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END OF TOUR REPORT

**Management of Agricultural Research & Technology (MART) Project
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By

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The MART (Management of Agricultural Research and Technology) Project is funded by the United States Agency for International Development (USAID). The MART Project's chief link to the Government of Pakistan is through the Pakistan Agricultural Research Council (PARC). A MART Project Coordination Committee composed of federal, provincial, and university representatives coordinates and guides project activities. Its purpose is to assist the Pakistani agricultural research system to strengthen its research management capabilities, and to improve communications, training, farming systems research, arid zone research, and research in the rural social sciences. Winrock International, through a contract with USAID, has responsibilities to assist with the first four of these tasks. Two international agricultural research centers, the International Maize and Wheat Improvement Center (CIMMYT) and the International Center for Agricultural Research in Dry Areas (ICARDA), are responsible for the other two tasks.

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EXECUTIVE SUMMARY

My work as Provincial Research Operations and Support Specialist has been guided by the spirit of my terms of reference. I looked for areas of greatest concern to the farmer and when they became clear to me, I looked for those with whom I could work to try to develop some of the answers to help alleviate those problems. This being my all-consuming interest, I had much time to look for and locate both problems to work on and people to work with. I was also the beneficiary of much appropriate and pertinent direction and advice from a number of people well equipped to provide and proffer them.

We worked to build bridges between different institutions, disciplines and groups in everything we did whether it was multidisciplinary, interdepartmental, interprovincial or crosscultural.

My usual procedure was to remind people that while farmers are like the rest of us, some good, some bad and some indifferent, we needed to develop an understanding of them since our work is to be judged by them and that they were the final arbiters of our success or failure. Therefore, we must start with ascertaining their aspirations and circumstances before we can hope to approach relevance in setting our research agenda.

The next point is that although in a sense we are working for the farmer, to do something for him, we generally have to work with him to solve his problems. He can accept much better a solution mutually resolved and realized than a finding declared and disseminated.

We are working for the small, subsistence farmer who is doing a creditable job with his physical and financial resources and his knowledge base. We do not have to know everything about him before we can be helpful to him. We do need to know where he is hurting and assuage that pain before we can attack the next problem. We have to help him see what his opportunities are. Usually, opportunities for enhancement are fraught with increased risk, so we must proceed with due caution. A friend once called the subsistence farmer a risk-averting profit-seeker. I believe that describes him well.

We have arrived at the conclusion that in order to maintain or improve his standard of living, the average subsistence farmer usually has to augment his income from the staple crops by doing one, two or all three of the following: increase his dependence on livestock, grow more labor intensive crops such as fruits, vegetables or ornamentals or resort to off-farm employment. If he goes for livestock, he can not rely on the traditional crop residues alone even with urea enrichment. He has to increase fodder production. Mott, a highly productive, palatable and digestible perennial dwarf napiergrass, should then be the vehicle of choice to carry him from marginal subsistence to relative prosperity.

We work not only to help sustain the subsistence farmer. To provide sustenance for the nation, we must depend upon the farmer who produces a marketable surplus. These entrepreneurial types are, fortunately for Pakistan, increasing in number and my

perception is that their proportionate use of the land resources is growing. We can learn a lot from them and we must, if we are ever to entertain any ideas about being useful to them. Often, they will find where the opportunities are and tell us what their problems are, but we certainly have an important role to play in assisting in the development of these enterprises. In their enlightened self-interest, they will help us in our efforts to find the solutions to their problems.

I have little patience with those who think that we have to present the farmer with a complete plan for his farm. He knows better what to do with what he has to work with than most of us do. We can best help him with some alternatives to what he is doing that he can consider integrating into his system. I never believed in the necessity of his adoption of the complete package of technology that was offered. I have always believed that he already has a package of technology, but he is willing to adjust its components and levels if he could see an advantage in doing so.

With a philosophy like this, it was against my nature to preach drastic changes in research management, however desirable such changes were. I tried to influence change by presenting examples. I am not aware of any plausible package of technology to change human nature. Rather than attempt inevitable failure, I preferred to try to do the doable needful.

I also found it difficult to condense in an executive summary the array of needfuls that were attempted and are in the process of doing. I request the indulgence of the executive to accept my humble suggestion to read on.

INTRODUCTION

My first entry into Pakistan was on February 10, 1968 when I arrived in Lahore to work with the Accelerated Maize, Sorghum and Millets Improvement Project on a West Pakistan basis. Since then, our principal residence was outside of Pakistan for only nine years. Even during those years, during which I worked as the Asian Regional Maize Program Coordinator for CIMMYT and as the Tropical Maize Breeding Research Coordinator for Pioneer Hi-Bred International, I had a continuing responsibility for and an abiding interest in Pakistan.

It was because of the latter that I took early retirement from Pioneer to accept the position of Provincial Research Operations and Support (PROS) Specialist and returned to Pakistan in September, 1986. I served as PROS covering all four provinces from 1986 to the end of August, 1993 except for two years, 1989-1991, while Dr. James Barnett served as PROS for Sindh and Balochistan. After the departure at the end of March, 1992 of Research Management and Administration Specialist and Chief of Party, Dr. Bill C. Wright, his duties devolved upon me as well.

During these seven years of service with the MART Project, I had an unparalleled opportunity to meet and to work with a very wide assortment of people and a broad spectrum of situations throughout the country. Imaginative interpretation of my terms of reference provided ample justification and sufficient encouragement for me to respond to the perceived needs of the officials, scientists, extensionists, agribusiness people and above all, the farmers. I tried my best to do the necessary as they were made clear to me by those entrusted with the responsibility, of doing the needful rather than adhering to the prescriptions which did not promise to provide the cure.

I must express my gratitude for the advice and encouragement provided to me by my colleagues in Pakistan. Whatever we accomplished was accomplished together. Whatever encouragement and assistance that I may have provided was possible because of the aid and encouragement provided to me. This is a valedictory, but this is not the end. Like the commencement exercises that graduates of educational institutions go through, Winrock's departure signals a new beginning.

For my End of Tour Report, I would like to recount some of our activities, to provide an idea of what we have done, where we are, and what we must do to reach fruition. Since this will terminate Winrock's involvement in the MART Project, whatever was intended to be done, if it is to be done, will have to be done by others. In this report, I have tried to devote my energies towards discussion of what can be done rather than to dissipate them on what could not be done. Much remains to be done. Our work must continue and fortunately, there are enough nimble minds and willing hands to do the job. I ask those entrusted with the scepter of leadership to do their best to provide them the wherewithal and the environment so that they can do it.

AGRIBUSINESS SECTOR COLLABORATION

The architects of the MART Project mandated that the PROS work to help forge close working relationships between researchers and agribusiness firms. This mandate gave me great comfort that at least some of my efforts would be likely to bear fruit. People at the entrepreneurial and management levels of agribusiness firms are adept at providing judgment not only on the validity, but also on the economic effects of technological innovation. They are also apt in providing us suggestions for researchable problems of utmost concern to themselves.

After the researchers have proved their usefulness to their agribusiness clients, the entrepreneurs may become inclined to support research by providing services, facilities and eventually even money. There is no history of a scientist developing a proposal and looking for a buyer and finding one without first providing service and earning trust.

I tried working with many agribusiness firms and tried to involve interested scientists who had something to contribute. In this section I shall discuss some of the ones that resulted in some degree of collaboration. With more people becoming involved with more enterprises, I am sure that we could talk about many more success stories. Let these serve as examples.

Nestle-Milkpak's Village Milk Collection Scheme

This firm has hired veterinarians to serve as Dairy Extension Officers (DEOs) who have gone to each village within certain areas away from the major cities to induce the farmers who have milking animals to provide milk to a Milk-Pak appointed Village Milk Collector (VMC) in each village who then delivers the milk as soon as possible to a chilling tank. Milk-Pak tankers collect the milk from the chilling tanks and transport them to their UHT treatment and packing plant at Sheikhpura. The volume of collections now has risen to about 400,000 liters per day during the winter (1/2 of that during the heat of summer) and is rising for several reasons.

One reason is that the DEOs help the farmers by providing health care and assistance in breeding. Each DEO has two or three assistants hired from within the areas who are trained by the DEO to provide help to the farmers in the same manner that Stock Assistants of the Department of Livestock and Dairy Development do. Another reason is that through the VMC, feed supplements and forage seed are sold at cost to the farmers. Finally, the Manager Milk Collection and his DEOs are expanding their activities into new areas.

They started operations on the Sheikhpura-Chiniot road at Sukheki and during the past several years, they have established collection centres and DEO offices at Pindi Bhattian, Jalalpur Bhattian, Halalpur, Bhowana, Farookha and Renala Khurd. They are planning to expand to Khanewal, Vehari, Burewala, Arifwala, Hasilpur, etc. and collect milk to be processed at what has been until recently an inactive UHT plant located at Kabirwala.

The Chairman of Nestle-Milkpak, Syed Yawar Ali, recognized the importance of fodder production for increasing milk production and the role that Milk-Pak could play to promote fodder production and asked the Chairman of the PARC for assistance. A two day meeting was held in Lahore in January, 1992 to promote a "Fodder Explosion" in the irrigated Punjab. In attendance in addition to Milk-Pak officers were the usual complement of fodder researchers and government officials as well as representatives of each of the international seed companies active in Pakistan.

In general, it was a good meeting with good participation from the seed industry, the provincial agricultural research and livestock extension people and the federal people, but performance was less than promised, probably because of insufficient followup. I circulated my own unofficial minutes of the meeting. A committee was formed to provide training and publicity for the program and they were to meet periodically to do this. If anything came of this, I am not aware of it. No followup meetings were held to determine if the targets set for the seed companies of certain numbers of demonstration plots of their proprietary sorghum-sudangrass hybrids were met or not.

It was in this context that I approached Syed Yawar Ali and expressed a desire to work with Milk-Pak for the enhancement of milk production through increased fodder production with Mott in the vanguard.

With the unstinting cooperation of the then Chairman of the UAF Department of Livestock Management, Dr. Sadaqat Hanjra, we worked with the Milk-Pak DEOs to plant many small nursery plots of Mott throughout their milkshed area from March-October, 1992 as time permitted. Their enthusiasm and capacity for hard work was commendable. Due to the extremely heavy rains and unusual flooding, many plots were lost, but Mott is spreading from the surviving plots to lands of friends and neighbors.

It was noted that these DEOs were looked upon with considerable respect by the farmers and this made them natural carriers of information and inputs to the farmers. They have well educated and well motivated assistants recruited from within the villages to multiply their efforts. There are many opportunities limited only by our own energy and imagination. We undertook a few of these. For example, in the sandy areas, seed of new lentil varieties from the Pulses Directorate of AARI were plugged into the system through some of the DEOs.

They conducted demonstrations of Jumbo SSG, seed of which Milk-Pak was selling at cost. We planted small plots of Mott, Malayam bajra-napier hybrid, Biloela buffelgrass,

Carostan flaccidgrass, Tifton 85 bermudagrass and guineagrass at Pindi Bhattian, but the only ones that excited the interest of their milk suppliers who came to the centre were Mott and Malayam. The other grasses each have their place, but we will not be able to get their attention until Mott has been made more generally available.

If we are careful not to overload the system, Milk-Pak, through its DEOs and their own extension field assistants can do a lot to help the villagers and in that way do some real nation building work while increasing the supply of milk for their business. I have felt that this is a self-financed NGO for village aid that is working well with a minimum of input from technical assistance specialists.

The work that Milk-Pak is doing with the farmers is a program that researchers at AARI and UAF can plug into and provide technical support while gaining willing hands to study practical field problems and providing their students and assistants exposure to real life farming situations. Their work is what Farming Systems Research is about. Milk is what they need, but to get it they must deal with the entire farming system. Milk-Pak cooperated well with us in hosting a variety of delegations from Islamabad who wished to review their work. I am sure that they will welcome anyone genuinely interested in studying their operation with a view towards helping others to develop their own programs.

I feel that what Milk-Pak is doing is replicable and expandable to other businesses and other provinces. Within the same business there are other UHT plants whose management may be encouraged to emulate and adopt or adapt the laudable efforts of Milk-Pak. Then there are the people in other businesses who, in their enlightened self-interest, might be induced to undertake similar extension type activities to help the growers who produce the raw materials which supply the grist for their mills.

In an effort to foster more activities of this type and to widen the circle of cooperation, I have arranged visits for the FSR units, the PARC/NARC Management and Marketing group, USAID Project Officer, Chairman PARC and the Agricultural Information Unit of AARI. An audio-visual training course designed to lift the provincial agricultural information units' capacity to produce documentaries which will educate and entertain is being arranged by Mr. Anwar-ul-Hassan and Mrs. Shireen Pasha in cooperation with Milk-Pak and MART. The course will be conducted in Milk-Pak's dairy extension project area in September, 1993. The outputs of the course will be a motivational documentary called "Milk as a Cash Crop" and about twenty information transfer specialists trained to entertain while they educate.

Rafhan Maize Products

One of Pakistan's premier food manufacturers, Rafhan is a locally managed subsidiary of CPC International. As the name implies, it uses maize as the basic raw material. Rafhan is in the process of expanding its facilities by moving its food division to a new

factory near Lahore and of increasing its wet milling capacity at Faisalabad to 600 tons of maize per day.

Unlike Milk-Pak, Rafhan does not deal with small farmers in its production program. It does buy any maize offered in the market at prices which are higher than they would be if Rafhan were not in existence. In that way they are helping the small farmers and many others. By providing jobs up and down the food chain, it is doing its part. Unlike most other users of agricultural products as raw material, but like Milk-Pak, Rafhan takes an active hand in promoting production.

This it does through a Maize Development Manager, Dr. Khan Bahadur, and his small staff of agronomists and an assistant breeder. Basically, their job is to contract with farmers who are willing to grow at least 25 acres of maize during the spring season and supply the produce to Rafhan. With agronomists located at Dipalpur, Sahiwal, Faisalabad and Multan, they contract for 30,000-45,000 acres of spring maize production. They supply the farmers with Rafhan hybrid seed, technology, service and a price at or above the market value at harvest.

Some of the maize inbred lines which they use were supplied to them in germplasm lots by PROS under the MART Project. Others were developed from material supplied to them by CIMMYT or by international seed companies. It has been my pleasure to work with Dr. Khan Bahadur in his efforts to develop hybrids producible in Pakistan for each season and each production area in Pakistan. Currently, maize hybrid seed production is up to 1000 tons, practically all produced during the kharif season. This is still essentially all the hybrid maize seed produced in Pakistan.

Some of the international seed companies doing business in Pakistan are in the process of gearing up for local production, but as of now, they are selling mostly imported seed. Maize breeders in Pakistan have had 25 years of association with the CIMMYT Maize Program and some of them have earned postgraduate degrees from well regarded institutions in the USA cornbelt states. Between them and the international seed companies with local production capabilities, I am confident that acreage sown to hybrid maize seed would triple in the next five years, with most of the increase coming during the kharif season with temperate X tropical double crosses.

Is the failure to do so up to now due to the fact that under the current level of the average grower's maize growing technology there is no advantage of hybrids over the composite varieties which have been developed in Pakistan? Is it because of inability to keep inbred lines pure and therefore to make hybrid performance reproducible? Rafhan's experience indicates that hybrid maize seed of acceptable quality can be produced in Pakistan since at least 60,000 acres are planted to their products. Rafhan too had growing pains when they first started hybrid maize seed production. With this in mind, the international seed companies should persist in their efforts to produce hybrid maize seed in Pakistan.

Rafhan is a company that is working very successfully and has an MD, Mr. Rashid Ali, who has been very cooperative and an MDM who is no less helpful. People in the federal and provincial research, teaching and extension services should become acquainted with them and their operating procedures to gain insights into how they can help to make things work better. They will find that Rafhan management is not only sharing, but also is receptive.

I have written about Rafhan and Nestle-Milkpak because I have known some of their people well for many years and have admired their results. I am quite sure there are others just about as worthy of citation that other people could name. Professors at teaching institutions would do well to do case studies of these exemplary agribusiness firms to be used in their teaching. Plant breeders, economists, engineers, agronomists, seed technologists, food technologists and others could work with firms like these and learn from them and hopefully contribute to them something in their specialties.

Cargill Pakistan Citrus Ltd.

I have long felt that citrus has a great future in Pakistan and was happy to find in 1987 that the then Secretary of Agriculture of the Punjab shared my views. At his request, the MART Project invited Dr. Walter J. Kender, Director of the Citrus Research and Education Center of the University of Florida, to come as a citrus consultant during January, 1988. At that time we did not know that there were going to be three citrus juice concentrate plants in operation in Pakistan by 1991.

One of these was built by Cargill, Inc., which is the largest, privately held company in the world with production and distribution expertise in an impressive array of commodities. I was asked by the Cargill Country Manager, Mr. George Landsverk, to help them arrange citrus seminars at Sargodha. The first was held in January, 1992 with Dr. Zafar Altaf, by then Chairman PARC, presiding and citrus specialists from the UAF and AARI presenting papers. I was responsible for the program and the guest list. Cargill took care of all arrangements and bore all costs. Cargill took the opportunity to invite their fellow processors to attend and to set the stage for making common cause to request increase support for citrus research in the future. This was attended mostly by government officials in research, teaching and extension, Cargill employees, other businessmen, local dignitaries, AID officials, Winrock staff and a few citrus contract growers. Proceedings were in English.

The Director of the Horticulture Research Institute, AARI, Dr. Muhammad Hussain, suggested that one of the major problems was the lack of standardization of quality in the nurseries. He suggested that the government should certify nursery plants as it does seed of the major crops. With the encouragement of the Chairman PARC and help from myself, Cargill undertook to identify and assist four farmers who wanted to learn how to produce good nursery stock. The Horticulturist of the Mango Research Station, Ch.

Abdul Haq, provided certified seed of rough lemon and seed of Carrizo citrange was made available for purchase by Cargill to start these nurseries.

Pots of Volkameriana, Citrus sunki X Beneke trifoliata, Swingle and C-35 citrumelo seedlings, which were grown at my home from seed imported under MART Project auspices, were provided to these candidate nurserymen. Technical assistance is being provided by the Horticulture Research Institute.

The second seminar was held in August, 1992 on the farm of one of the certified nurseryman candidates located near the Cargill citrus juice plant and most of the speakers at the January event spoke again, but this time in Punjabi or Urdu. The then Secretary of Agriculture, Mr. M. Sadiq Cheema, an excellent citrus grower himself, presided over the event.

With some ideas adapted from the Rafhan Maize Products contract growers scheme, but mostly with their own thinking, Cargill's Purchasing Department Manager, Syed Reza Mohyiddin, and his colleagues devised a model orchard program which incorporates what they learned from the seminars. Three of the Purchasing Officers who supervise these model orchards are themselves contract growers of Kinnow for Cargill. Their program provides credit for inputs such as fertilizer and pesticides with recoveries made when fruit is delivered to the factory. This extension program works and others can do it too.

As the Milk-Pak program does, the Cargill citrus team takes the view that anything they learn that can benefit the farming systems of their suppliers, they are ready to help with. They have helped to spread Mott and are continuing to do so because they know that the farmers can benefit from it and by avoiding the growing of fodder crops within the citrus orchards, they will be helping to grow better crops of citrus. They provided some of their model orchard farmers trial quantities of winter pulse seeds (provided gratis by the Director Pulses Research at AARI, Dr. Muhammad Tufail) with the idea that if they had to have an intercrop in their orchards, they should grow a crop which needs less water, as suggested by the Director Horticulture.

