomagh includes a comparison of vegetation responses in a mixed shrubland-grassland range type to grazing sheep and goats, evaluation of vegetation changes under different seasons of grazing use, and measure of livestock responses to different health cover and feeding practices.

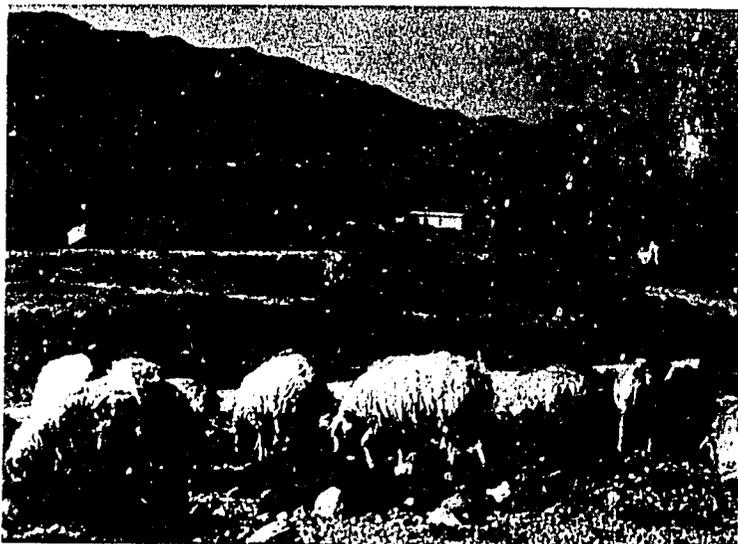
Vegetation sampling will be done in November, March, July and October. Livestock weights and other parameters will be observed on a monthly basis. Grazing behavior observations will start in March.

### 3. AZRI Animal Nutrition Unit

Research at the Animal Nutrition Unit, AZRI headquarters, will continue to emphasize animal responses to different feeding regimes and health measures. Studies involving high intensity-short duration grazing.

### Agro-Pastoral Systems Research

In conjunction with other scientists at AZRI the Range-Livestock group will assist in conducting surveys in the vicinity of Zarchi and Tomagh related to range and livestock management practices and economics, with special reference to off-range forage production. These preliminary studies will be multidisciplinary, tied closely to farmer-stockman actions and options, and carried out in the economic framework of the agro-pastoral system.



*AGRO-PASTORAL SYSTEM AT TOMAGH 1986*

### Range Rehabilitation Studies

Field adaptability trials of range grasses and shrubs will be conducted at several sites to evaluate commercially available species and varieties for establishment of perennial range vegetation. Range sites currently lacking useful perennial species, or lacking a perennial grass component, and sub-marginal cropland sites (typically former rangeland) will be considered for trials. A later winter seeding and an early fall seeding will be tried during 1987.

#### Botanical and Ecological Support

Collection, identification and preservation of range plants will be done as part of the joint effort in development of the combined range and germplasm herbarium at AZRI. A special training program for the range botanist is planned for March. Field collections will be made on a regular basis from March to October.

Ecological baseline data, including climatic and edaphic measurements will be collected. Meteorological stations are planned for two research sites. Soils data will be analysed when AZRI laboratories are functional sometime during 1987. Botanical data, not otherwise obtained as part of the grazing studies, will be collected as collections and staff time permit.

#### D) Extension/Communication specialist

The main activities being planned for the 1986-87 season are presented under four headings: (1) Surveys + Research, (2) Extension/Outreach, (3) Training and (4) Resource Centre Development.

#### 1. Surveys and Research

1.1 A survey of the present status of extension agencies and their operation will be conducted in Baluchistan. An attempt will be made to prioritize the areas in which remedial assistance is most urgently required.

1.2 Participation with MART/AZR staff in an ongoing series of diagnostic surveys of farmer practices, economic and physical constraints, etc. This will assist our understanding of farmer/herder practices and assist in designing improved methodologies of technology transfer.

1.3 Special case studies will be made by the extension group to examine:

- A) Access to mass media in rural Baluchistan
- B) Internal communication patterns within villages
- C) Effectiveness of communication modes at village level
- D) Gender roles in decision making in agricultural activities
- E) Traditional information exchange patterns (folk media).