Cargill knows very well that dairy farmers in Europe and Brazil appreciate dried citrus pulp as feed and are willing to pay for it. Cargill also knows that the wet pulp is a burden on them for disposal because farmers in Pakistan are not yet aware of its value. Therefore they asked the Chairman of the UAF Department of Livestock Management (DLM) to arrange for doing some analyses and some feeding trials. Cargill provided some funds to purchase supplies for conducting the required analyses and provided the wet citrus pulp in bulk. The UAF DLM mixed the pulp with wheat bhusa and made silage out of it for feeding. Concurrently, they demonstrated its preparation and feeding for several of the farmers taking the wet pulp directly from the juice factory. The feeding trials were made the subject of a thesis.

I introduced the PARC/NARC Management group composed of the Associate FSR Coordinator for Livestock, the MART Project Acting Project Secretary, the NARC Training Institute representative and the TV producer of the Audio-Visual Institute to Cargill's Purchasing Department staff and brought up the subject of citrus pulp utilization.

The Associate FSR Coordinator, Dr. Amanullah Cheema, who has a Ph.D. in animal nutrition, suggested that anyone who has access to some capital can quickly get into a feedlot operation and discussed how one could get started. One of Cargill's staff members, Mr. M. Maqbool Bhatti, became interested since he could have a very large supply of wet citrus pulp during late December to late March. He also has expanded his planting of Mott and is trying the other fodder grasses. We must foster this type of productive introduction and interaction that will result in increased production and economic activity.

The period that the plant is in operation coincides at present with the Kinnow season. They rush it a little by starting in mid-December and they extend it a little by holding some of the fruits of their contract growers on the tree until early April. The early product is mixed with the late at the time of reconstitution to bring the brix of the former up to par. By these strategies, they are able to lengthen their season to 100 days more or less.

In Brazil, they use a number of different varieties to keep their plants in operation for twice that length of time. In Pakistan, Cargill is looking for ways of using different mandarin varieties to lengthen the season to at least five months. I learned at the Citrus Rootstock Research Station at Sahiwal that the variety Honey is ready in early October, but its juice is too insipid, but that Fremont is ready by mid-October and though the trees are young and the fruits are small, its flavor is excellent and the yields appear sufficient. I arranged for a field trip to Sahiwal for the Cargill staff and this resulted in an immediate order for 200 plants and a later one for 2000.

At the end of the season utilizing late maturing varieties, we should be able to supply the juice plants with enough fruit to remain in full operation until the end of April. Our tropical fruits consultant sent me the seeds of a late maturing Japanese variety of mandarin called Kunenbo, which was given to the HRI, NARC and Cargill to germinate. It will require ten years or more before the value of this introduction will be evaluated. In the meantime, there is another very good possibility already present in the country.

In Florida and Brazil the season can be lengthened because they grow Valencia, which is arguably the best all around citrus for processing. It is not well known in Pakistan by varietal name, but it does exist. Adding 30 days to the season at the late end in Pakistan would probably have to be with Valencia. The extreme heat in May and June in Pakistan would militate against delaying harvest much later than the end of April. Still, starting the factory on October 15 with an early variety like Fremont and continuing until April 30 with a late variety like Valencia would be a big improvement over the present situation.

Shakarganj Sugarcane Research Institute

This institute is located in Jhang on the Toba Tek Singh road. The erstwhile Wheat Coordinator and DG AARI at one time, Dr. S.A. Qureshi, serves as Chief Scientist. I have made several visits to this institution, the first time with the then Chairman PARC, Dr. Amir Muhammad, and learned of their sugarcane development program dealing with farmers of all sizes and reported on it in 1990. In 1991, I arranged for a delegation of UAF professors of different disciplines and the Director Agronomy of AARI to visit Dr. Qureshi and the SSRI's program. A good interchange of ideas came out of this visit. I also took the FSR advisor, Dr. Murray Dawson, and the federal and provincial FSR units and our agribusiness consultant to visit Shakarganj.

Dr. Sadaqat Hanjra helped Dr. Qureshi demonstrate to farmers the making of silage with sugarcane tops. We used their mill waste product called press mud extensively for plant propagation with excellent results. Bagged in attractive plastic bags, it should fetch a good price in the cities. The same product was tested as a component of livestock rations.

Dr. Asghar Jalis worked with Dr. Qureshi to help solve the problem of late sowing of sugarcane in the spring by farmers reluctant to sacrifice the last cutting of berseem by planting Mott with them to demonstrate that henceforth they would not need the last cutting of berseem anyway.

Dr. Qureshi's breeding program developed a sugarcane variety with improved quality which was named SPSG 26. To multiply "seed", they planted "seed" multiplication plots with selected farmers strategically located. To achieve multiplication, spread and adoption of the new variety, which produces more sugar, but does not produce more cane, requires a great deal of hard work and educational efforts and some incentives based on quality.

Each situation being different, Shakarganj Mills is having to evolve its own program to work with the farmers to have them produce quality cane that will benefit both grower and mill owner. How they go about it and how they finally achieve it are questions worthy of collaboration and study by researchers from public institutions. Young people should avail themselves of the opportunity to study at the feet of the master, as they say. Well past seveni'v years of age and still active in the field, Dr. Sardar Ahmed Qureshi serves as an example to everyone of intellectual curiosity in service to science and dedication to human welfare.

Al-Seemi Farm and Cotton Gin

Located in the Kabirwala area of Khanewal district, Al-Seemi is dedicated to the production of quality cotton lint that fetches higher prices. Its proprietor, Syed Siddiq

Akbar Bokhari, has converted over time with excellent management a saline wasteland into one of the most productive and progressive cotton growing operations. This is a case of a vertically integrated commercial operation serving the functions of a community service NGO that is very much worthy of observation and emulation. Ever the genial host, Mr. Bokhari's farm and gin is visited by small farmers in need of inputs, credit and advice, pesticide company representatives, cotton research scientists, extensionists and others who come to offer advice and to learn. Since I first met him in April, 1987 when I accompanied Dr. Zafar Altaf on a visit to Cholistan, Multan and Dera Ghazi Khan, I have introduced Mr. Bokhari to many who were interested in learning about how cotton is grown and ginned.

Mr. Bokhari specializes in breeding cotton varieties with long staple length and greater fibre strength. He also produces commercial hybrid cotton seed by hand emasculation and pollination. He has developed a tillage device for bed preparation that saves on watering and weeding. He has grown a Mott nursery and has made cuttings available to others.

Chaudhry Muhammad Siddiq

This is an old family owned vegetable seed business located in Faisalabad and is under the management of young Mr. Azhar Siddiq. They are one of the big five vegetable seed importers. Unlike some of the other seed merchants, Azhar and his family grow what they sell, i.e. they market vegetables as well as seed.

They also produce those vegetable seeds that can be grown economically where they can control production. Whatever they have the expertise to grow locally and can be grown for less than it costs to import, they grow locally on rented land on the Jhang road. Whatever they cannot grow or is costlier to grow than to import, they import. It is as simple as that. We should not lull ourselves into thinking that import substitution on a large scale is feasible with vegetables. That is something that I learned from Azhar Siddiq, who knows the vegetable seed business. If it were still commercially feasible to grow vegetable and flower seed economically in Quetta, you can assume that Azhar Siddiq or his colleagues in the seed business would be doing it.

Another point is that some people know that cheap seed can be expensive and expensive seed can be cheap. For whatever reason, some farmers prefer to pay the higher price for imported seed even when lower cost local seed of the same variety may be available. Seed merchants have to accommodate to customer preferences too.

I have introduced many people to Azhar Siddiq. I also introduced to him the concept of the Seed Improvement Association and invited him to the first SIA meeting. He came with an entourage of his colleagues, but decided that while they could cooperate with the people he met at that meeting, they did not belong. Instead he called a meeting of the vegetable seed merchants to form the All-Pakistan Seed Merchants Trade Association and

was elected President. I am delighted, definitely not disappointed just because they did not join the Seed Improvement Association we were fostering.

During the seven years that I have known Azhar, their business seems to have grown by leaps and bounds. They grow alfalfa and produce seed of the Type 8 X 9 variety which I took to him from the Fodder Research Institute. They also grow sorghum sudangrass hybrid seed for which they purchase female parent seed from Rafhan. I got him started, but he continues on his own. They use Greenleaf sudangrass, seed originally supplied by the MART Project, as the male. They are able to sell their seed for 75% of the price of imported SSG hybrid seed. Starting with one acre in 1987, they grew 10 acres in 1992. They sell all they produce and when they run out of their own seed, they also sell imported forage sorghum seed for the international seed companies at their full, prescribed price.

They have also become commission agents in the New Grain Market for maize, pulses, sorghum and such. Some of these are used as seed as well. All this evolved from a start as a vegetable seed retailer.

CITRUS

I am not alone in thinking that citrus fruits have a tremendous future in Pakistan. The operation of three frozen concentrate juice plants have now installed a floor under citrus prices which, while not exactly high, is higher than it used to be. This has triggered a turnaround in citrus acreage from gradual reduction to a gradual increase.

Add to these, the fresh fruit exporters who have built an export business based on Kinnows and oranges. If they can find export markets for what is available now, just think of what they could do with citrus with improved quality.

Serious efforts at fostering improvement in citrus cultivation are being attempted through seminars and leaflets through cooperation between Cargill, Sunflo, the Horticulture Research Institute of AARI, the Horticulture Department of the UAF and PARC/NARC/USAID/ MART. Cargill has instituted a model orchards scheme with their contract growers with technical assistance from the soil chemist, entomologist, plant pathologist and horticulturist of the Ayub Agricultural Research Institute.

The present Chairman of the PARC, then Secretary of Agriculture Punjab and PROS decided in 1987 to request PARC to invite Dr. Walter J. Kender, Director of the Citrus Research and Education Center of the University of Florida at Lake Alfred to come to Pakistan to advise on enhancing our citrus research program. Dr. Richard A. Hamilton, retired Professor of Horticulture of the University of Hawaii, who came as a tropical horticulture consultant also advised on citrus fruits and provided a considerable array of seeds of rootstocks and table varieties. The MART Project has sent several horticulturists for research management training to the USA and one of them, Mr. Rafi, has brought back scionwood of the most recent Florida releases, Fallglo, Ambersweet and others.

The climate and soils of Pakistan in general are not naturally ideal for citrus, but few places are. Pakistan has a great advantage in having winters sufficiently brisk to give good rind color and juice quality, but thanks to the Suleiman Range, the Hindu Kush, the Karakorums and the Himalayas blocking the frigid blasts from the north, we have no freezes to destroy fruits or trees where citrus could be grown in Pakistan. Where citrus is being grown today in Pakistan is not necessarily the best areas for growing them, but where the farmers have an interest in doing so. In some areas, like the Potohar, soils and temperatures are good and while water is somewhat limiting, it is technically feasible to augment the natural supply. In other areas, the water table is too high, but drainage is being arranged. Vast areas of the Thal are available for citrus cultivation and will be converted to citrus once markets have been developed. This will probably depend on the use of rootstock and scion varieties other than those which are in common use today.

Most of Pakistan's citrus is Kinnow on rough lemon rootstock and practically all of that is grown in the plains of the Punjab. Oranges are less productive and higher priced. Grapefruit, which is well adapted and very productive, is being introduced into the market,

but seems to be encountering some resistance. It will probably find its place as an item that juice vendors could sweeten before serving their customers. Sweet lime, as the harbinger of the citrus season, has a loyal following, of whom I definitely am not one. Grapefruit, with much superior flavor, is available in late September and can be substituted with just a little help from sucrose syrup.

If sweetening grapefruit juice with sugar at the juice vendors' level is not feasible, citrus breeders have already done the job for us by crossing tangerines and grapefruit to give us the tangelo, which is as juicy as the grapefruit, as colorful as the tangerine and has a much higher sugar content than the so-called sweet lime. Varieties available at Sahiwal are Pearl, Orlando and Minneola. All are early and have a pleasant, refreshing flavor.

There are three pummelo (Citrus grandis) trees at the Sahiwal citrus station. They are the best looking trees by far in the station, giving rise to the belief that pummelos might well be the best adapted citrus species to the plains of Pakistan. If only there were a market for it in Pakistan. Pummelos are highly appreciated in China and SE Asia. They produce a giant fruit which can be quite seedy and reminiscent of the grapefruit, but is drier early in the season, which begins in late September. By December, instead of becoming less acid and drier as one might expect, it becomes much more acid and juicier, resembling a grapefruit. It is best used during September to mid-November.

There are two highly regarded Thai varieties of pummelo, Kao Hom and Kao Yai. Kao Hom has been introduced as seeds. Pummelo does not come true to seed, but these seedlings will offer opportunities for selection. Since pummelos are universally riddled with virus, we have resisted the temptation to import scionwood, although we know we would not be transporting anything that is not already here.

Ortanique is a selection from a natural tangerine-orange cross which is shaped like a large tangerine, but which tastes and peels more like an orange. It is higher in soluble solids than the orange and ripens in December-January in Jamaica where it is the most popular citrus fruit. In Hawaii it was about as productive as the Kinnow and considerably superior in flavor. We have introduced it to Pakistan and it is available at Sahiwal. There is another natural tangor in Jamaica called Ugli, which is said to look like its name, but tastes better than it looks. Some processor might consider propagating it to entrap his suppliers.

Murcott, grown commercially in Florida and marketed as Honey, is believed to be a tangor. It is sweeter and firmer fleshed than the Kinnow and is almost as seedy. It will definitely be a hit in Pakistan as a fresh fruit. I was told that it had been introduced to Pakistan before, but have never seen a tree or fruit of Murcott. We introduced it again in March, 1993 and gave seeds of it to a number of horticulturists and to the candidate certified nurserymen in Sargodha.

Pera, a truly delicious orange of midseason maturity, is the mainstay of Brazil's citrus juice industry, but is so far practically unknown in California and Florida. It has a characteristic neck to its fruit not unlike the Minneola Tangelo. We introduced seeds of it from Hawaii, but since October, 1992, the Sahiwal Citrus Station has had scionwood of it which I arranged for them from Cargill. Pera is another likely candidate for adoption in Pakistan during this decade.

We have been looking for an early tangerine/mandarin with good juice quality (Feutrell's Early just will not do: call it Futile). We think we have identified one at the Sahiwal station. The name is Fremont and it results from a cross of Clementine X Ponkan. It was released by Dr. J.R. Furr of California in 1964. When we were looking for a variety for processing before Kinnow is ready, it was pointed out to us by Assistant Horticulturist M. Saeed Cheema and confirmed by Horticulturist Ch. Niaz Ahmed that Fremont is sufficiently early (flavor was already good in early October) and has promising productivity (the trees are young). Cargill's citrus people have seen it and have ordered 2000 trees for fall 1993 delivery. Its flavor so far surpasses that of Feutrell that once Fremont becomes available in quantity, growers with groves of Feutrell will come to understand the meaning of the word futile. Because of the anticipated demand as an early table fruit, who can tell when Fremont will become available for juicing, but eventually the market for fresh fruit will become saturated and juicing can begin.

Dr. Furr released two other varieties in 1964, Fairchild and Fortune. Fairchild was selected from a Clementine X Orlando Tangelo cross. Orlando is a cross of the Duncan grapefruit X Dancy tangerine. Ch. Niaz Ahmed likes Fairchild too. It is early midseason in maturity and has a rich flavored, high quality fruit. Fortune (derived from Clementine X Dancy) also bears watching, but since it matures late, it will have to compete head-on with Kinnow, which, in Pakistan, is tough competition indeed because of Kinnow's tremendous productivity.

At the end of the Kinnow season, there is some desire to continue operations at the plants. If Valencia oranges can be grown commercially, that is one option. If a mandarin is needed, there is a Japanese type called Kunenbo, which is grouped together with King mandarin in species classification (which makes it close enough to Kinnow), which is said to be later in maturity than Kinnow. Seed of one of these was sent to us by Dr. Hamilton.

Ambersweet is a selection made in Florida between a complex hybrid of Clementine X Orlando tangelo and a midseason sweet orange. It appears to be very promising in Florida where it is enough like an orange to be considered an orange. It was ready in late October at Orlando. Mr. Rafi got scionwood of this from Dr. Kender in 1992 and brought it home.

Using different varieties which can be marketed as table fruit until production rises to a level sufficient for the juice plants to handle, we can look forward to a citrus processing season starting in October and extending until the end of April within easy transport distance to the existing plants.

The next problem is what to do about rootstocks. At present, the horticulturists in the Punjab are very much satisfied with rough lemon and the horticulturists in the NWFP are continuing to accept sour orange. The Sindh and coastal lowland Balochistan, where they grow mainly lime on its own roots, the question of citrus rootstocks does not arise.

Regarding nursery trees of citrus, we have a problem in Pakistan due to price distortions. A few farmers are willing to pay as much as Rs. 850 for 10 kg of single cross hybrid seed to plant one acre of spring maize because they are confident that five months later they will harvest a crop of maize that will more than pay for the cost of the seed. The crop will be uniform and beautiful to look at as well as profitable. They will earn the plaudits of their neighbors while getting Rs. 8400 gross for a 60 maund crop. They feel they got true value for what they spent and they are right.

Contrast this situation to the cost of citrus plants to plant one acre. The grower will buy 110 plants at Rs. 5 (sometimes even less for second or third grade plants) to plant his acre of citrus. He does not know what rootstock was used and does not know what kind of tree the scions were taken from, except that he will know what variety it is. This orchard is expected to last for over 30 years, but the cost of the budded trees is just Rs. 550 per acre. We are not campaigning against inexpensive trees. We are concerned that a nurseryman may not be able to provide good quality trees at that price, but competition is forcing him to compromise on quality. At least this is the concern of the horticulturists at Faisalabad that prompted me to help do something about it.

We obtained literature from Florida and California on rootstock selection and seed from Willits and Newcomb in California, from Dr. Hamilton in Hawaii and Dr. Heinz Wutscher in Florida and made them available to horticulturists throughout the country.

Rough lemon rootstock gives trees of large size, high yield, large fruit size and poor juice quality. It is adapted to sandy soils. It has gone out of favor in Florida and never was popular in California because of poor quality fruit, blight susceptibility and lack of cold tolerance, but so far, in the Punjab, it reigns supreme, and not without good reason. The scion varieties grow fast and yields are good, though quality is relatively low.

Volkamer lemon is being evaluated in Florida as a possible replacement for rough lemon. It has all of the good traits of rough lemon and most of its faults, but to a lesser degree. It could be a quick fix where nurserymen could charge more for plants certified to be on Volkamer lemon rootstocks and as long as citrus blight does not become a major problem, it may be all right.

If quality table fruit is to be produced for a more discriminating market demanding high quality and willing to pay premium prices, rough lemon and Volkamer lemon may not be the rootstocks of choice, but for processing fruit they should be all right, unless citrus blight becomes a major problem.

Where more cold tolerance may be required in such places as in Dir district whence cometh the blood oranges of highest repute, the lemons will probably not do. Citranges and citrumelos or even trifoliates should be tried. Seed of Carrizo citrange, Swingle and C-35 citrumelos, Rubidoux trifoliolate, Citrus sunki, Citrus sunki X Beneke trifoliolate, Cleopatra mandarin, Heen Naran and Rangpur lime have been introduced and are being propagated for testing as rootstocks at Sahiwal, Islamabad, Sargodha, Tarnab and Batkhela.

Soon we shall have to set up a citrus germplasm source nursery, probably best done in conjunction with the National Plant Genetic Resources Unit at the NARC where virus free material could be grown and kept virus free and scionwood and seed made available to genuine certified propagators. Fortunately, Pakistan has a very capable citrus pathologist, Mr. Ahmed Saleem Akhtar, who was able to make good contacts with other citrus scientists in Florida on a short term training program under the MART Project.

It is perplexing to me that no sweet citrus is being grown in the parts of the Sindh and Balochistan where I have traveled. During the next two years, I would like to enlist the help of friends in the NWFP and the Punjab to work with the horticulturist-in-charge, Mr. Ehsanullah Baloch, of the Mango and Citrus Research Station of the Sindh at Sakrand to give sweet citrus another chance in southern Pakistan.

ADVANCES IN HORTICULTURE, OLERICULTURE AND FLORICULTURE

Horticulture in General

There has been a continuing improvement in fruit production with particular emphasis on temperate zone fruits at the NARC reflecting the availability of a captive market willing to pay a higher price and the training received by the few horticulturists who received opportunities to qualify for doctorates in the temperate zone. These efforts are not to be disparaged, but should be considered in the context of the overall demand for fruits in Pakistan.

Having discussed citrus in another chapter, I shall not refer to it here. There will be no attempt to discuss all possibilities, just the two of major importance that we were able to do a little about. Others that would seem to be worth trying to introduce or improve will be found in two MART Project consultancy reports by Dr. Hamilton.

Mango (Mangifera indica)

Even more important in Pakistan than citrus, in terms of commercial value, acreage and production, the mango is Pakistan's premier fruit. There is a fair export market for superior varieties commonly produced in Pakistan and the market should grow about as fast as the expatriate communities of Pakistanis and Indians in the temperate zone are growing.

To expand the export markets more substantially, we should at least consider growing some of the less aromatic, more colorful Florida and Hawaiian mangoes which were descended from an Indian mango which is not particularly appreciated in India and Pakistan, but which are grown in Florida and Mexico for export to North America and Europe. We have been introducing some of these to Pakistan beginning in 1987. These scions were given to several institutions and private growers, but since they were brought in when we could, i.e. in June or October, the take has not been satisfactory. However, Mr. Mohammad Hussain Panhwar, who has a mango garden near Tando Jam, has propagated the largest number of these introductions successfully.

I have recently met in Dr. Omar Khan Baloch's office an entrepreneurial gentleman named Maqsood who is a hotelier in the UK. He and his brother have established a horticultural enterprise at Mian Channu where they are successfully growing dwarf Cavendish bananas propagated by tissue culture. They are full of good ideas. They have introduced Florida varieties of mango which they feel confident will be welcomed by the general population in Europe.

The Horticulture Research Institute of Ayub ARI has successfully propagated such varieties as Keitt, Momi K, Zill and Sensation. Sensation is unsensational in flavor to us, but it matures late in the season and has an attractive color. It is probably the best

tasting mango available in September. While some people like to have mangoes in September, most people have had a surfeit of mangoes by then, especially at the higher prices. People buy a large volume of mangoes at a higher price early in the season. Witness the pathetic, unripe, but artificially colored, product that are inflicted upon us in May. Sindh would have a particular advantage in producing early mangoes as in everything else that is early. An effort to hasten flowering and fruiting should be high on their research agenda, higher than the search for dwarfing rootstocks.

Every mango grower who has heard about the dwarf mango trees of India and the dwarfing rootstocks of apples produced at the East Malling Station, wants a dwarf tree from which he could propagate. There are no magic answers. It is going to require some hard work, but mostly it will require some concerted effort by many people to identify them. These dwarf trees do not fall out of the sky. They exist in nature. If they are present in India, surely they are present in Pakistan in seedling orchards. We should look for somewhat dwarf trees with passably edible fruit. Perhaps the easiest way to get started is to write up a story of a national search in the local press with a prize for the smallest tree of ten or more years in age with the best fruit.

Guava (Psidium guajava)

Essentially all guava orchards in Pakistan are propagated from seed. We have white fleshed fruit predominating, but there is a red fleshed type available in the market. The guava orchards of Pakistan must be a fertile field for selection of specimens outstanding in flavor, production, or some other characteristic of economic merit. In the past several years Mian Irshad-ul-Haq at AARI and Mr. Abdul Hafeez at the NARC have shown an interest in selecting special types in existing orchards.

At AARI they have propagated by grafting and at the NARC, Mr. Hafeez is producing rooted cuttings with a growth regulator called Paclobutrazole. Mr. Hafeez has propagated two dessert type guavas which we have introduced from Hawaii.

In Hawaii they grow a high yielding, somewhat acid, pink-fleshed guava strictly for processing. The processed products are shipped to the mainland U.S.A., Asia and Europe. Three of these have been successfully introduced into Pakistan and two of them are performing acceptably at the NARC. Thanks to the efforts of Mr. Hafeez, it would be possible for an entrepreneur to obtain plants to initiate commercial production.

Olericulture in General

In the quarter century that we have been involved with Pakistan agriculture, one of the most wonderful changes that we have seen is the increase in availability of a greater variety of vegetables for longer periods of time during the year. Much remains to be done, but much progress has been made. Off season production of tomatoes is such that we have it nearly all year round. Cucumbers are no longer universally rust colored.

Some of them are even crisp and tasty. Onions are being grown in every province in commercial quantities and are being shipped countrywide. Exotic vegetables such as broccoli are available in Islamabad and Lahore though at premium prices. Head cabbage and bell pepper used to be rare and are now common. Chinese cabbage is available. Zucchini squash, oyster mushroom, the list goes on and on. New ones are adding variety and new flavors to the diet.

In 1968, watermelons were uncommon and uncommonly tasteless. I gave the then Secretary of Agriculture, Mr. Amir Ahmed Khan, some seed of Sugar Baby watermelon and he gave me a ripe fruit, which was the first watermelon that we enjoyed in Pakistan. Today, Sugar Baby is plentiful and is being transported everywhere from the producers to the consumers in Bedford trucks in great quantity.

However, much remains to be done in the field of olericulture. I shall mention some of the possibilities, starting with Pakistan's national spice, the hot pepper. For a nation that appreciates hot cuisine so much, there is a paucity of varieties grown and a disconcerting lack of interest on the part of most of the vegetable specialists in expanding Pakistan's arsenal of hot chillies. For six years I have been importing quantities of seed of chillies and have given them to vegetable specialists and farmers. The results have been disappointing, but I have not given up hope. Let us proceed.

Capsicums

The Jalapeno is thick fleshed, prolific, sufficiently hot to suit the Pakistani palate and is excellent for preserving as pickles. The potential market in Pakistan for Jalapeno should be at least one lakh times as large as that for strawberries. Yet, more effort is devoted to the strawberry at the NARC than to the Jalapeno. Jalapeno has been appreciated by all Pakistani visiting scientists and trainees at CIMMYT and by several people to whom I have given the pickles made in the American way and I am sure that the traditional Pakistani achar made with it would be even better. Dr. Zafar Altaf loves it. If the horticulturists at the NARC who are growing poorly adapted frivolities like the strawberry were to grow Jalapeno instead and the food technologists were to apply their techniques to making Pakistani type pickles and Mexican style salsa with it, would not the public perception of the value of the NARC be even more substantially enhanced. Azhar Siddiq likes Jalapeno pickles too, but not enough to order seed to sell. Noor Muhammad Miano too likes it, but he has many other duties and is not in a position to make a business of it. My next attempts will be with the National Coordinator for Vegetable Research, Dr. M. Banaras Raja, the Director of the Horticulture Research Institute, Mirpurkhas, Syed Javed Bokhari, and their Food Technologists. Let us see what they can do. I am also counting on Dr. Bajoi in Quetta and Mr. Gulfam in Mansehra to do their part in popularizing the Jalapeno.

The Cayenne is a thin fleshed, quite hot and very prolific chili that is suitable for drying and is used in making hot sauces. Some Cayennes are very large fruited, as large as 6 inches X 3/4 inch. The trees are long lived perennials in Hawaii.

The Tabasco goes up the scale of hotness and is the basis of the sauce that is made by the Mcilhenny family of Avery Island, Louisiana. As with most of the chillies, its country of origin is Mexico. The plants are vigorous and high yielding.

The Habanero is the hottest of them all. It is reputed to be 1000 times as hot as Jalapeno, which is sufficiently hot for most people. We have seed of it in Pakistan.

There are many other varieties which have varying degrees of pungency between sweet and Habanero that should be tried. One of these is the Anaheim variety which is used as a green chili for stuffing and as a dried chili. It is mildly pungent, heavy yielding and versatile in its usefulness. The fruit can be as much as 7 or 8 inches long.

Another chili variety used for stuffing is Big Jim, which can become 8-9 inches long and is mild to medium hot. Chimayo is a legendary variety of New Mexico which is used green in hot green sauce and is dried, ground and used in red sauces. We have seed of several other interesting varieties bred at New Mexico State and of a few traditional varieties of New Mexico.

There are many more types of chilipepper varieties, including some that are being developed by Dr. Richard Hamilton that are bacterial wilt resistant, that can be introduced and tried, but it requires someone who is looking for something new and is willing to stay with it for the course. If there is anyone else interested, I shall be waiting to hear from him or her.

Alliums

Onions are another very important crop in Pakistan. For cooking purposes the red fleshed local varieties are certainly excellent, but they strike me as a bit pungent for use as a salad vegetable. I tried the short day adaptation Granex types with several people and there was some interest at AARI, but its lack of storability and pungency kept it from promotion even for fresh consumption. The onion crop harvested early in the season are not stored so the question of storability should not be raised. They are consumed before the crop from the NWFP and Balochistan highlands come in. The crop that matures last is stored until the next crop from the Sindh comes in, not the crop that comes in first.

Texas and New Mexico Grano types are generally large and lack pungency, which is what makes them popular in the USA and which may make it less desirable in Pakistan, but how would we know if we do not let the consumers decide? I have tried these with many people, but so far no one has ordered more seed on their own. At the Hala FSR site, Mr. Miano was very much impressed with Takii's Superex hybrid and we even ordered 4 kg

of seed, which produced a good crop that satisfied the farmers, but no seed importer was willing to bring in more seed on his own.

There are other short day hybrids available, but so far it has not been easy to sell hybrid seed of vegetables. We can try the non-hybrid seed that can be increased locally or even imported in bulk if the demand can be generated. These should be tried in the Sindh in the Hala area where early maturing onions are grown in large quantities. I am sure their customers will not raise the question of keeping quality.

Exotic medium day length adapted onion varieties can be tried in highland Balochistan and, with some modification in planting methods and dates, in upper Hazara and Malakand Divisions. The onion has become a major crop during the rabi season, spilling over into the kharif in Swat. This results in delayed transplantation of rice and delayed sowing of maize. According to the PATA Associate Expert in Agro-Economy, Mr. Olaf Ehrenstein, approximately one third of the irrigated areas of the Swat valley is devoted to onion production and this increase has occurred with only a minimum of technical assistance heretofore. Onions are becoming increasingly important in the Mansehra area in spite of the competition from tobacco. Clearly, since onions are being produced in many localities in Pakistan and acreage can be expanded, export markets should be vigorously pursued without fearing that export demand would put local prices of onions beyond the reach of the general population. Research in variety testing and agronomic practices are needed to support onion production.

In the lower Sindh, the first onion planted in the fall is the Thano Bula Khan variety for which small bulbs are planted and which split into two or three or even more bulbs (I am told) and are ready for the market before anything else is, with resultant high prices which make the low multiplication rate economically worthwhile. I have long thought that onion sets of the Phulkara variety should be grown and transplanted when they normally plant the seed. Well, like all good ideas, I am happy to say that someone else has thought of it too. The farmers near Hala are now planting onion seed in February and are growing small bulbs which can be planted in August to produce mature onions earlier in the winter than previously. In Swat, Mansehra and highland Balochistan, where medium day length adaptation varieties are grown, this sort of strategy should reduce seed requirements and duration that the crop occupies the land. While this would add work, it would give greater flexibility in planting dates and timing of harvest dates.

Non-Bell Sweet Peppers

There is more to like about the flavor of peppers than just pungency. There is a reason why some people who dislike the heat in hot peppers still like peppers. The Bell pepper has been introduced to Pakistan and is making headway. Let us try the various elongated, thinner fleshed, flavorful, non-hot peppers of the non-Bell type. I believe that a nation of hot chili lovers will take to these if we were to introduce them to the public.

Sugar Snap Peas

Peas are almost a staff of life in Pakistan during the winter. Dr. Charles Lamborn at Oregon State did the cooks of the world a favor by developing the Sugar Snap pea which requires no peeling and discarding of the shells. You just cook the whole thing and eat it all. If you do not want to cook it, no problem, you can just eat it fresh as a salad vegetable. There are both tall varieties requiring poles or trellises for support or dwarf varieties which do not require support. The tall one is more productive, but both are delicious. Growing conditions are identical to the regular peas.

Roasting Corn

Roasting ears of maize were available in Karachi on April 19 when we happened to be there, but not in Peshawar on May 23. Watermelon, which is shipped great distances, was available in both places. We asked about roasted maize in Peshawar and they told us, not for another month, at least. Great quantities of fresh vegetables are shipped both ways. Why not corn as a specialty off season crop? Has anyone tried it? Off-season fruits and vegetables command high prices and there are always those willing to pay for it. We can try growing white corn varieties in the lower Sindh for shipping to Peshawar to fill the gap from December to June. We can start with an existing variety that does not have too large an ear to reduce shipping cost per unit, which may be the reason it is not being shipped at present. The demand will presumably be greater at the front end of the season rather than at the tail end. Swabi White may be the best to start with but eventually there may be a need for a specially bred variety. According to the Senior Maize Breeder, Dr. M. Saleem, at the CCRI Pirsabak, people in Peshawar appreciated the variety Khyber very much so we may already have one.

While we are thinking about corn, why not sweet corn for the local market. In 1968, popcorn was virtually unknown, but a few people including Rafhan and the MMRI Yousafwala began growing it and today, it is an important business. I have heard of one farmer growing 300 acres of popcorn for the Karachi market. Sweet corn, being more perishable, may not be as easy to sell, especially against the competition of roasted ears of flint maize, but there probably is an appreciable untapped demand.

Then there is baby corn, which is a highly utilized commodity in Chinese cuisine. Special varieties have been bred to provide the immature ears that are consumed as a vegetable. Judging by the popularity of Chinese food in Pakistan, there could be a market for baby corn if someone would grow it. Let us try it.

After I had written the above, I learned from Dr. Bashir, actively entrepreneurial Seed Technologist, that the awesomely innovative entrepreneur, Fazal Rahman Khan, was already testing baby corn production at Panch Pir.

Beans

Several kinds of beans and peas are used fresh shelled in season and dry shelled during the remainder of the year in Pakistan. With chickpeas, lentils, mung and mash we even have breeding programs. With others such as peas and cowpeas, varieties are introduced and tested. The regular bean, Phaseolus vulgaris, is completely ignored at the experiment stations throughout the country. This should not be the case since the dried shelled bean is used as food and the green bean could become popular if suitable varieties were propagated.

We have tried the sorry excuse for green beans sold in the Islamabad and Lahore markets and we have successfully grown green and wax beans at home in self defense. On rare occasions we have been treated to Pakistani dishes prepared with what we call kidney beans (rajma) and navy beans and a little but not much more commonly with cowpeas (lubia).

Speaking of cowpeas, Vigna sinensis, which is reasonably popular, IITA has a very successful breeding program. They will send anyone interested their best varieties for testing. In 1988, I got some for Dr. Altaf Hussain to try and he selected several and increased seed of them. One was the industry standard California Blackeye type which was very well adapted to Faisalabad conditions. Cowpeas have become the principal dal used in Sri Lanka during the last two decades because of its productivity and a government ban on imports of grain legumes in the early 1970's.

Cowpeas are generally used in Pakistan as a green shelled bean, but there is a variety of cowpeas with long edible pods called asparagus or yard long beans (sitao in the Philippines) which is very popular in SE asia. We have grown and enjoyed it in Lahore and Islamabad. Its advantage is that when it is too hot for regular temperate zone green beans, it is just right for yard long beans.

Fresh green beans may never become an important article of commerce in Pakistan except among the diplomatic community and in five star hotels, but varieties suitable for use as green shelled or dry shelled beans could become very popular. There are about 8 general types and 20 or so named varieties available in seed catalogs. I have tried giving these to people at NARC and at AARI, but am unable to report successful adoption yet. I can report that I have not given up. As long as we can see dried shelled beans in jute bags in the food shops, I know that we should keep trying to get someone to adopt these orphans.

Varietal Introductions

Introducing new kinds of vegetables is getting to be more and more difficult as new varieties are mostly closed pedigree hybrids where parental stocks are not available to us and breeding programs can not be initiated for every species. What we might try,

however, is to think in terms of every hybrid being a breeding cross that was made to order for us and to grow F2 populations of each to practice selection in. This is logical because the parents were selected on the basis of possessing complementary characters just as we would think of in making a breeding cross. There are no guarantees that selection in all of these will result in success, but some will and they would make the activity worthwhile.

Some introductions are instant hits, like Sugar Baby, because they supply a trenchantly felt need. Others, like fennel, which is popular in Europe, are not appreciated here. Some like asparagus and strawberries are successful only because a few people are willing to pay a very high price for them. I suspect most will be like bell pepper and head cabbage which were initially not accepted but is slowly becoming available in more markets. People are introducing more and more varieties of the more commonly used ones, like carrots and lettuce. We should keep trying and the best ones will eventually attain the status of being called desi.

Floriculture

Seven years ago it was difficult to get people to think about floriculture as an economic activity. Dr. Zafar Altaf founded the Landscaping and Ornamental Horticulture Training Centre in Lahore and got Punjab government support for it. Although no other source of financial encouragement was forthcoming, it seems to be flourishing.

Today we find flower shops everywhere and a mile of ornamental plant nurseries near Pattoki and a few hundred meters of it across from Tarnab. Floriculture is a serious business demanding attention from researchers.

Besides satisfying man's craving for beauty within the country, we should seek to learn where Pakistan might have a comparative advantage for producing plant materials for export. In Bangalore, India, Dr. Manmohan Attavar's firm produces, among other things, bulbs for export to Holland. Talk about shipping coals to Newcastle!

Ch. Khurshid told me many years ago that he felt that Hemerocallis spp. (daylilies) would be a natural for Pakistan. I have come to believe him and we have started the process of donating to Pakistan one plant each of over a hundred different varieties. You can admire its looks and you can eat it too. The buds are good for making pakoras. Stir fried daylily buds are tasty too. This is truly an example of having your cake and eating it too.

We have ordered for July delivery 52 varieties of bearded iris to add to the 23 we have already imported. While they give us only a brief splash of color in the early spring, they are so spectacular that everyone will want to have some once they have seen them.

Amaryllis is one of Ch. Khurshid's favorites that is well adapted to the hot climate of the Punjab and should grow everywhere in the country except in the high mountains. There are many other possibilities too numerous to mention here.

FARMING SYSTEMS RESEARCH

As PROS, I was involved with farming systems research activity in each of the provinces, rather more in the Punjab and in the Sindh, but also to some extent in the NWFP and to a very limited extent in Balochistan. Besides participation at the usual complement of internal meetings and workshops, I arranged for the major attempts at forging links with the extension service of the agriculture department and with the livestock department in the Punjab.

Dr. Murray Dawson, operating nationwide through the Farming Systems Research Coordinator at the NARC, was the FSR advisor. My role was to provide support to the provincial FSR units, particularly in the Punjab and Sindh. I helped them to get into the field and to look for viable interventions. For example, the availability of good quality seed was always a problem. Seed of recently released varieties was not available in any of the target areas. Producing seed with respected villagers became one of the cornerstones of the FSR effort.

Farmers in the Hala area were planting NIAB 78 cotton seed, but the seed available to them was a ginnery mixture with NIAB 78 plants predominating only because it is the predominant variety in the Sindh, but it was an unsightly and depressing mixture of varieties. I arranged for basic seed to be shipped from NIAB to its sister institution, the AEARC, the then Sindh FSR Coordinator, Dr. Kazi Suleman Memon, took the seed to the farmers. When the farmers saw for themselves the effects of growing quality seed, demand for good seed was generated. To satisfy this demand on a more sustainable basis, several contact farmers are being encouraged to produce seed for their villages. They have requested the present FSR Coordinator, Mr. Noor Muhammad Miano, to make available a mobile cotton gin so that they could keep their seed pure. These are being arranged through our contacts in Multan.