## 2. Extension/Outreach Support Activities.

2.1 To assist the local extension agencies to participate in the advanced stages of on farm/on range research and early phases of technology transfer. The extension/communication specialist will act as a linkage agent between the research and extension services. These activities will be in close collaboration with the AZRI range/livestock and agronomy groups. A specific example of a new agricultural technology will be selected such as vitavax seed dressing or flock internal parasitic load reduction to proof this stage of the research/extension process prior to the development of AZRI engendered technology.

EXTENSION AND ECONOMICS GROUP ACTIVITIES		EXTENSION AND ECON GROUP		TIMITES
FARMER MANAGED TRIAL-1987		FARMER MANAGED TRIAL -		87
FACTORS		TREATMENT	N-P-K	COLOUR
A. VARIETIES		LOCAL WHITE	0-0-0	■
(i) LOCAL (ii) SONALKA		-- DO --	0-60-0 <sub>1/2</sub>	■
B. FERTILIZERS		III SONALKA	0-0-0	■
(i) 0K, P, 0, S, 1, 1/2		IV -- DO --	0-60-0 <sub>1/2</sub>	■
SEED RATE = 100 Kg/ha				
PLOT SIZE = 10 X 20M				
FACTORIAL				
DESIGN: RCBD, 2-FACTOR.				



JOINT AGRONOMY/ECONOMICS EXTENSION FARMER MANAGED TRIALS AT KOVAK 1986/87

2.2 Close collaboration will be encouraged with radio and television broadcasting authorities to assist in the farming/herding community receiving improved information on dryland agricultural activities. The development of information in specific regional languages will be encouraged. All AZRI Research groups will be encouraged to participate

2.3 As part of an enhanced information dissemination process on dryland agriculture the feasibility of publishing a newsletter for extension workers will be examined. Contributions from all agricultural research and extension agencies in Baluchistan and associated climatic areas will be canvassed.

### 3. Training

Initially training efforts will include participation in the provincial extension agencies in service training programs and the reciprocal involvement of provincial extension staff in AZRI's technical training activities. It is proposed that a formal seminar system be developed at AZRI in association with the provincial research/extension organizations and a workshop on extension education will be conducted in the next twelve months. This will include specific information for AZRI and other research personnel to assist in developing a better understanding of the role of extension in agricultural development.

### 4. Resource Center Development

It is intended that the extension/communication specialist assist in the development of an AZRI information resource center (as per contract). Initial steps have been taken by a short term Consultant in Library Studies. Collections of highly specific literature on arid zone agriculture will be made in association with collections of other information/training resources such as slide sets, video films, microfiche, etc. It is proposed that the AZRI information center will act as a resource base for arid zone agricultural development throughout Pakistan.

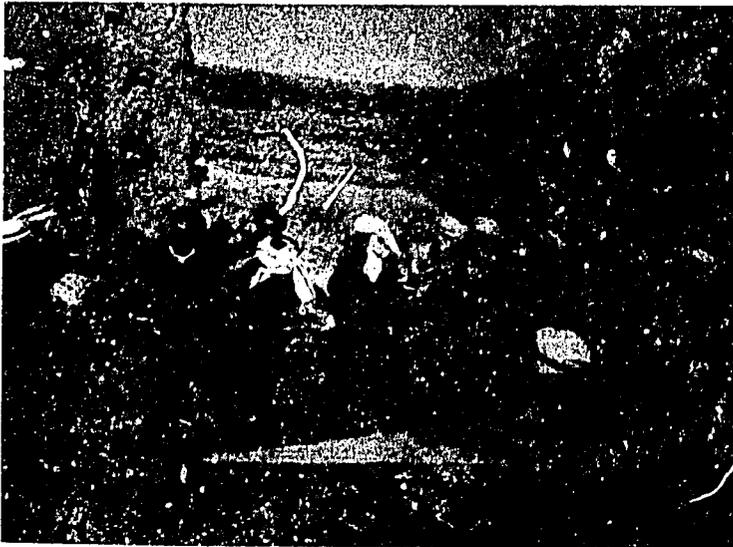
E) Farming Systems specialist

In the forthcoming year, the primary emphasis of the Farming Systems/Economics Group will be on the following two topics:

1. a description of the dryland cropping and range-livestock farming systems of Baluchistan, and
2. new technology evaluation.