It was obvious that most farmers involved in the FSR program were experiencing a need for better quality of fodder during much of the year. The first intervention that I arranged for them was sorghum-sudangrass hybrid (SSG) seed. Although I had first introduced the parent seed in 1968 to Yousafwala at the request of Dr. Abdul Ghafoor Bhatti, seed of SSG hybrid, better known as Sadabahar, was still a rare commodity when the FSR program got under way in 1987. International seed companies such as Cargill, Pioneer and Pacific (ICI) were just beginning to import the hybrid. The Fodder Research Institute and the Maize and Millets Research Institute had only limited production capacities. Rafhan Maize Products was already producing parent seed of the hybrid and selling it to some of their contract growers who were producing seed on their own. I arranged seed from one of these local seedsmen in early 1987 for the FSR program to use with the farmers.

One farmer in the Shahkot FSR project area, Mr. Mokhtar, did a very good job of producing SSG fodder under our guidance. The editor of Jadid Ziraat, Mr. Sadiq Qureshi, visited his farm and featured Mokhtar's experience in his magazine. This publicity gave SSG a great boost. After 20 years, this forage sorghum hybrid was finally on its way, due at least in part to the workers and cooperators of the FSR program.

Since it is not difficult to produce SSG hybrid seed (no detasseling necessary and no confusion about mixed seed of the two parents), I arranged for parent seed of the two parents for Azhar Siddiq of Ch. Mohammad Siddiq, Vegetable Seed Merchant, to grow on their seed farm. From 1 acre in 1988, they are now up to 10 acres of seed production and plan for 25 acres by 1995. Dr. Hanjra purchased the seed that he used in his FSR activities partly from this source and continues to do so in his new activity in the Gujranwala area.

From a very modest beginning during 1989-1991, Dr. Hanjra and his staff became the prime movers of Mott in 1992, feeding planting material into the Milk-Pak and Cargill Citrus programs to help their cooperators, into the FSR program and finally to the thousands of farmers responding to the publicity campaign conducted by the retired AARI FSR Coordinator, Dr. Asghar Jalis, with a little financing from the MART Project. Someone began calling this the Management of Technology Transfer (MOTT) Project. The retired FSR advisor even went so far as to say that five years from now, MOTT may be what MART will be best remembered for. People involved in the FSR program in all provinces have been effective exponents of Mott, in response to perceived and expressed needs of the farmers in their target areas.

When we started in the Shahkot area in October, 1986, wheat planting season was starting. Farmers did not know about Pak 81, much less know about a source of pure seed. Lyallpur 26 was their "new" variety. We introduced Pak 81 by requesting the Director Wheat Research, Dr. Muhammad Hussain who has been very cooperative, to send his on-farm research crew to plant a few demonstration plots in the village.

Before the designated FSR Site Coordinator for the AARI unit could be found and the program mobilized, I invited the Director Agronomy and Director Pulses to the Shahkot area to do a simple diagnostic survey without questionnaires. We talked to several farmers and ascertained that fodder supply was a big problem, wild boars were too numerous to consider growing maize for grain, livestock was very important, pulses were hardly grown, they never had enough water, vegetables were becoming popular (particularly eggplants) and they converted their sugarcane into gur which when sold was their main source of income. Farm size was small and people generally produced their own wheat and rice. In short, they were subsistence farmers who sold gur mainly and livestock on occasion to earn cash for buying whatever needs they could not produce themselves.

The Pulses Director asked them why they did not plant lentils which required less water when they told him that they did not have enough water. Their answer was that they would like to try, but they had no seed. He provided them the seed and the next year there were five times as many plots of lentils popping up here and there on their own. That was when the FSR Site Coordinator set up a trial demonstrating the value of putting part of the acreage into lentils and reducing the wheat acreage, but using the water spared by the lower requirement of the lentil crop on the reduced area under wheat, which would give the farmer a good crop of lentils for home consumption without sacrificing production of wheat. In other words, they grew 7/8 acre of wheat instead of 1 acre, used about the same amount of water (except for one irrigation) on the 7/8 acre as they did on the 1 acre and got almost as much yield of wheat. The lentil crop was a bonus.

In the Mansehra area of the NWFP, the main rotation was maize-wheat on the uplands and rice-berseem in the paddies. The main interventions undertaken were pure seed of improved varieties. Within the target villages, the FSR team concentrated on a few things and succeeded in winning the approval of their target farmers.

I am not as familiar with the Balochistan component, but it seems that it has excellent leadership and is well organized. They are operating in the Kanak valley where temperate fruit trees, onions and livestock appear to provide the best economic opportunities.

When we began our work we had fond hopes that Farming Systems Research could be made into household words and that the principles would be embraced by all. The idea that we had something to learn from the farmer, that we would let him help us set our research agenda, that we would undertake research for the farmer, with the farmer and even by the farmer has not been universally accepted. However, substantial progress has been made. Many collaborating scientists now realize what it is that sets apart the FSR scientists. We have many scientists outside the program increasingly embracing the FSR philosophy.

The four provincial and the one federal units all have different characteristics reflecting the idiosyncracies of the individuals involved. Generally, however, all of us can and should do more to proclaim the good news of FSR. What good news? Perhaps that is the problem. It is difficult to specify what makes FSR unique. Trying to explain what it is sounds so much like good old fashioned common sense too obvious to require further elaboration.

We do have a general problem of thinking that we have something that the farmer needs, that the agribusinessman needs, but we need to learn what it is that they really need. That knowledge should then help us develop our research projects. There is some sense that more researchers have begun to realize our need to diagnose what our clients require since agribusinessmen and progressive farmers are often invited to seminars and are asked to give us advice. However, they are often asked to speak at the end when

everyone is thinking about lunch and the journey home. Let us demonstrate our sincerity by inviting them to speak at the very beginning. How about asking an articulate, genuine farmer to give the keynote speech? Then the scientists and officials may react to their comments and address some of their concerns during their own presentations.

When the FSR programs were being organized, interventions discussed were usually based on what was there at the research institutes. Usually this is not a problem, because you have to start somewhere and you would not often be too far off. However, on occasion it can be ridiculous, if not disastrous, like trying to take wheat technology existing at Sariab and AZRI to the Kanak valley where wheat, if grown, is not grown for grain, but for fodder. A windshield survey would have shown the planners that a program for pruning and spraying fruit trees would have been the most essential interventions and something to do with onion cultivation, like starting with onion sets instead of broadcast seed, another possibly important one. To the credit of the Balochistan FSR Coordinator, Dr. Abdul Hamid Bajoi, they started with pruning and spraying apple trees.

Let us cure ourselves of the Lab to Land syndrome which all too often determines agricultural development activities. Let us try the Land to Lab approach so that we can invigorate the information development and dissemination system. This is what the FSR approach is promoting. Much progress has been made in this regard with FSR units leading the way.

The National FSR Coordinator, Dr. M. Qasim Chatha, and his team have developed an effective liaison with the Rawalpindi Division Director of Extension and his field staff that serves as an excellent example. Their activities should educate those who are involved and they in turn should educate their colleagues. They are now integrating the activities of the Technology Transfer Division of the NARC into their work.

We do have considerable contact between some researchers and the extension services of livestock, forestry and agriculture. We should increase our efforts to achieve closer collaboration. The Agriculture Department's extension service has adaptive research farms which have multi-disciplinary teams of specialists who would be natural partners for the FSR units. Since cooperation is voluntary, we can not hope to achieve universal acceptance, but we surely can have more cooperation if we were to try.

The main thing is that although the FSR approach is good, these ideas have to be spread to more people, not just to help people to adopt the specific interventions, which are potentially productive enough, but more importantly, to help people to adopt the method of operating in such a way that more useful ideas will evolve and a greater array of specific interventions can be made available to more people.

MOTT DWARF NAPIERGRASS aka DUDH KA KAMAD

Napiergrass (*Pennisetum purpureum*) has been known in Pakistan since long ago, but it had never captured the imagination and interest of the farmer. The same can be said for the bajra-napier hybrid. When cut at the right stage, both of these are not bad, but because there was no concerted effort to promote them, they never became widespread.

The story of Mott dwarf napiergrass is different. Mott was selected for quality from the very beginning and once the ultimate decision makers, our four footed friends, were presented with the opportunity to evaluate Mott, it began to spread. There are enough enthusiasts like the previous and present Chairmen of the UAF Department of Livestock Management, the retired Director of Agronomy of AARI cum agricultural journalist and the first and foremost FSR Convenor at Faisalabad, the previous and present Secretaries of Livestock and Dairy Development of the Punjab and the Farm Superintendents of the livestock experiment stations that the momentum of Mott now appears to be unstoppable. Its potential to contribute is unquestionable.

Mott is the result of the work of many people, but Dr. Wayne Hanna and Dr. Glenn Burton started it all at Tifton, Georgia. They gave me cuttings in June, 1988. I increased it in my backyard in Lahore and Dr. Hanjra and I made the first effective planting of about 10 marlas at the UAF Dairy Farm on April 2, 1989, when Dean of the Faculty of Animal Husbandry, Dr. Bakht Beidar Khan, as Livestock Management Department Chairman, gave his blessings.

From this very modest beginning, Mott has spread all over Pakistan due to the enthusiastic efforts of a large number of people brought together by the MART Project. Letters to the editors of most of Pakistan's newspapers and agricultural periodicals describing Mott's attributes and availability resulted in thousands of responses requesting further details and information as to where to obtain planting material. Information sheets, posters and folders were printed by the thousands in response to this demand. Research and extension personnel, professors and students, legislators and civil servants, landlords and tenant farmers, agribusiness tycoons and village milk collectors are becoming involved in furthering its spread throughout the country.

There is the heartening case of a Sayed farmer in Halalpur of Distt. Sargodha who got from Dr. Nisar Ahmed of Milk-Pak a fertilizer bag full of rooted cuttings of Mott in mid-October, 1992, well past the best time of the year for planting it, but that did not stop him nor Mott. By April 15, 1993, this farmer had provided planting material to twenty other farmers and had expanded his area sown to Mott by one full acre by April 1, 1993. We wish we had met him in 1989 when we first started providing limited quantities of plant material to people. Who knows how many more people he would have spread it to by now?

Another farmer, Mr. Javed Iqbal, whose farm is on the Vehari-Luddan road, got some 20 sticks from PROS in 1990. When I visited his farm in July, 1992, he had one acre of Mott as the sole green fodder on his farm and he had 16 milking buffaloes and was planning on increasing his herd to 20-25 because he was having a surplus of green fodder. Mott seems more productive than I had been led to believe. Just one acre of Mott has made this very progressive crops farmer a commercial dairyman as well. He was always an entrepreneur and when presented with this fodder grass he decided that he was now in a position to supply commercial quantities of milk. Since his acre of Mott lies alongside a well traveled road, he has been asked for and has supplied planting material to many people, thus earning a local reputation as a generous man.

It is apparent that Mott is a crop which has the potential for making new friends. He who has it and treats it well has the potential to prosper and if he is inclined to share his good fortune by providing planting material to others, he might gain great popularity. Just as the first eight sticks were given to me by the originator, it has spread everywhere in Pakistan as gifts from those blessed enough to have it to those who were in need of it.

Mott is a perennial bunchgrass that does not spread by rhizomes, stolons, or any other means. Hence, it can not become a pest. It can produce seed, but that is not the way we propagate it because it does not breed true to seed and in any case it does not produce enough viable seed. It produces a large number of tillers, about 40 in four months from planting 1 stick in the spring. In another three months, during the kharif, each tiller can grow to eight foot height and be cut into at least four planting pieces. In seven months, 1 stick can provide 200 pieces of planting material and more if you were to dig up the entire clump and divide it.

People ask how much green fodder Mott can produce. This is not an easy question to answer because if you go for quantity, you will sacrifice quality; if you go for quality (and therefore, animal performance) you will have to sacrifice quantity; if you do not provide enough nutrients and moisture, you will sacrifice both; if you live in the lower Sindh, you will have good growth for ten months; eight months in the central Punjab; seven months in Islamabad, Peshawar and Mardan; six months in Mansehra and Swat. The best thing to do is to plant some and find out for yourselves what Mott can do for you under the management you are going to give it. Somebody has gotten 400 tons per acre of excellent quality green fodder in eight months, somebody else destroyed it by neglect. I would reverse the question and ask you to show me what you are capable of producing with Mott. With Mott as with everything else, man is the factor that transcends all others.

Some people are inclined to equate Mott fodder with sugarcane tops and strippings. That is a mistake. Sugarcane is harvested once a year and on any given farm, the fodder becomes available all at once. Mott is available nearly the entire year. No selection for fodder value was made in breeding sugarcane. Mature, even dried, leaves are stripped from the stalks and fed, but not always consumed. If the dried leaves of Mott were to be

stripped and analyzed, its quality would be just about as low as that of dried sugarcane leaves. However, Mott is dealt with differently. It can be cut every five to seven weeks during April to November and you would be feeding green leaves and succulent stalks, with dry matter digestibility percentage of leaves being 65% and stalks around 58%.

Mott is amenable to grazing, which is the way the livestock experiment station Farm Superintendents, Dr. Muhammad Anwar at Serai Mohajir (Distt Bhakkar in the Thal area) and Dr. Abdus Sattar at Jahangirabad (Distt Khanewal), and Fodder Production Agronomist Ch. Akbar at the LPRI Bahadurnagar (Distt Okara) are using it. Most farmers have incorporated Mott into their cut and carry feeding system. In the Sindh, where several hundred Bedford truckloads of maize fodder are transported from Hyderabad district to Karachi each and every day, several entrepreneurial types have obtained Mott for eventual multiplication for growth on a scale sufficient eventually for replacing maize, at least to some extent.

The advantages of perennial Mott over annual maize or sorghum are obvious. With Mott, you plant once and harvest 4-7 times per year for as many years as you want to or until the field is flooded or abandoned. With maize, sorghum and desi bajra, you have one harvest per planting. With maize, you can plant in February-March and harvest for fodder in late May. By then you are ready for your second cutting of Mott. You cut 40 stalks of Mott from one square meter and at best you get 10 of maize or sorghum. Each planting of maize requires adequate land preparation and fertilizer. Each cutting of Mott requires only fertilizer and water to produce the next one. There will be no more outlays for seeds and tillage costs, ever.

Maize and sorghum (Sadabahar is a cross of two sorghum species and has the same pest problems as sorghum) provide a happy environment for a multitude of insect pests. Bajra does not. Neither does Mott, which is a bajra relative. In any IPM program in Pakistan, where we must consider the pest production potential of other crops in the system, it is well to remember that bajra and Mott play host to fewer insects than maize and sorghum.

Mott does not make much growth during the cooler months. It can be intercropped with berseem from October to April so that your fodder needs can be met. Mott makes so much growth during the warmer months that there is every likelihood that growth will exceed consumption and delayed harvest means reduction in quality. During those periods, it is advisable to make silage, which preserves quality and which can be fed during the periods of slow growth. Ensiling at the best stage for feeding is far preferable to allowing the fodder to grow past that stage.

Mott has been the subject of several M.Sc. students' theses at the University of Agriculture Faisalabad and is part of at least one Ph.D. student's thesis. It has become a bridge to improve communications between the Departments of Livestock Management and of Agronomy. Professors from many other departments are talking to the people

from Livestock Management, if for no other reason than to ask for cuttings. That may not be much, but it is a start. Again, it is always given away to friends.

At least three agribusiness firms are extending Mott to their cooperating farmers. The Punjab Government of Livestock and Dairy Development has planted Mott on most of their livestock experiment stations with some spreading to neighboring farmers. In this connection it should be mentioned that even in the sandy areas like the Thal and Cholistan, Mott is being planted and is being used for grazing. It is being grown under barani conditions at the NARC by Dr. Noor Mohammad of the RMI.

Mott was developed by Dr. Wayne Hanna at the Georgia Coastal Plain Experiment Station at Tifton, Georgia, USA in 1977 as selection N75 from among selfed progeny of "Merkeron", a cold tolerant napiergrass clonal variety developed by Dr. Glenn Burton. N75 was tested by Dr. Gerald Mott and his colleagues in beef cattle grazing trials at the University of Florida and in 1988, they named it Mott, posthumously, in his honor.

Dr. Hanna's breeding program continues and two further introductions, N222 and N224, were made in April, 1991. These are being propagated at several sites in Pakistan in preparation for testing against Mott. At the University of Florida, Dr. Lynn Sollenberger et. al. are making bajra-napier hybrids which can be propagated vegetatively or by seed. One of these, S-41, was brought to Tando Jam by Dr. James Barnett in November, 1989. Since then it has been lost in the Sindh due to flooding, but since we grew it in the Punjab, we were able to reintroduce it to Tando Jam in 1992.

Because of its very succulent leaves, we have named this Mott-like semi-perennial fodder grass Malayam. There are those who feel that the name should more properly be Naram. It seems to be superior to Mott in palatability, but it requires careful management to make it persistent. Malayam is preferred by the laborers at the UAF dairy farm because it does not cause them to itch when they cut it as compared to Mott. This, together with palatability and higher percent leaf, may give Malayam some advantage in adoption rate if we were to present the two together, but Mott is believed to be more productive and is definitely more persistent.

We have not ignored Malayam, but have concentrated our efforts on Mott. Perhaps it is time to take a good look at Malayam as a possibly farmer friendly alternative to Mott. We should have M.Sc. students compare the productivity and palatability of the two under several different harvest regimes at Peshawar, Faisalabad and Tando Jam.

We have received feedback from the instructors at the Animal Husbandry Inservice Training Institute (AHITI) that farmers have complained about excessive itching after cutting Mott. Principal Ajmal Qureshi told PROS that along with their certificates, they provide their trainees planting material of Mott to take home with them.

There are other fodder grasses to be discussed, but they will be treated in another chapter in order to stress the over-riding importance of Mott as a primary cultivated fodder crop to stand with berseem, oats, sorghum-sudangrass hybrid, maize, sorghum and bajra. Much is being said about commercial livestock enterprises, particularly, meat for export to earn foreign exchange and dairy products for import substitution and even potential future exports.

It is well known that small farmers rely heavily on sale of animal and animal products to earn cash. Such reliance can only increase, as it has to, if fodder production can be increased since increase in the usage of crop residues is limited and about all we can do is to try to enhance the value of the residues we have. The Farming Systems Research program has been promoting urea enrichment of wheat bhusa and rice straw and such efforts are not to be disparaged, but judging by results for efforts expended, it would have been better to ignore residues and promote production of Mott and other fodder crops as if they were the valuable cash crops that they really are.

Napierglass is ancient but Mott is new. There are scores of questions about how to grow it and how to use it that it will serve as the subject for dozens of theses.

There is an excellent liaison being established between an animal nutritionist, Dr. Makhdoom Abdul Jabbar, and a fodder production agronomist, Choudhry Akbar, at the Punjab Livestock Production Research Institute with my assistance and the blessings of the Director, Dr. Khalil Ahmed. They have established that Mott can serve as the sole green fodder for dry cows and, supplemented with concentrates, for milking animals. Now they will conduct a feeding trial for young heifers and hopefully next on bull calves for beef production, which will increasingly have to be done in Pakistan to satisfy the demand for meat which will be difficult to do with traditional fodders and crop residues.

PROMISING FODDER GRASSES OTHER THAN MOTT

Tifton 85 Bermudagrass (Cynodon dactylon)

Bermudagrass, locally known as 'kabbal', is among the most important fodder crops in Pakistan. Its study is a totally neglected subject. It is a crop that no one plants and everyone harvests. It is even sold in season along roadsides in many areas of the country. It survives as a persistent weed in cultivated fields and along roadsides. The desi variety is appreciated by all classes of livestock, but, when it is harvested and sold, is generally reserved for tonga horses and milk animals.

We now have the ultimate version of bermudagrass from a breeding program which was started in 1936 and persists to this day. Dr. Glenn Burton provided me a few rhizomes of Tifton 85 bermudagrass in 1989 and we have grown large nurseries of it at the University of Agriculture Faisalabad and at the Jahangirabad Livestock Experiment Station. Potted plants of it have been given to fodder institutes and stations, but their interests seem to lie in the direction of seed propagated fodder crops. A few farmers who have visited the UAF Dairy Farm have shown interest in planting it.

It has not been easy to generate enthusiasm in Pakistan about Tifton 85, especially among fodder scientists, who forget that undoubtedly the greatest of them all has devoted an active 55 year career to the improvement of Cynodons and this is likely to be the capstone of his very productive career. In terms of beef cattle gain per acre from unirrigated, but fertilized pastures, it is four times as productive as common bermuda. Tifton 85 and its predecessors going back to Coastal bermudagrass have been in this country from 1969, but the largest field thus far is but an acre in size. At least on the government livestock farms, where the labor constraints are causing difficulties with the cut, carry and chaff system, Tifton 85 would seem to be a natural. There is no similarity in performance or appearance between the desi and this improved variety.

One difference between Mott and Tifton 85 in spread is that Tifton 85 has not gotten beyond the personal phase. Mott is spreading far and wide because there are others who share my enthusiasm for it. Not so with bermudagrass. Most farmers have some livestock. That means that most of the farmers feed bermudagrass growing as a weed for at least part of the year. That means that they do appreciate its fodder value. Why then do they not grow the most productive variety available? The answer may lie in the fact that the people who might participate in making it available to the end users may not have begun to appreciate it.

Well fertilized bermudagrass grown under irrigation can be highly productive. The cold tolerance of Tifton 85 keeps it green all year round and although growth slows down during the cooler months, it does not actually cease. It can be intercropped with berseem during the winter so that an acre of land devoted to that combination is productive all year round.

Hay is used in Pakistan, especially in the barani areas. Its use is therefore not unknown and not uncommon. Much of the bermudagrass grown in the USA is converted into hay and constitutes an important article of commerce. Cut at the proper stage, i.e. between 4-6 weeks, irrigated bermudagrass should produce 30 tons of very high quality hay or about 150 tons of green fodder per ha with no outlays for tillage and seed once the stand is established. Equipment for mowing and hay preparation brought into the country under the MART Project is already available, but is lying idle. They should be put to work.

Well-fertilized bermudagrass, if cut every three weeks, would be over 15% protein in dry matter and could be useful even for poultry rations. It would certainly improve the color of egg yolks.

The provincial fodder research people have shown no interest in doing the painstaking research necessary to obtain the basic information necessary to support an extension program to popularize Tifton 85. I am suggesting that the NARC has the necessary scientific talent, the mandate, the resources and I hope the enthusiasm necessary to carry out the kind of studies with Tifton 85 that will create the essential foundation of facts derived in Pakistan to help farmers make intelligent economic decisions regarding Tifton 85 bermudagrass.

Tifton 86 Annual Ryegrass (Lolium multiflorum)

This was introduced in October, 1988 when Dr. Wayne Hanna, who selected it on a farm in South Georgia, U.S.A., sent me about 100 grams of seed. I asked Robert Spitaleri, who was familiar with this crop and was accustomed to planting it at the rate of 20 lbs per acre to increase this over as large an area as possible. He planted it on nearly half an acre and harvested 109 kg of seed. This multiplication rate of 1090 to 1 was truly commendable as well as remarkable.

Tifton 86 ryegrass was tried at Bahadurnagar and was found to be quicker growing than the Wimmera ryegrass that had been introduced before. In general, it appeared that although it matured earlier, its total forage production was the same as that of later maturing cultivars.

Ryegrass can be sown with berseem and is ready for cutting before berseem in December. It is finished in April whereas berseem lasts until May. It can be used for grazing or for the cut and carry system. It is used in many parts of the southern U.S.A. as a fall seeded intercrop in bermudagrass pastures to provide winter grazing. It can be used in the same way in Pakistan.

If allowed to go to seed there is a chance that it will become a weed in wheat fields, but its weed potential is nothing like Phalaris and its fodder potential is spectacularly better. Except for our inability to produce sufficient seed at the UAF DLM, LPRI Bahadurnagar, NARC and FRI Sargodha, annual ryegrass is a fairly promising crop that

several farmers who have tried it have liked. A local seed producer has to be trained and motivated to produce seed. Seed production would be around 200 kg per acre and price would be around Rs 20 per kg. One would then not grow ryegrass solely for the seed yield. No one does. Seed is produced in the U.S.A. in Oregon where vast pastures are grazed by sheep twice during the winter and then left for seed. Until we can figure out how to produce seed economically in Pakistan, annual ryegrass can not become more than an intriguing possibility.

Carostan Flaccidgrass (Pennisetum flaccidum)

This grass was introduced in June, 1992 as seed obtained from Dr. David Timothy who is professor of forage crops at North Carolina State University and President of the Board of Directors for Diversity, which organization publishes the international journal by the same name on the subject of preservation of plant genetic resources. Carostan was selected in North Carolina from an introduction made from Afghanistan. Hence, the name Carostan. We have an extension fact sheet about its characteristics and its potential use, but we must have more information before it can be recommended for general cultivation in Pakistan.

However, a few comments can be made regarding its performance so far in Lahore and Faisalabad. It came through the relatively severe winter of 1992-93 in better shape than Mott and other Pennisetums. It can stand drought rather well. In plant habit, it is a bunchgrass. Leaves are tender and tillering is profuse and regrowth is rapid. When fertilized well and harvested or grazed at heights below 45 cm, digestibility is within the 60-70% range and crude protein is up to 18%.

Total gain of beef steers from flaccidgrass pasture for an entire season was 973 kg per ha vs 1006 kg for fescue-bermudagrass. However, average daily gain per steer on Carostan was 900g vs. 576g for fescue-bermuda.

There is a source of seed, but cost is US\$70/lb=PakRs. 4100/kg. We have not found seed on the plants we have here, but clumps can be divided and planted. With the relatively mild winters we have, tillers can be planted at any time during the monsoon and well into November. We avoid new plantings during March-June because of the extreme heat and dryness of May and June.

If someone in Pakistan would give the matter of producing flaccidgrass seed some serious study and succeeds, he may be able to supply seed to the U.S.A. There is certainly a price incentive.

Buffelgrass (Cenchrus ciliaris)

This native of the Subcontinent (local name is dhaman) is a distant relative of bajra with excellent potential under both irrigated and barani conditions. It has long been

appreciated by the Director of the Range Management Institute at the NARC. There are several types available of which the bluish-green, giant type selected in Australia, e.g. cultivars Nunbank and Biloela, appear particularly productive where moisture is not limiting. These are available at the TDA 205 Livestock Experiment Station, the NARC and the UAF Dairy Farm. Seed production is copious and vegetative propagation is easily done.

Again, we have only observations. We need production data under different management regimes. This is a very promising crop worthy of further study. It can be grazed or repeatedly cut. Its regrowth after cutting during the cooler months is quite good. We have noticed that though it produces plenty of seed, unlike some other good fodder grasses such as guineagrass, Rhodesgrass and blue panic, it does not spread aggressively. It has remained in discrete clumps in our plantations and the clumps do not coalesce.

Nunbank buffelgrass has been introduced recently into the Fodder Coordinator's program at the NARC. It is hoped that it may be increased and some idea of its productivity can be gained by clipping trials at 4 and 6 week intervals throughout the year under adequate irrigation and fertilization. A similar trial might be conducted by the Range Management Institute under barani conditions at an appropriately reduced level of fertilization.

Guineagrass (Panicum maximum)

Guineagrass has been repeatedly introduced into Pakistan by different people and appears to be quite promising under irrigated conditions. It produces good seed in Pakistan and has a tendency towards natural spread where moisture is sufficient. It is drought tolerant, but does best with adequate moisture and fertility. At the TDA 205 farm at Serai Mohajir where Dr. Muhammad Anwar has grown it very successfully, it is moving quite rapidly from the introduction nursery into a neighboring field of Mott. It is suitable for grazing and for the cut and carry system. Like Mott, it is a long lived perennial bunchgrass which grows fairly tall. Unlike Mott, it does not produce stalks which can be used for propagation, but because of its ability to spread by seed, guineagrass has a tendency to become naturalized, which is an advantage.

Blue Panic (Panicum antidotale)

This is a native, cut and come again grass which has much to recommend it. I am surprised that it has not been propagated more. We believe that it is drought tolerant and is productive. It was appreciated by the Chairman of the UAF Department of Livestock Management and by the Farm Superintendent at TDA 205 as well as by the Director RMI of NARC, but it has been used only to a limited extent.

Perhaps there just isn't enough rainfall in most of the unirrigated areas for such a productive wild grass, but I believe that in some of the barani areas, blue panic would be productive if seed were produced in some enclosures and allowed to migrate into their environs. No doubt, on the majority of the small farms, where livestock numbers equate with availability of crop residues, there are other fodder grasses such as Mott which would be more productive, but I believe that blue panic would have a place in large common use grazing areas such as along the roads, canals and riverain areas. Some judicious range reseeding with it would seem to be in order. This is a grass for the forestry people, who have responsibility for the rangelands, should adopt and add to their arsenal.

Birdwood Grass (Cenchrus setigerus)

This is what it is called in Australia whence came the commercial seed which we ordered, but its origin is in the Nile Valley eastwards to India. It is not as tall as or bluish as Nunbank or Biloela. Its seed is larger also. Seed production is good. It persists well when clipped and protected from grazing. It appears to be reasonably productive and drought tolerant. It has been introduced at the NARC. It might be suitable in higher rainfall barani areas under natural conditions.

Limpograss (Hemarthria altissima)

This is a native of the Limpopo River area of southern Africa. We introduced this in 1988 and it has been surviving at the UAF Dairy Farm, but it has not spread. The DLM staff have noticed that the livestock seem to prefer it. We have put considerable effort into the task of introducing it to a number of other people and places, but there does not seem to be much enthusiasm for it. Its season of best growth coincide with that of berseem, which may be a factor contributing to its neglect.

It might be useful in low lying riverain areas, but it can not be recommended for general cultivation, since there are other grasses which are more productive over a longer season. It turns chlorotic during the monsoon, but recovers when cool weather returns.

Sudangrass (Sorghum sudanense)

Sudangrass is the male parent of the commercial hybrid known in Pakistan by the felicitous name of Sadabahar. The female parent is the same female that is used for grain sorghum hybrids where no selection is done against HCN potential. Since sudangrass is used solely as a fodder crop, serious efforts are expended to reduce HCN potential. Sudangrass fodder is safer and of superior quality to that of SSG hybrid.

The sudangrass parent confers tillering capacity and therefore the multi-cut feature to the hybrid. In fact, it provides essentially all of the required fodder characteristics of the hybrid. The sorghum female provides the seed size and quantity. Greenleaf sudangrass

is the male used by most seed producers. Jumbo has a unique day length sensitive sudangrass male and a unique female. It is unique. Otherwise, the SSG hybrids can be considered generic.

Seed of Greenleaf sudangrass is available in the country and should be tested against commercial and government station hybrids. When cut as frequently as they should be for fodder quality, the hybrid gives much more in the first two cuttings, the two are equal in the third cutting and the fourth and fifth cuttings of the sudangrass are equal to or better than that of the hybrid. Total production of fodder of sudangrass and Sadabahar does not differ significantly. All this is to say nothing against the hybrid, but to say that since non-hybrid seed can be spread from farmer to farmer, promoting sudangrass as a fodder crop for those farmers who have not yet seen fit to purchase hybrid seed is not necessarily a retrogressive step. Let us say that SSG hybrid seed is a convenience when commercial interest makes it available, but sudangrass seed is an alternative worth considering.

We did have Georgia 337 HCN-free sudangrass from Dr. Burton, but we lost it due to lack of interest. This variety was later to flower and more resistant to leaf diseases than even Greenleaf. It was very productive in trials conducted by Mr. Robert Spitaleri at Manga Mandi. If someone is interested, I could try to reintroduce it.

Multi-cut Bajra (Pennisetum typhoides, glaucum, americanum)

The multi-cut bajra concept is the brainchild of Dr. Glenn Burton who began breeding pearl millets for grazing purposes in 1936 and by recurrent selection developed the highly tillered Tift 23D inbred which is still today the basis of the hybrid pearl millets of the world. A rust resistant version is the female parent of Tifleaf 2 hybrid, the most recently released Tifton hybrid.

Dr. Wayne Hanna sent me 20 lbs of seed of this hybrid, as well as generous quantities of seed of the parents. The hybrid was much appreciated and we saved F2 seed. There were enough dwarf type plants with profuse tillering that many farmers who tried it were interested in saving F3 seed, but due to aphids and small plot size, saving seed was not possible.

The hybrid seed production plots were ruined by untimely rains during the kharif of 1991 and 1992. Since I had been introducing bajra inbred lines from time to time since 1970 and we had not succeeded in producing bajra hybrids, Dr. Burton suggested that we try increasing the seed of Synthetic 7 multi-cut bajra which he sent to me. Thanks to the Director of the Cotton Research Station Multan, Mr. Muniruddin Khan, around 50 plants were grown under isolation and seed was increased to 2.2 kg during the 1992 kharif and half of that is being increased during the 1993 kharif under his direction at the station and by two farmers. The other half is being increased at Bahadurnagar LPRI, Azhar Siddiq, Cargill, SAU, NARC and the Smallholders Dairy Development Project at Gujranwala.

Rhodesgrass (Chloris gayana)

We introduced two varieties of this tall, summer growing perennial fodder grass, Callide and Samford. They are surviving and spreading naturally and aggressively at TDA 205 under irrigated conditions in coarse sand and at the UAF. It is being increased now at the NARC for further study.

In the immature stage, Rhodesgrass is quite palatable, but as with many other tropical and subtropical grasses, there is a great need for good grazing management. Due to vigorous stolon development and good seed formation, it can spread very quickly where moisture is sufficient. It is best adapted to the 1000mm rainfall zone. In Pakistan, it therefore will probably be restricted to irrigated lands, but it has considerable potential.

At AHITI, on the Charsadda road near Peshawar, Farm Manager Dr. Irfan has obtained plant material from the Forest Department and has increased it. It is being cut regularly while it is still in the vegetative stage. In this way, they are able to keep Rhodesgrass in discrete, easily managed clumps.

Bhopal Lablab (Lablab purpureus)

Though this is not a grass, I have included lablab in this section since it is also used as a fodder crop. Lablab is used as a pulse for direct human consumption in the Subcontinent, in SE Asia and in Africa. In Australia where it is used as a forage crop, two cultivars, Highworth and Rongai, are being sold by seed companies. These were grown at LPRI Bahadurnagar by Sheikh Waheed for many years but not spread elsewhere. I took some seed of Highworth and we tried it at a few livestock experiment stations. The outstanding Field Assistant at the Jahangirabad LES, Mr. Reham Din, appreciated it and increased the seed. It was also appreciated by Dr. Anwar of TDA 205.

At the farm of Brigadier Ghazanfar near Kot Addu, we noticed two very vigorous lablab vines loaded with pods. We were told that Brigadier Sahib had brought the seed of these from Bhopal. The seed of one variety was at least triple the size of any other lablab I had ever seen. The other variety was characterized by a pod that looked very much like that of peas and it was much more prolific than any other lablab I had ever encountered. These two varieties are definitely more vigorous and productive than the white flowered type sometimes found being used as ornamentals by some people in Pakistan. What their productivity as a fodder species may be, their propagation as an ornamental leguminous vine with attractive flowers and edible beans makes them worthy of consideration.

Concluding Remarks on Fodders

I have a confession to make. Though I have come to be identified in Pakistan as a fodder expert, I can not claim to be one. While serving as PROS, I studied and learned as much

as I could to acquire sufficient expertise and experience so that I could extend the good work of my good friends. My interest in fodder crops stems mainly from a perception of the basic needs of the small, subsistence farmer who needs to add value to his production since his resources are meager in relation to his need. One of the best ways to do this is to raise livestock on a scale beyond that which is required to meet domestic requirements.

While the majority of the rural population are small farmers who practice mixed farming, there is an increasing trend toward commercial farming, particularly with livestock enterprises by persons who are able to make special arrangements regarding markets. To serve these people who will in the future account for an increasing share of the production, research and extension personnel will have to make themselves more knowledgeable about both fodder crop production and livestock requirements.

There is a great need for people specializing in fodder crop production to work with people working in the area of animal nutrition. I should not have to say this, but I am because even at the NARC they do not. Fodder people are not ignorant about the concept of nutritional quality, but do little more than pay lip service to it while continuing to report massive yields of green matter of mature plant material that is usually rejected by the livestock. Fodder not ingested and digested can not be claimed to be fodder produced since it yields no economic benefits.

We need to link up the persons working on fodder production with the animal nutritionists to make the research work of both more meaningful. This is being done at the LPRI at Bahadurnagar and at the UAF, but this kind of teamwork should become the norm rather than the exception. The animal nutritionists need not be restricted to working with characterizing the qualities of various crop residues which are quite limited in quantity and not likely to grow in availability. Instead, by working on high yielding fodder grasses clipped at various stages, they will be able to extrapolate their analyses to a much greater total tonnage of nutritional value, do more good and gain better job satisfaction.

ANIMAL AGROFORESTRY

A substantial proportion of the farmers of Pakistan are in fact practicing some form of agroforestry. It usually is not done in a systematic manner aiming at optimizing results, but is more in the nature of minimizing inputs and harvesting whatever is there when it is needed. There is a great need to promote enlightened agroforestry to attempt maximization of tree production consonant with the needs of crop production. With my interests in helping the small farmer produce more fodder for his livestock and enabling him to return a larger proportion of the farmyard manure to his fields, I naturally turned to fodder trees. Hence the title of this section.

Fodder trees are well known in Pakistan. Kikar/Babool, Acacia nilotica, is only the most commonly used of many species appreciated by nomadic and sedentary herders alike. Leaves as well as pods are fed to mainly small ruminants. Though not grown primarily for producing fodder, this species is widely used throughout Pakistan.

Debi, Prosopis juliflora var. glandulosa, is not grown as a crop, but it grows everywhere as a weed. Its pods are eaten by livestock. Other species of Prosopis are also used. Albizzia lebbek is often lopped, especially in the Thal, and used as fodder.

There are many other species which can be used, but since this is not a botanical nor a silvicultural treatise, I shall confine my remarks to a species that has all the characteristics needed for a tree to provide fodder and fuel on the farm. I refer to the **Leucaena** (called Ipil Ipil in the Philippines). Leucaena leucocephala is a native of Central America and has spread throughout the tropics. About a decade ago, great concern was expressed about the depredation of the leucaena trees throughout the tropics by the Leucaena psyllid. This reduced the enthusiasm of many people for the leucaena, but at that time, I said that it was highly unlikely that the insect could become established in Pakistan. I believe that these past few years without an invasion tends to lend support to this assertion.

During the last three decades, largely under the leadership of Dr. James Brewbaker of the University of Hawaii, giant varieties of leucaena have been spread throughout the tropics and subtropics as a browse legume for its protein rich foliage.