The descriptive phase

The descriptive phase will look at all aspects of the dryland cropping systems and the range-livestock systems as mandated under the ICARDA/MART contract. Several questionnaires will be designed and surveys will be carried out over the 1986-87 period. Secondary and informal survey information will also be used. The amount of emphasis that will be put on each area of the descriptive phase will depend on available information and the importance of the area as defined through the collaboration of the economic, agronomy, livestock and extension groups. The intent is not to make the descriptive phase a massive data collection exercise but rather to collect data that can be useful for (1) planning field experiments and, (2) technology evaluation. Along with describing what farmers and herders actually do, the intent is also to find out why they observe certain practices, i.e., is it traditional, or is it to avoid disease and insects or are they unaware of other methods?



*SURVEY AND EXTENSION WORK KOVAK 1986/87*

## New technology evaluation

### a) Technical feasibility in the field

This involves answering the question of "Is the technology or management practice agronomically or technically superior to existing farm practices and under what circumstances are they or are they not superior?" This data and information comes from the on-farm experiments carried out by the agronomy and livestock sections. Farmers are also asked about what they think of the technology.

### b) Economic Feasibility (profitability) and Risk Considerations

The data and information from the technical feasibility stage lends itself to economic interpretation through the use of economic budgeting and rate of return analysis. A good economic feasibility study, like that of a good technical feasibility study, requires taking into consideration the various states of nature that occur over time. Several years of experimental data and associated input and product prices are required. In the initial years of a program, however, few state of nature observations are available. An economic analysis can (and should) be carried out using sensitivity analysis with synthetic data for product outputs and associated prices to arrive at rates of return and breakeven points to assess under what conditions and states of nature the technology or management practice is economically feasible. The synthetic data can come from researchers experiences, farmers (from the descriptive information) and secondary data sources, i.e. rainfall probabilities and price movements. Information from farmers on how many years out of ten does one get large, medium and poor crop or livestock responses can also be utilized.

### c) Technology Fit into the Farming Systems

Profitability may not be a sufficient criteria for farmer acceptance of a technology or a farm management practice. A new technology may require more labour at peak labour demand periods than the farm can provide from family labour or that can be provided by the labour market. A new activity may have higher capital requirements than the farmer can obtain from cash reserves or the credit market. Access to input and product markets may be unreliable. Data from the descriptive phase of the project such as labour profiles, access to credit and markets and other information can be used to assess farmer acceptance.

Whole farm modeling through the application of linear programming (LP) will be used to assess many of the questions of fit within the farming systems as well as add further budget analysis information.

d) Intra-Household and Inter-Household Dynamics

The roles, decision making powers, goals, resources and incentives of individuals differ within households, between households and among different groups of households. The main areas of concern are: (1) labour allocation on a gender and age basis, (2) access and control of resources i.e., who has access to resources (based on gender and age) and who has the ability to decide how resources are used, (3) incentives/benefits - what motivates people's decisions about the allocation of resources, what incentives are there to change present allocations? Information on the above may indicate further production constraints and even further opportunities in terms of research and agricultural policy.

Training

At least five workshops are planned for the 1986-87 season and will include AZRI and provincial agricultural agencies staff. Subjects to be included are:

1. Introduction to microcomputers (completed Dec. 86)
2. The appropriate use of analysis of variance (Dec. 86)
3. Introduction to the MSTAT statistical package (Jan. 87)
4. Range ecology (April 87)
5. English language (written and spoken).

Three AZRI staff members are receiving medium term training at ICARDA, Aleppo in the PFLP and FLIP training courses.

It is hoped that more AZRI staff will be sent for long term and medium training training in 1987.



*MSTAT WORKSHOP AT AZRI JAN. 1987*

#### Linkage with ICARDA core programs

Considerable support is being provided to the MART/AZRI project by the core ICARDA programs. In germplasm evaluation nurseries, screenings visits, inoculum, etc. have been provided by the CIP, PFLP, FLIP and GRP.

Visits by FSP in the areas of economics/survey and water harvesting were most valuable in the 1985-86 season.

The project's training plans for 1986-87 were discussed during a visit by the ICARDA training coordinator and liaison with the PARC training group was encouraged.

Active support has been received from the finance, purchasing and personnel departments.

The visits of the Director General and Deputy Director General for International Cooperation in 1985-86 helped to support staff morale and indicate the active involvement of the ICARDA directorate in their remotest but largest outreach project.