Leucaena has a very vital role to play on any farm where livestock is kept. It can be fed as a green fodder or conserved as dried leaves for use as a protein supplement. Its branches can be used as firewood. Beyond this, the wood can be made into charcoal, as high energy fuel, as paper pulp and for making wood chip board products.

Leucaena is particularly well adapted to high pH soils and warm, humid climates. In Pakistan it is found all the way from Karachi to Peshawar. We have recently introduced it at the Agricultural Research Station, Dhodial, Mansehra. Leucaena seed is available with the forestry people throughout the country, with the agronomist at Tando Jam ARI (where I first introduced the K8 variety in 1969 to Mr. Ahmed Mustafa Khan), the UAF

Livestock Management Department and the Punjab Department of Livestock and Dairy Development.

It can be established through direct seeding of hot water treated seed or by transplanting three month old seedlings. Hot water treatment consists of pouring boiling water into the container with the seed, letting it stand for five minutes and pouring out the hot water and replacing it with tap water. It is best to change water daily and after two or three days we are ready to plant the seed which has imbibed the water. For such a fast growing tree, seedling growth is very slow. Protection from plant competition and from grazing is necessary. It is best to forego harvest for about one year to allow the plant to establish a good root system which would ultimately make it more productive.

Dry matter yields of edible leucaena forage from experimental plantings can be as much as 20 tons/ha/yr. By way of comparison, a single cut oat variety yielded 12.5 tons dry matter and a five cut berseem crop gave 15 tons of dry matter. While leucaena is only almost competitive in dry matter production with these crops (and considerably below Mott), its true value can be appreciated more in terms of its protein production, its capacity to add nitrogen to the soil and its indirect effect on soil fertility by providing firewood which reduces dependence on cow dung for fuel.

One way to justify growing leucaena in the irrigated tracts is to establish it along the periphery of the fields along the roads, uncommanded areas, canal banks, water channels and railroad tracks to provide fodder on a regular basis, fencing material and firewood and to serve as dust catchers and windbreaks to protect crops. It could also be grown around fish ponds and be fed to the fish.

Secretary Ghias-ud-din of the Punjab Department of Livestock and Dairy Development has appreciated the potential benefits of leucaena and has planned an expansion of area sown to it on the livestock experiment stations. The late Dean of the UAF Faculty of Animal Husbandry, Dr. Akram Raja, initiated feeding studies of leucaena using sheep and found that when fed at the rate of 50% of dry matter intake in combination with other fodder, growth rate was excellent without shedding of wool. Acceptance by the animals of this exotic fodder was good. There seems to be no good reason for further denying the livestock of Pakistan an opportunity to partake of this excellent fodder from this multi-purpose tree.

Because of my interest in agroforestry to support FSR activities, I have introduced seed of and we have tried the vaunted tree lucerne (called Tagasaste) from the Canary Islands via New Zealand and the Gliricidium sepium from Central America. The tree lucerne seed germinated but the plants did not survive. Gliricidium grew well at Tando Jam, but not at Faisalabad and Lahore. Animals did not relish it. It is time we quit looking further for a fuel and fodder tree for the farm. We have **Leucaena**.

CAPRINE CAPERS

When I started working as PROS back in October, 1986, I was able to renew my acquaintance with Mr. J.R. Lockman, who was about to complete a 40 year career in Pakistan as an agriculturist working in the Punjab with small farmers. He operated a 12 acre rented farm irrigated with a shallow "dug well" at Manga Mandi on the Multan road. This farm served the purposes of seed multiplication and as a testing site for the Directors of Wheat and of Pulses who were very happy with the results he reported meticulously to them.

Mr. Lockman told me that it was his experience that there were two neglected areas of research and development: Goats and Fodder Crops. I investigated both and found that much (though not enough in relation to its importance) was being done with fodder crops, but work being done was not necessarily attuned to the needs of the farmers and certainly was not being communicated to the farmers adequately. With goats, however there was abysmal and total neglect at the University of Agriculture Faisalabad and in the livestock departments in every province. The then Chairman of the Department of Livestock Management at the Sindh Agriculture University was doing a study to document the goat breeds of the Sindh and was planning an international seminar on Goats for Meat Production in cooperation with the IDRC and Dr. C. Devendra.

We followed that up with a national workshop on small ruminant production at Lahore in November, 1989, again with cooperation with Dr. C. Devendra, internationally renowned animal nutritionist specializing in goat nutrition.

There is a Sheep and Goat Development Project of the Punjab Department of Livestock and Dairy Development with Dr. Muhammad Hanif with headquarters in Multan and operations in DG Khan, Multan and Bahawalpur Divisions.

I have not had any real exposure to small ruminant activities in the NWFP and Balochistan, but by early 1990, I had made myself reasonably well acquainted with them in the Punjab and Sindh. I have not been able to work up any enthusiasm for sheep. As a result I have little to say about sheep except that they do not seem to be very intelligent animals and judging by the comments I hear on the quality of the wool they produce and the prices paid for them, I can not think of wool as a good justification for keeping them.

It probably is safe to say that goats and sheep are primarily kept for the meat they produce on grazing land that would otherwise yield scant economic benefits. It is also probably safe to say that in Pakistan the caprines and the ovines are the only species specifically and primarily kept for producing meat. Neither of them have females with anywhere near the multiplication potential of another species which need not be mentioned because there is no local market for its meat, but between sheep and goat, the goat has a decided edge in reproductive capacity, at least with most of its breeds.

Principally from Dr. Ghous Bakhsh Isani and Dr. Muhammad Hanif, I have learned that Pakistan possesses a wealth of caprine genetic resources and that very little genetic improvement is being done on the species. In fact, since the males are principally used as sacrificial animals for Eid-ul-Azha and a premium is paid for superior specimens, one would think that there may be a tendency towards negative selection. However, since one buck can service 25 or more does, the fact that somewhere over 96% of young goat bucks meet their fate on Eid-ul-Azha every year may not be that deleterious as long as due care is exercised to select sagely the other 4% kept to participate in perpetuating the species.

The Kamori, a two tone brown spotted breed, which is one of the Dadu district's claims to fame, is a non-seasonal breeder which is reasonably precocious and quite prolific. Since it is a good milker, the Kamori doe is a good mother. It could well be one of the best dairy goat breeds in the world, but is little known outside of Pakistan. Indeed it is little known outside of the Sindh. Why that should be so I can not imagine except that under colder temperatures and tough conditions, the seasonal breeders may have some survival advantage.

Except for coat color and a little bit larger size, the Beetal, which predominates in the Punjab seems similar in milking performance and prolificacy to the Kamori. Both are equally good, but the Beetal is bit later to maturity and has a high percentage of seasonal breeders. This may have been due to natural selection operating in the colder winters of the northern Punjab. If better nutrition and care can be provided, possibly with Mott cultivation, selection may be practiced for non-seasonal breeding in Beetal to increase the number and weight of kids per doe per 24 months, with three kiddings per two years very much possible.

If selection to increase the proportion of non-seasonal breeders is too slow, we might do crossbreeding with the Kamori without sacrificing anything except relative uniformity of coat color. Five does and one buck of Kamori were introduced at my suggestion from the Sindh to the LES at Jogait Pir on the edge of Cholistan during the tenure of Dr. Zafar Altaf as Punjab Livestock Secretary. We have not been back to assess their adaptation to southern Punjab conditions, but it would be useful to see whether they retained their non-seasonal breeding characteristic and how the crossbreds with Beetal would behave.

Also in the Sindh, there is the Pateri, a meat breed locally prized for Eid sacrifice purposes. It has a dark brown head and shoulders and a white body. It gives less milk than the Kamori, but enough to raise the two kids it frequently bears.

There is another large meat breed called the Jattan without a characteristic coat color unlike the Pateri. Then there is a breed called the Lohari with strange, long, ribbon like ears which would seem to be a disadvantage since it gets caught in the brush and injuries are common.

The Sindh has its own breed of little goats called the Bari. It is pure white in coat color and has short, pointed horns. Unlike the Teddy, the Bari is quite uniform in all respects and is not so ubiquitous.

In the Multan area is a breed with a strange gait. This is the Nachchi breed, which as the name implies dances as it ambulates. They say that this is an adaptation to the hot surfaces over which the goats have to walk. It is said that they take many short steps to avoid the pain of keeping their feet on the hot ground.

Near Layyah at Dera Dinah Paneh, is a very good milking goat called by the name of its locality. It is a prolific non-seasonal breeder, smaller than the Beetal, but gives more milk. This is a true dairy goat, kept as such, at a higher latitude than Multan and is capable of breeding at any time of the year.

Throughout the Punjab, there is a highly precocious, very prolific breed called the Teddy. There are several theories, but no one really knows its origin. Some say that it was brought from Bangladesh, but the goats I saw there were even smaller and were solid black in color. With its bearded bucks, the Teddy looks somewhat like the Swiss breed from the Saanen Valley, but the Saanen is one of the most productive milkers and an absolutely seasonal breeder like all temperate zone breeds. The Teddy is a non-seasonal breeder and can hardly produce enough milk to feed its kids.

Most people say that they do not prefer its meat. However, it is the most readily available goat meat and the breed has proliferated in spite of its faults. Because of its small size, some call it the broiler goat. It is becoming more and more variable because of natural crossbreeding. Perhaps there is enough variation in the Teddy for successful selection for larger size and better milk production while retaining precocity and prolificacy.

At Rakh Khairwala LES, there is a herd of Angora goats which have not proliferated, but they are there. There seems to be no demand for it. An English author of a book on goatkeeping likes the Angora goat because he says that it even looks like a sheep in shape and that I suppose is all right for a nation of sheep meat eaters, but Pakistanis seem to prefer goat meat even though they call it mutton. The Angora is non-prolific and is a seasonal breeder, both of which disqualify it for the main purpose for keeping both sheep and goats in Pakistan.

At the Kheri Murat Barani LPRI, there is an apparently well adapted, but less productive breed of hairy goats with various dark colors. Along the Mangla Dam lakeshore, we found a very long haired goat breed which is shorn for its hair. This breed is called the Pahari and hair colors are gray, brown and white.

The only other time that I saw specimens of this breed was at the Lahore Horse and Cattle Show. They were long haired too, but they were all white. The owner told us that he and his goats came from a village near Tando Allahyar which is east of Tando Jam.

He also called it the Pahari, but it sounded like Bahri, which is the word used for river in Egypt, e.g. Bahr el-Nil.

There must be some interest in dairy goats in Pakistan even though people say that goat milk is not preferred. It is well known that goat milk is better for people with certain digestive problems. So at Dera Ghazi Khan, Dr. Hanif showed us some dairy goat herds and at Dera Dinah Paneh, we talked with herders who sold goat milk in the town. Up in the hills north of Abbotabad and Madyan, Swat, the cows are so scrawny that dairy goats should be better adapted. Certainly, milk production capacity per kg of body weight is all in favor of goats.

The Swiss, who have developed some of the more widely known European dairy goat breeds, have been active collaborators in area development projects in Upper Swat and Kalam. Perhaps we should suggest to them that there might be an interest in the NWFP and the Northern Areas of Pakistan for their highly productive dairy breeds.

In Hunan, China there is a meat goat breed called the Ma T'ou (means horse's head), which is said to be larger than the Teddy and even more prolific, is a non-seasonal breeder and is a better milker than the Teddy. Will someone please introduce an adequate population of this paragon among meat goats?

Then there is the Boer Goat, developed in South Africa, which is said to be the largest goat breed in existence. We do not have to go to South Africa to get them. GTZ has brought the Boer goat to Sri Lanka and if Sri Lanka can import Pakistani livestock breeds, which it has been doing (including the Beetal), why can not Pakistan import the Sri Lankan Boer Goat for evaluation?

When I talk about introductions and crossbreeding, the cognoscenti of the Punjab Livestock Department very rightly talk about selection within the local breeds as the first step. They are absolutely right. So, we should proceed to do what we know we should do, like keeping records of kids born and reared by individual does and selective crossing within the breed. However, we should not rule out these exotic breeds and crossbreeding among local breeds. Nothing can substitute for careful breeding. Blood always tells.

TIPANIC ACTIVITIES IN THE PUNJAB

The TIPAN project in the NWFP, with its massive funding aimed at transformation and integration of the provincial agricultural network, was the envy of institutions in the other provinces and the University of Agriculture Faisalabad was no exception. By 1987, the last of the professors at the UAF who had been trained in the U.S.A. during the 1962-1972 university development project era were approaching retirement and very few of the younger faculty members had had the opportunity in the interim to obtain overseas degrees. Several departments, notably Soil Science, Entomology, Horticulture, Livestock Management, Animal Nutrition and Agronomy, were providing students opportunities to earn Ph.D. degrees, but the vast majority were not. Particularly inept in this regard was the Department of Agricultural Economics, which had not produced a single Ph.D. in a wide open field. The UAF was in dire danger of becoming impervious to external influence as it dissociated itself from its environment. On the positive side was the very popular appointment of Dr. Abdur Rehman Chaudhry as Vice-Chancellor, himself a product of the land grant college system, who lent a ready ear to the suggestions we made and provided full cooperation.

It was in this context that USAID officials responsible for Agriculture and Rural Development (ARD) assistance, Dr. H. Pat Peterson, Mr. Richard Goldman and Mr. Harry Dickherber used their discretionary funds and technical assistance team members from Winrock International and no doubt of other contractors to do a great deal towards what might, in its totality, be dubbed a second phase of the university development project. As PROS, I was their point man and agent assisting them in all phases of these activities.

The MART Project had been sending a large number of people for two to three month short term training in research management. A limited number of facilities had been made available for postgraduate degree training in the U.S.A. A Farming Systems Research unit, which was designed to work in concert with a similar unit at the Ayub Agricultural Research Institute, was in the process of being established at the UAF.

Overseas Training Opportunities

We felt that a piecemeal approach was better than nothing, but Mr. Dickherber suggested that the University really needed to come up with a long term training plan for the next decade for their faculty. On the basis of this plan, USAID provided 30 Ph.D. training facilities. We arranged for TOEFL testing opportunities ahead of time for all University faculty members likely to be nominated for these scholarships. We also arranged for them to take the Graduate Record Examinations to assist them in obtaining placement and also to serve as a screening mechanism. The University administration could feel confident that its nominees were really worthy selections. The first of this batch of Ph.D. holders have returned to the UAF.

Those professors who were able to earn Ph.D. degrees at the UAF during the 1980s were not forgotten. A total of 16 six months to one year sabbatical leaves to work in laboratories in the U.S.A. were granted for their further training.

Strategic Planning

Mr. Dickherber and Dr. Curtis Nissly, who succeeded him as Project Officer, felt that the UAF should be assisted to undertake the formulation of a strategic plan by a process similar to that which was done at the NWFP-AU under the TIPAN Project. To do this, they engaged a Blue Ribbon Panel led by Mr. Robert McAdam to provide direction and guidance in the process. Most of the University faculty participated in these meetings. PROS contributed to this activity in a number of ways such as orientation of the panel, participation in the meetings and followup activities and arranging for meetings in Lahore with the end users of the products of the University.

Agribusiness Activities

From Mr. Goldman to Dr. Dennis Weller, USAID officials aided and abetted by PROS had been promoting the involvement of the University with agribusiness entities as the need of the hour and the wave of the future. An agribusiness cell such as exists at the PARC and at the Federal Ministry of Food, Agriculture and Cooperatives was suggested. This is still a good idea with a lengthy gestation period waiting to be born. It is suggested that it be made part of the Registrar's Office rather than of a faculty.

Increasingly, university graduates will have to accommodate themselves to employment in the private sector as the increase in the number of government jobs can not possibly keep pace with the increase in numbers of graduates. This places responsibility on both the faculties and the agribusiness firms to join hands in modifying the curricula to reflect the new realities. The current Vice-Chancellor, Dr. Muhammad Rafiq Khan, understands this very well as he has prepared scores, if not hundreds, of graduates for work in the private sector as entomologists. All members of his staff now need to follow his lead to prepare as best they can their students for a future in the private sector, some even as entrepreneurs.

In this connection, the UAF is in the process of initiating a 12 week diploma course to prepare graduates for entrepreneurship of their own businesses. This will be administered by the Division of Extension Education with considerable support from the Department of Farm Management and oversight from the Registrar's Office. The unique feature of this innovation is to invite a scintillant galaxy of guest speakers from a broad spectrum of the private sector. This is a promising initiative which must not be allowed to falter for lack of support and encouragement.

Integration of Teaching and Research

The question of reuniting of the UAF and the AARI on the pattern of the Punjab Agricultural University at Ludhiana is a perennially simmering one which occasionally comes up to a perfervid boil when someone for some reason or another decides to turn on the heat. During PROS' tenure, this happened twice.

Since the question of the overall merger involved two ministries, it was decided to look into the possibility of merging the Barani Agricultural College at Rawalpindi and the Barani Agricultural Research Institute at Chakwal. Dr. Zafar Altaf, who was responsible for both, as Secretary of Agriculture Punjab, asked MART/Winrock to provide him a feasibility study on the idea. Dr. Ralph Nelson and Dr. Floyd Bolton were engaged to do this and PROS provided them assistance by providing background and arranging appointments with the appropriate people. After much deliberation, Dr. Zafar Altaf came to the inevitable conclusion that although it would not be difficult to merge the functions, it was impossible to merge the cadres because of questions of seniorities, retirements and such personal considerations which are irrelevant to the task of the institutions, but are of crucial importance to the individuals concerned. Basically, the teachers are for it because they have the seniority and the researchers who do not are against the merger, but to their credit, they professed an eagerness to serve as guest lecturers and thesis research supervisors.

The second time it happened was just after the distribution of the report of the Blue Ribbon Panel during the tenure of Dr. Ghulam Rasul Chaudhry, himself once a UAF Vice-Chancellor, as Secretary of Agriculture. That generation remembers very well the way things were during the Lyallpur Agricultural College days and consider the PAU at Ludhiana a true descendant of the LAC and the current situation in Faisalabad an unfortunate abomination.

Dr. Ghulam Rasul exerted irresistible pressure on the DG AARI, Dr. Manzoor Ahmad Bajwa, to try to effect reunification of teaching and research. Numerous, serious meetings were held at AARI at the Secretary's behest and votes were taken. A two person team went to visit the NWFP-AU to assess the situation there and reported to the DG and Directors. The institute was in turmoil for quite some time. The university seemed to be in a mood of placid acceptance of whatever will be will be. After much discussion with several Directors at AARI, I came to the conclusion that the younger staff members were for the merger, while the more senior ones, who had the most to lose, were implacably inimical to the very idea, which could have been easily predicted. On a strictly one man one vote basis, I was given to understand that a majority would have been in favor of the merger.

At the request of Dr. Bajwa and the concurrence of the Secretary, PROS arranged for a six person delegation composed of the Secretary, Dr. Bajwa, Dean of Agriculture and now V.C., Dr. Rafiq Khan, Deputy Secretary Inayatullah Shah, Chief of Agriculture Planning Ch.

Zakaullah and DG Extension Abdul Qayyum Dasti to visit the NWFP for three days to give the matter serious investigation. PROS made arrangements for visiting the University itself, the Agricultural Research Institutes at Tarnab, Mardan, Pirsabak, the Secretariat to meet the Secretary and his staff, the DG Extension, which was left out of the merger, and the University outreach activities at Dhodial, Mansehra. We had plenary meetings and paired meetings where deputy secretary met deputy secretary and agricultural planner met with his counterpart.

The meetings were very much worthwhile as a diplomatic mission, but for the purpose intended, it depends on what the purpose was. Two members of the mission are now retired and deceased, two more are retired, one is still at his post and Dr. Rafiq has been elevated to Vice Chancellor. The UAF and the AARI are still separate institutions in different ministries. The degree of cooperation between the two are at approximately the same level with personal, rather than institutional, relations predominating.

After seven years of attempts at facilitating intercourse at all levels between the two institutions, I have come to the conclusion that a merger, if it is desirable and feasible at this stage can occur only if dictated at the level where the division was dictated, at the very top. While we all would prefer a voluntary coming together, the pace of action to resolve all questions has been too slow to withstand the inexorable passage of tenure of the office-holders who have to try to accomplish the merger by democratic means. That there are reasons for the merger and the presence of proponents there could be no doubt. Equally beyond doubt are the presence of reasons and antagonists against. I do not have the wisdom to decide what is best for the Punjab. I doubt if anyone does. I would like to suggest that cooperation is a desirable state which can not be dictated, but can be encouraged at all levels between departments and institutions. Pending any decision by those entrusted with the power to alter the status quo, there is nothing to stop us from working together at least where that would be more helpful than individual effort.

TIPAN Seed Improvement Study Tour of Punjab

PROS suggested and arranged for Dr. M. Bashir, Seed Technologist at NWFP-AU, and his Dean, Dr. M. Kareem Khan, and their research advisor, Dr. Farrell Olson, to visit Faisalabad to meet with their counterparts at the UAF and the AARI, as well as to visit with Dr. Khan Bahadur at Rafhan and Mr. Azhar Siddiq at Ch. Mohammad Siddiq to look at the status of seed production and seed processing in the Punjab. They also visited the Pioneer and PSC seed plants at Sahiwal. The result of this visit, as Dr. Farrell Olson informed PROS, was the preparation of a research and development project for farmer based seed improvement activities under the aegis of the Seed Technologist of the NWFP-AU. The proposal was approved and a complete set of seed handling equipment for the University was ordered under the TIPAN Project.

Agricultural College of Bahauddin Zakariya University

While helping the BOSTID consultants with their work as part of my responsibilities, I ventured into places and met people new to me which brought up new possibilities worthy of consideration. One of these was Bahauddin Zakariya University in Multan and the memorable person I met there was Mr. Faisal Imam who was providing much support to BZU, particularly its School of Business Administration and its College of Agriculture (BZUAC), where he had some expertise.

He has a clear idea of the land grant college concept and a vision of the BZUAC serving agriculture in the Cotton Zone of Pakistan in a very practical, entrepreneurial way. To do this, he felt the need for an advisor for their Principal, Dr. Zahid A. Cheema, and his staff. We had no funding, but a suitable person was going to become available due to the changing of the guard at the TIPAN Project. I helped to arrange for Dr. Rodney Fink and his counterpart, the Dean of Agriculture, to visit BZUAC and establish communication.

Faisal hopes that the several agricultural institutions in the Multan area can be brought under the influence, if not the jurisdiction, of an improved BZUAC which would be uniquely equipped with the philosophy of farming as a business. To say that it is the right idea in the right place at the right time may sound like a cliché, but it seems most appropriate. Everything can click if the funding can be arranged.

The Vehari Agricultural and Economic Development Centre (VAEDC) initiated during the tenure of Dr. Zafar Altaf with advice from Dr. John Woods and Syed Iqbal Mustafa is beginning to serve a real need for practical agricultural training at the subcollegiate level. Associating this institution with the BZUAC would strengthen both parties. Since the Vehari district produces more cotton than the Sindh province, it is not unreasonable to suggest that the VAEDC deserves more attention and investment than it has so far received from both government and the private sector.

WORKING WITH COMMUNITY DEVELOPMENT NGOS

The Chairman PARC asked me to look at the Pakistan Rural Support Program which had been operating under the leadership of Ch. Anwar Aziz in Shakargarh. I made a few trips individually and with others and was impressed with the dedication of the workers who were continuing under straitened financial circumstances about which I could do nothing. I did try to help them where I could and reported back to the Chairman that it was a project worthy of his attention, but funding was woefully inadequate.

The Chairman also sent people from the Water Resources Research Institute and the Audio-Visual Institute to see what they could do to help. We should be able to figure out a way to regularize the outreach activities of research institution to gain the multiplier effect in ways such as this.

In the irrigated areas of Shakargarh tehsil, rice and sugarcane were the main crops during the kharif and wheat prevailed during the rabi. In the barani lands which are blessed with a fair amount of rainfall, bajra during the kharif and lentils during the rabi should be important interventions. With a high proportion of Gujars in the population, good rainfall and lots of culturable wastelands, animal husbandry is very important in the area. The Women Social Organizer, who was very dedicated, was trying to promote Fayoumi chickens and home handicrafts. The Project Manager, who was an investigative journalist by profession, was talking up an "Education without Literacy" program which sounds to me like an oxymoron.

We planted several nurseries of Mott and though I have not been back, I hope that they were able to achieve some spread. The Pulses Research Director took some demonstration plot samples of new varieties of lentils and chickpeas for trial. I took them the kitchen garden vegetable seed kits prepared by the Vegetable Research Institute AARI for their distribution. The Project Agriculturist and the Azizes were interested in promoting vegetable production as well as farm forestry.

Range grasses such as Tifton 85 bermudagrass, guineagrass, blue panic, buffelgrass and Rhodesgrass should be taken to them for planting where the cultivated fields and the uncultivated areas meet. The present Chairman of the UAF Department of Livestock Management, Dr. Raza Ali Gill, is native to the area and is a friend of Ch. Anwar Aziz. Hopefully, they will facilitate the spread of Mott and the potential range grasses.

The other NGO that I worked with, the Sarhad Rural Support Corporation, was completely different. It had a full-time Chief Executive, who was on deputation from the Civil Service, adequate funding, a fleet of vehicles, a functioning Board of Directors headed by the Chief Secretary of the NWFP and a full field and office staff. It even had USAID support to engage an expatriate advisor on NGO activities.

Mr. Javed Majeed, the CEO, asked me for help in assembling a team of consultants to look at the villagers' current farming systems in both the Charsadda and Kohat areas. He got the approval from his Board and I arranged for approvals from the Secretary of Agriculture Punjab, the UAF Vice-Chancellor, and the Chairman PARC for the consultants to take up to two weeks to complete this task.

The group was composed of Dr. Altaf Hussain, retired DG AARI and retired Director of the Vegetable Crops Research Institute; Dr. Muhammad Tufail, Director Pulses Research Institute; Dr. Sadaqat Hanjra, the Chairman UAF Department of Livestock Management; Mr. Muhammad Azeem, Associate FSR Coordinator for Social Sciences at NARC; and myself.

We received orientation as to their purposes and procedures and spent seven days of field visits to the villages which they had organized, wrote individual reports which I edited and brought out as a group report. On the tenth day we gave an advance copy of the written report and made our oral presentations to the SRSC.

As suggested by us, the Project Agriculturist, Mr. Ibrar Khan, and the agricultural workers went to Faisalabad and the NARC to obtain further training and seed and planting material to give substance to suggestions made. A continuing relationship exists between SRSC and the consultant team because they are here in Pakistan.

One of the team members, Mr. Azeem, has joined the Pakistan Rural Support Program in Islamabad. He said that his experience as a consultant to the SRSC gave him such an understanding of the RSP concepts and ideals that it was very helpful to him during the interview for his present position. It is no doubt true that a consultant learns at least as much as he teaches. Another, Dr. Hanjra, has gone on to a position as an FAO advisor on the Small Holders Dairy Development Project at Gujranwala. Still another, Dr. Altaf Hussain, has gone to Jordan as a Vegetable Crops Advisor. Dr. Tufail is continuing as Director Pulses, which is fortunate for the SRSC since he provides good liaison with scientists at AARI. Just recently, newly appointed Chief Agriculturist of the SRSC went to Faisalabad and presumed upon the good offices of Dr. Tufail to obtain seed for their program.

We learned that the Kohat district offered unique opportunities for guava cultivation and since NARC has a capable and enthusiastic guava scientist, Mr. Abdul Hafeez, who has been very successful in propagating the introductions of dessert and processing guavas from Hawaii, SRSC workers from Kohat came to NARC in February for training and took home plants of new varieties for planting. In July and August, Mr. Hafeez will go to Kohat to conduct a brief training program for them.

When visiting the FSR Site Coordinator, Mr. Gulfam Khan Jehangiri, to help him with expanding his inventory of fodder crop species for the Mansehra area, he apprised me of an IFAD loan financed rural support program for the Mansehra district which is planned

for execution by the same SRSC. Mr. Gulfam was requested by the project manager to participate in the process of organizing that program and he requested that I advise him. Ideas generated by the activities of the Coordinated FSR Program will be very useful in supporting this program.

Providing technical assistance to these NGOs multiplies our efforts at modest cost. There must be many more than I am aware of and many opportunities for us to share our knowledge and concurrently for us to learn more and to sharpen our abilities to assist.

MANAGEMENT AND MARKETING GROUP

Formed under the impetus and the imperatives of the penultimate USAID Project Officer, Dr. Ronald Senykoff, the composition of the Management and Marketing Group reflects the components of the MART Project. With one representative just below the Director level of each of the Agribusiness Directorate, Audio-Visual Institute, BOSTID Project, MART Project Secretariat, Farming Systems Research Program and the Training Institute, this group holds weekly meetings when possible to discuss management topics of concern to the group.

Formed in the fall of 1992, the group was nurtured by the project officer and his assistant during the first few months and was turned over to the PROS/COP in March, 1993. The leader of the group is the Associate FSR Coordinator for Livestock, Dr. Amanullah Cheema, who takes the job very seriously.

Their first project was to study the situation at AZRI in Quetta and to draft a report with ideas and suggestions to improve its performance in the future. They did a creditable job with many useful suggestions that did not require additional facilities or funding.

However, it is generally not difficult to advise a third party on how to go about altering their activities, especially when the responsibility for execution is not theirs. The next project the MM group undertook was to look at themselves and then to advise each other and their Directors. This more difficult and sensitive project is ongoing.

I took them on a one week trip through the Punjab to introduce them to as many agribusiness entrepreneurs as possible. Two members of the group introduced us to two other situations which were excellent and appropriate. Everyone comported himself in exemplary fashion and I believe that they set a new standard in professional behavior for study tour groups. It was beyond doubt most economical and cost effective.

We went on a five day tour of the NWFP which emphasized contact with organizations which have continuous contact with the farmer. We looked at the FSR activities in Mansehra, received orientation on the activities of the Kalam Integrated Development Project, the PATA Agricultural Development Project, outreach activities of the NWFP-AU and the community development activities of the SRSC.

The Management and Marketing Group started their field activities in Balochistan with a review of AZRI. A study tour of the Sindh remains to be done in 1994 before the termination of the MART Project agreement.

There are a few suggestions I have to make for future operation of the group. They need an interested godfather at the Director level to meet with them once a month. Dr. Anwar Ali Chaudhry, Director of the Scientific Information Unit, seems to me to have the necessary interest. He has already met with the group and is providing wise counsel.

He suggested that the group be expanded and perhaps in the future have some people deleted as others are added. Perhaps other appropriate common interest groups can be assembled by the ones who have had experience with this group.

The group took the course in lateral thinking offered in May, 1993 and found it to be very helpful. Two of the members were part of the delegation that went on the agribusiness tour to the USA in April, 1993, but the other members did not benefit from their experience with an oral or any other kind of a report. This should be done.

We now have a strong, very capable, full-time Director-General, Dr. Muhammad Akbar, at the NARC. The MM group should ask for meetings with him so that they may share their observations with him when the occasions permit or demand. Since the underlying purposes of the group are to improve the management at PARC/NARC and to prepare the members for leadership roles, their observations and conclusions need to be brought to the attention of those who are currently in positions of leadership. This will require the utmost in diplomacy and a certain degree of understanding by the Director concerned and the Director-General.

They, individually and in concert, shall determine the value of the Management and Marketing group. Unless the group can be heard by those in position to do something about it, they are nothing more than a Thursday morning tea club. I believe that this young group deserves to be taken seriously and would request that Director-General of the NARC spare some time to meet with them on a regular basis.

SEED IMPROVEMENT ACTIVITIES

In one way or another, I have been involved with the issue of seed in Pakistan ever since my first arrival. During 1968-86, working for CIMMYT's maize program and Pioneer Hi-Bred International, which is primarily a hybrid maize seed company, my main concern was performance centered on maize, first with composite and synthetic variety seed and later with hybrid seed. Since then, under the MART Project, my scope of interest was liberated to include all seed, all planting materials, whether they be tubers, bulbs, corms, stems, rhizomes, scions, whatever, of all crops, cereal, vegetable, fruit, fodder or floricultural.

It has been my good fortune to have known many people involved in the seed sector during these 25 years. One of them has been Deputy MD of the Punjab Seed Corporation and its predecessors for all of this time. What the PSC is today and what its predecessor was in the early days are two completely different things. One important reason must surely be the work of Dr. Mahbub Ali during the early 1980's in setting up the basic seed production operation at Khanewal and in training the dedicated people who made things work.

The measure of how well things worked may be seen by the fact that a number of entrepreneurs in the cotton zone who have the marketing mechanism or distribution potential have replicated on a fair scale the PSC model of basic seed production, commercial seed production through registered growers, keeping the seed cotton harvest only up to the inception of cold weather, ginning varieties separately, arranging for certification of the seed, proper storage and finally, sale through reliable outlets. All this was made possible because the breeders made available enough breeder seed of demonstrably superior cotton varieties which the industry wanted and the farmers were able to learn of the value of good quality seed. All who have been involved in Pakistan's White Revolution richly deserve the nation's gratitude.

The situation with cotton in Pakistan seems ideal for establishing a seed business. A maund of seed generally sells for four times the price of a maund to be crushed for oil. The margin is great enough to warrant and compensate for special treatment. The amount of seed planted per acre and the cost is low enough (8 kg, which would cost Rs. 80), especially in relation to the gross income of the output per acre (well over Rs. 15,000) that nobody in his right mind would stint on the price he would pay for good quality seed. The amount of cotton seed required to plant the annual crop in Pakistan is estimated to be 1.2 million maunds, which will cost at retail Rs 480 million. The Punjab Seed Corporation accounts for a static one third share of the seed market and organized seed companies about one sixth now and their share seems to be growing. This leaves about one half of the total area sown with gin-run seed (hard to believe that farmers would still do this), seed saved by farmers for themselves and ginned with a mobile gin, or with seed sold by the informal seed sector.

Some of the international seed companies, facing the fact that the hybrid seed market is still too small, have resorted to purchasing good cotton seed, bagging them and selling them under their brand names at a small margin. They are serving a useful function by assuring quality and capitalizing on their well earned reputation to sell seed produced by persons who do not have a distribution capacity.

There are many farmers who insist on and are able to get good seed which are grown carefully and can be used to produce seed for the next crop, but their crop is not used as seed because of just this reason of lack of capacity to distribute. The commission agents are often purveyors of seed and while we do not usually think of them as seedsmen, what they sell at planting time back to the farmers is used as seed. I believe that they do a sizeable proportion of the total business in what we call the informal seed sector. They and their outlets, the village merchants, have long performed well without any intervention from the governmental agricultural functionaries. With this thought in mind, we should exert ourselves to help them do the job better.

How shall we do this? We have the producer who can not sell and the seller who can not produce. We have to help them get together. Every group seems to have a trade association, which may or may not be formal. The agricultural research service can think of how they might reach the commission agents through their association to convey information on characteristics of new varieties and where to get basic seed. Not all of them are inclined to make the arrangements for supplying basic seed to their most reliable farmers, but it will not hurt to try improving upon this mechanism for getting good seed of the new varieties to the farmers more quickly.

We recognized that the informal seed sector is important and we felt that something should be done to help it do its job better. The MART Project engaged the services of Johnson E. Douglas and Dr. Mahbub Ali to look at this segment of the seed sector. While Mr. Douglas was the author of the report, Dr. Mahbub Ali and I contributed information and ideas. Since the question of seed is my main area of interest, I worked with them throughout their consultancy and continued to follow up on the recommendations made in the report.

Our mandate was to suggest means whereby government could facilitate development of the informal seed sector. A report published by MART in September, 1990 was widely distributed. In it, we suggested that seed improvement associations be formed with the patronage of government. These are equivalent to the state crop improvement associations organized by the land grant universities to promote the production and dissemination of the new varieties developed by the state experiment stations. A seed production agronomist coordinated activities of the association and multiplied breeder seed from the individual breeding programs.

At the NWFP-AU, Dr. Muhammad Bashir, trained in seed technology at Mississippi State University, is in the process of developing his own model with excellent support from his

administration, from the TIPAN Project technical assistance team and a little bit of help from PROS, all of which is promising to go a long way. Dr. Bashir is trying to do the work of the seed production agronomist, the breeder, the seed technologist and the seed business entrepreneur. All this is too much for one person to try to handle, but if anyone can do it, it is he.

Before discussing the first seed improvement association which is being organized under the leadership of Dr. Mahbub Ali, I would like to indulge in a brief discourse upon the existing system.

Breeder Managed Informal Seed System

Some particularly successful breeders have attracted some effective and enterprising farmers who help with the selection and approval process by growing candidate varieties before release. These farmers provide an excellent service to the nation and are correspondingly rewarded for the risks they take in undertaking seed multiplication of varieties prior to release.

The breeders benefit from this association since these farmers can often help in the selection process as they do in the process of multiplication. The seed produced is usually of basic seed quality and sometimes is even of pre-basic seed quality. There is no reason to upset this system because it is working. We should, however, link them into the overall system more effectively by accepting the fact that these people are producing quality seed which should be used for further multiplication.

Neighborhood Seed Producer and Disseminator

I am told that they have always been there, but when technological innovations became more frequent and more appreciable in effect, their numbers proliferated. They are the ones who go to the researchers and bring back new germplasm and new knowledge to the villages and test their worth for themselves and their neighbors. People like these deserve a lot of credit for the good they do. The best way to recognize this is to accommodate them, to make it easier for them to obtain the seed and the information they seek. Perhaps they prefer the present system of having to go to each breeder for the crops they are interested in, but one way of streamlining the system is to appoint a seed production agronomist whose job it would be to produce and make available basic seed of the more recent releases of all crops for these unsung heroes of Pakistan agriculture.

The Indigenous Seed Company

There are several organized seed companies in the cotton zone which are producing substantial quantities of seed, primarily cotton seed, on their own farms or under contract with other farmers a la PSC. They sell their seed at their warehouse and gin or through

their shops in towns in the rural areas. They have a capacity to distribute and have the potential to grow.

They can branch out into other crops, either by wholesale purchase of seed to sell or by producing their own. They are in a position to purchase parent seed to produce Sadabahar hybrid or maize hybrid seed to compete with imported seed.

On the international scene, there are foundation seed companies in the USA and elsewhere which conduct extensive research and have developed very competitive hybrids which they license to produce in many countries. Perhaps not right now, but in due course of time, some of these indigenous companies may find it advantageous to tap into the global genetic improvement system.

The International Seed Company

These have ready access to germplasm developed by public sector breeding programs worldwide, but rely primarily on their own breeding programs. Some of them have biotechnological capabilities which are already impacting upon hybrid development. They can protect their huge investment in genetic improvement by selling F1 hybrid seed with well protected parent lines or by protecting their new varieties under the Plant Variety Protection Act which prevails in many countries.

Most international seed companies concentrate on a few hybrid crops which constitute the majority of the commercial seed business. They make no pretense of trying to produce and purvey all seed for all farmers. Still, they perform a very useful function in that their seeds have the potential to increase production at a cost which may seem high, but is fair to the farmers. Otherwise, they could not remain in business.

While the international seed companies have a very useful role to play in making good seed available, they will not supplant the informal indigenous seed system. Their presence will not absolve us of the responsibility of doing something to improve the existing system.

The Seed Improvement Association

We called potential and actual seedsmen to meet and discuss the SIA as a financially self-supporting organization at the CCRI in August, 1991 and engaged the services of Dr. Mahbub Ali as a consultant for three months to help organize it.

The Constitution and By-laws of the SIA was drafted by a committee and the SIA was registered under the Societies Act in late 1991. A budget and a program of work was developed for the first three years. Federal and provincial government officials were informed of the formation of the SIA and planned activities and budget were discussed with them. SIA representation on federal and provincial seed councils was requested, but

no action could be taken until the SIA becomes a force to be reckoned with. For cotton, Dr. Mahbub Ali and others would be consulted anyway.

We requested the government that seed cells be established at federal and provincial levels to implement decisions taken by seed councils, to deal with problems faced by the seed sector and to coordinate seed activities. Such things are being done informally or by the concerned breeders.

We met with representatives of research institutions and informed them of the SIA and requested assistance from them in terms of pre-basic seed, technical expertise, use of seed conditioning facilities and in training for seed production.

We met with PSC officials to determine how PSC could help. Basic seed was supplied to individual SIA members on cash payment. We also reviewed with FSCD leadership SIA plans and desire for participation in the seed certification program.

We also advised donor agencies of SIA plans and identified areas where such agencies may help SIA achieve its objectives. It would be useful to organize study tours of seed enterprises of different sizes, seed associations and foundation seedstock organizations.

We need to determine how the processing and storage facilities of the research institutions may be strengthened to support the basic seed program of the SIA and indeed of the total seed system.

The first SIA is underway in the Multan area with 30 members who are presently producing cotton and wheat seed. It is not self-financing yet, but production is going on. The big test will come when the members try to market seed under the SIA label and self-assess a fee to support the activities of the Secretary and staff of the SIA.

POTPOURRI OF INVOLVEMENTS AND INTERVENTIONS

From time to time PROS received requests for assistance that had nothing to do with his TOR, but this happened because someone who, for whatever reason, thought that I could help. I declined out of hand all requests for intercession with the U.S. consulate for obtaining visas as completely beyond my sphere of influence, tolerance and terms of reference, but tried to oblige on any matters agricultural even some which might be considered far fetched. Some of these worth mentioning are detailed below.

Cholistan Circle of Cooperation

At the request of Dr. Zafar Altaf, I imported some range grasses suitable for semi-arid conditions and gave small samples of seed to a number of institutions including the Bahawalpur Regional Research Institute. Not long afterwards, I received a letter from one Muhammad Arshad, Research Officer of the Cholistan Institute of Desert Studies (CHIDS) of Islamia University, Bahawalpur, requesting samples of the same and a visit at the earliest opportunity.

I met the Vice-Chancellor, Dr. Misbahul Ain Khan, and in the name of MART, introduced Drs. John Swanson and Curtis Nissly to the work going on at CHIDS and at the AZRI substation. Soon after this visit, Mr. Ghulam Akbar Moghul was assigned there as Deputy Director of AZRI and there began excellent coordination between CHIDS and AZRI, with looser ties with BRRI, Jcgait Pir LES, PCWRR and Cholistan Development Authority.

MART sponsored a seminar on Cholistan Development with Dr. Noor Mohammad delivering one of the keynote addresses on range management and Mr. Shabbir Baig of the Soil Conservation Service delivering the other. A large representation from the Department of Livestock and Dairy Development, including their Director-General Extension and their Director Livestock Farms, attended this seminar.

With UNESCO participation, Islamia University hosted another seminar the following year with an emphasis on sociological and educational aspects.

Due to enforced concentration of PROS activities in other areas, my involvement with this project had to be discontinued, but when the British Council sent Ralph Oxley of the School of Arid Zone Studies of the University of North Wales to look into the matter of setting up cooperation with CHIDS, PROS helped condition Mr. Oxley towards the decision of arriving at a cooperative working relationship, according to feedback from Mr. Arshad.

When Mrs. Helga Ahmad approached me, at the instigation of Dr. Zafar Altaf, with questions regarding Cholistan, I assured her that it would be advisable to meet the people at CHIDS who would be in a position to provide technical expertise and plant materials. Hopefully, the NGO to which she belongs will find a relationship with CHIDS helpful.

Thar Desert Sub-Station at Mithi

It occurred to me that the Thar represented at least as great an opportunity as Cholistan and was much more neglected except by journalists who find fit subject matter for articles for the tabloids and monthlies on life in the eastern deserts of Pakistan. I met Mr. Parshotam Das, who is in charge of this provincial station answerable to the Director of ARI Tando Jam, and observed what he was doing. He got a fair amount of help from the NARC, particularly from the BARD Project, but he is essentially left to his own devices with scant resources. The last time I visited Mr. Das was when I introduced Dr. James Barnett to him in October, 1989, but at that time, there had been quite ample rainfall as the desert was green.

The main crops are guara, bajra and melons in the interdunal valleys. Seasonal rainfall during the monsoon is uncertain, but at times sufficient to grow good crops of grass if the seed were there lying in anticipation of precipitation. There is much that can be done in the way of reseeded with native grasses and re-establishment of native shrubs and trees. Some water is available in the valleys, but extreme care should be exercised to conserve the supply so as not to jeopardize the quality for household purposes.

A canal irrigated nursery and plant materials production center should be established somewhere, preferably at a location not far from the Mithi station, to support productivity enhancement activities emanating from the station. My recollection of Mr. Das' intellect, energy and dedication is highly favorable. It is one of my regrets that I could not be of more consistent and persistent help to his program. I would ask that the PARC/NARC provide some technical and material assistance to this station out of the federal resources.

Jojoba Research Activities

When Dr. Zafar Altaf requested Dr. Manzoor Ahmad Bajwa to obtain seed of jojoba to initiate a jojoba research program, the task was ultimately passed on to PROS. At that time, all I knew about the subject was the proper pronunciation of the name. I say this because if there is the will to learn and goodwill, it is a rather simple matter to dispel ignorance. From a very small beginning it is possible to amass enough pertinent information and collect enough germplasm to make substantial progress.

That is what we helped Dr. Anwar Hussain Butt and his colleagues do at Bahawalpur. A letter to UC Riverside to the big name in jojoba literature revealed that while his eminence was deceased, a Pakistani gentleman, Dr. Himayat Naqvi, was looking after jojoba in addition to his own interest, guayule. It just so happened that a MART Project short term course participant on research management, Dr. Mohammad Hussain, the Director Horticulture of AARI, was visiting Riverside. The seed passed from Naqvi to Hussain to Butt went into the ground at Bahawalpur as easily as you could please and flourished.

The major lots of seed were purchased under MART from a commercial source in Arizona through information gained from a letter written to the University of Arizona. Books on jojoba were purchased from the National Research Council BOSTID and from the University of Arizona Press and from a commercial source named agAccess.

When asking about jojoba in Pakistan, I learned about an enterprising engineer reincarnated as a horticulturist in the Sindh, but I did not know him nor his whereabouts and my source of information at Tando Jam could only tell me that he existed and had jojoba plants, but he did not know how to get in touch with him. I expressed my frustration to the Director of the AEARC, Dr. A.R. Azmi, who called one of his staff members, who was related to this gentleman whose acquaintance I was so desperately seeking. I got his phone number and called him up, was immediately invited to dinner. We arranged for Director Oilseeds, Jojoba Botanist and three other staff members to come by train to Hyderabad to visit the jojoba plantation of Mr. Muhammad Hussain Panhwar. Mr. Panhwar generously shared information and the jojoba research program of the Punjab was well on its way.

When we propagate from seed, 50% of the plants are male and 50% are female. There are no hermaphrodites. Of the females, Mr. Panhwar discovered that 2% of the best plants had produced 20% of the total yield. Obviously, this indicated the wisdom of clonal propagation for commercial plantings. To select the prolific females is the easy part. The selection of effective pollinators may or may not be a problem, but it probably is not.

It may be too soon to start setting up cosmetics factories in Pakistan to utilize the output, but in about five years from the time Dr. Zafar Altaf got the bug in his ear about jojoba, starting from scratch, the research system, with an assist from MART, has most of the answers required to assist the entrepreneur decide whether or not to commercialize this crop. The Jojoba Research Station staff members have even learned to say "hohoba", which is another accomplishment.

Naked Oats for Naked Arteries

When the popular literature of the world was deluged with reports of a fact that Dr. Murray Dawson and the Scotlanders knew all along, that oats are good for you, Mr. M. Banaras Bhatti, Fodder Coordinator NARC, who apparently is obsessed with oats, relentlessly bombarded me with requests for seed of varieties of naked oats. I tried to reassure him that oats are oats, clothed or naked, but he would not relent. He insisted that the Fauji cereals people needed naked oats to make oatmeal for human consumption. I had to reach deep into my bag of tricks.

In June, 1983 at a meeting held in Wisconsin of employees of the Quaker Oats Co. two resource persons were invited: myself, to dilate on the subject of white corn production and breeding programs to support it, and Dr. Robert Forsberg, oat breeder of the

University of Wisconsin, to talk about oats. To satisfy my good friend, Banaras, I wrote to Dr. Forsberg for help. Some people are so helpful.

The response from Dr. Forsberg was beyond my fondest expectations. He not only sent us the naked oats varieties he had in hand and under development, but also sent the commercial oat varieties. Then, he asked his colleague in Canada to send us his varieties and a colleague in Texas to send his. These I turned over to Mr. Bhátti and I have heard no more from him. If nudity were the vital consideration for adoption of oat varieties for food manufacturing purposes in Pakistan, we should be hearing a happy shout from the direction of the Fauji cereals complex soon and a hopeful reduction in cholesterol levels soon thereafter. We might even hope for alleviation of circulatory problems through improved diets.

Studies on Sesbania

Sesbania is a genus of predominantly annual leguminous species somewhat akin to the genus Leucaena, but which has the advantage of familiarity to the Pakistani farmer. He knows dhaincha and jantar. Ipil ipil sounds like baby talk to him.

Arguably the world authority on the genus Sesbania is a Mr. Dale O. Evans at the University of Hawaii who has authored a monograph on the subject and maintains a germplasm collection at the University of Hawaii with scant support. Evans is a good example of someone who does not let obstacles overcome him. If a technical expert on Sesbania is needed to come to Pakistan, Mr. Evans would be the person to invite.

I personally feel that much confidence as I repose in the genus Leucaena as a multi-purpose tree legume, I would not be quick to dispose of Sesbania as second rate. To my mind, it plays second fiddle to Leucaena, but still is first rate. Thanks to Dale Evans, I was able to introduce and have a look at some Sesbanias which would add to the two species in common use in Pakistan for fodder, fuel and land reclamation. He sent collections of seed more than twice to students of Dr. Riaz Hussain Qureshi at the UAF who were looking at them to assess differences in salt tolerance.

Dr. A.R. Azmi introduced Sesbania rostrata from IRRI to the AEARC Tando Jam and it looked very good there growing on the bunds of the rice paddies under highly saline conditions.

PL 480 Project on Pearl Millets

Dr. Wayne Hanna was the counterpart for Dr. Muhammad Afzal, Director of the MMRI at Yousafwala on a PL 480 Project for the collection of and improvement of germplasm of pearl millets in Pakistan. When Dr. Hanna was planning his trip to look at project activities at Yousafwala, he took me into his confidence. As a result, his trip took on the aspects of that of a technical consultant of fodder crops for the MART Project.

PROS took advantage of his visit by escorting him to the major institutions participating in pearl millet research and throughout the major production areas where it is used for grain and for fodder. We arranged for him to present seminars at the UAF and the SAU. We drove through the Potohar where he was able to collect seed of specimens of Cenchrus sp. and visited BARI Chakwal where seed multiplication of exotic bajra collections contributed by MMRI Yousafwala was being done. We drove through the FSR project area at Hala and in the Thar area to look at bajra in the Sindh under both irrigated and barani conditions. Dr. Afzal accompanied wherever he could in the Punjab as counterpart scientist.

Maize Seed Production and Procurement for Afghanistan

When DAI had the responsibility for deciding which varieties of maize of which seed was available in Pakistan should be procured for provision to the agricultural extension people they were training for Afghanistan, their consultant who had worked in Afghanistan while PROS was in Pakistan the first time, asked for some help in making the decisions. Since MART had a vested interest in the subject of promoting the SIA, I agreed to provide counsel.

Their consultant had obtained seed of CIMMYT's high elevation pools which had been grown at Madyan, Swat and at Kalam. The material was vigorous, but was going to take too long to mature to succeed under barani conditions in the low rainfall highlands of Afghanistan. I told them that the only way they were going to have seed available in time to provide to the extension agents on April 1 was to harvest early and to send the seed to Tando Jam to plant by October 15. They had already made up their minds that their local consultant who comes from D.I. Khan was going to do it during the winter. They sacrificed feasibility for the sake of convenience, with predictable results. The CIMMYT varieties they had selected were unsuitable in the first place and the growing conditions for seed increase were abominable.

Where they listened and took PROS' advice, i.e., in the use of the Pakistan bred varieties in each agroclimatic zone, the results were also predictable. We still lack an extreme short season yellow flint variety to replace the locals. We had made the crosses which promised to give us the required results two decades ago, but since the maize breeding institutes are located in the plains and scant effort is devoted to trying to approximate growing conditions in the fringe areas for testing these products, they invariably are rejected. The variety Zia, which predominates in the upper Swat Valley, was selected by the farmer with whom we tested it at Sambat after it had been rejected at Pirsabak. Zia is part of the parentage of Azam, which was selected at Pirsabak in the 1980s, which indicates that they have come a long way in developing suitable varieties.

For some time to come the major responsibility to develop and test maize (and many other crop) varieties suitable for Afghanistan and therefore the opportunity to assist and to profit will remain with Pakistan and the CCRI has to be the major player for the cereal

crops. Imaginative use of available cropping environments for developing these varieties is essential. Identifying production seasons and areas throughout the country will require shedding of prejudices and inculcating in all a desire to make common cause for mutual benefit.

Technical Assistance Activities around Turbat

At the behest of the then Deputy Chief of ARD USAID, Mr. Richard Goldman, PROS made contact with the BALAD Project and journeyed to Turbat to survey the agricultural situation in the project area. Turbat is apparently very isolated from markets for imports and exports, but fruit and vegetables were trucked in and in season dates and vegetables could be trucked out. In fact, the BALAD Project's engineering activities were based on improving roads as well as improving water supply for agriculture.

With the help of anthropologist, Rashid Baloch, and AID consultant, Dr. Prakash Upreti, we looked at recently developed farming operations utilizing the subsurface flow in the Kech River. We were fortunate to make the acquaintance of a Mr. Sorok, who had gone to Karachi by sea many years back and after working as a laborer for a while, took employment on a vegetable farm at half the daily wage. Sorok eventually returned to his village with knowledge of vegetable production and the ability to capitalize on the tubewell technology to which he had been exposed in the Malir Halt area. It was heartening to see what an intelligent, but simple villager had done without government assistance, foreign, federal, provincial or local. All he asked for during the several hours we spent together were a school and a health care facility in his village.

Sorok showed us the various crops which he was growing for local consumption. There was also someone from Karachi who rented land to grow melons. They had a napiergrass being grown on bunds at the periphery of the cultivated area. He said that they had brought it back from Oman where many residents of the Makran Coast are employed.

Dates appear to be the most important crop exported from the area. Citrus growing in the area were only kagzi limes. Since it was early February, winter pulses, wheat and alfalfa were the main crops in the field. *Vicia faba* was the main pulse being grown. The local variety of alfalfa, growing in sandy soils, looked very good. They were mainly fed to milk producing goats at a highly remunerative price, as I recall.

Before the advent of tubewells, water was made available through the karezes. Due to greater drawdown made possible by pumps, the karezes were drying up. Can this be considered progress?

After our visit to Turbat, AID then decided to engage the services of Dr. Zidan Abdel El, a date expert from Cairo, as a MART Project consultant. PROS was then given the duty of providing Dr. Zidan orientation, technical support and introductions to the Balochistan

authorities. By then, I was able to provide him sticks of Mott as well as a box full of vegetable and fodder seed of various kinds to initiate a testing program with the agricultural officers stationed in Turbat. He was able to work with Mr. Sorok, who I feel is a very special person, a real innovator who has his own package of technology and has the ability to integrate our interventions into his system, if they make sense to him.

ACKNOWLEDGEMENTS

This End-of-Tour Report is a summary of the author's seven years of activity with the MART Project capping a 25 year career of participation in agricultural development in Pakistan, of which sixteen has been in residence and an additional three spent looking west from a vantage point in New Delhi.

How can I acknowledge with mere words the myriad contributions made by so many to my education and my enjoyment and to our efforts as we worked together to help improve by modest spurts the well being of the Pakistani farming community? I must bow to custom and must give this task too my best efforts.

First and foremost comes the Pakistani farmer who provided the challenge, the need, the hope and the rationale for our efforts, indeed, our reason for being. Perplexing at times, exhilarating at others, it was always interesting and educational to work with him. If someone would be generous enough to say that I have succeeded in some way, I would lay claim to having come close to understanding and communicating well with the farmer, even without fluency in Urdu, Punjabi, Pashto, Sindhi, Balochi, etc. Somehow we had a common language, even those who did not have English.

My most enjoyable moments, and there have been many, were spent in the company of farmers in their fields in practically every district in Pakistan planting maize, planting Mott, planting and picking up ideas and learning that people are the same everywhere, differing only in degree, not in kind. I gladly acknowledge their contribution to the continuing growth of my understanding of how things work on the Pakistani farm whether it was in Jhudo, Perumal, Umarkot, Mithi, Sanghar, Tando Qaisar, Dadu, Dokri, Rajanpur, Kabirwala, Bahawalpur, Bahawalnagar, Burewala, Jalalpur Bhattian, Chak 95 S.B., Vehari, Kuluwal, Mansehra, Panch Pir, Sambat Cham, Madyan, Charsadda or at a host of other places which I could name.

Moments with the farmers were nearly always spent in the company of researchers and/or extension agents who facilitated communication and contributed much to my education. To all of them, I owe a debt of gratitude.

I have met many government officials in the agricultural research, extension and educational institutions and the secretariats of all four provinces over the past seven years. In the case of the Punjab, there have been four Secretaries of Agriculture and five Livestock Secretaries, three Directors of Livestock Farms, three Vice Chancellors, three Directors-General of Research, four Deans of Animal Husbandry and four Chairmen of Livestock Management. I have enjoyed a privilege accorded to few of being able to meet in the course of my work such an array of people with great responsibility and the dedication and talent to go with it. It would take much space to name them all in order to express my appreciation for the associations we have had. Inadequate as it may seem, a generic thank you will have to suffice.

In the private sector too, I have been privileged to meet some very talented and dedicated people who are real partners in progress with those of us in the public sector. I know how much I have learned from them and I can guess how much they have helped me widen the horizons of many of my colleagues in the public sector. I hope that in some small, but significant ways, we have contributed something in return. I have tried to link up people with common interests whenever possible and hope that at least some of them will continue and will be mutually beneficial.

USAID and PARC officials have been very supportive and receptive throughout my tenure. Having returned to Pakistan in 1986 for a three year assignment. My writing this End-of-Tour Report in August, 1993, seven years after having returned to Pakistan in 1986 for a three year assignment, attests to just how supportive they have been, every one of them.

Rarely have I worked with a group as congenial and as dedicated as the team that Winrock International fielded in Pakistan to provide technical assistance under the proud banner of the MART Project. Our work together of two to five and a half years duration were mutually supportive, positively enjoyable and, I hope, will be looked upon by others as productive.

The MART Project support staff members too were a rare group of individuals who did their work efficiently and with good humor. My project driver for these seven years deserves special mention as he was called upon to do more than any other driver was ever asked to do in the line of duty. He probably cut, dug, hauled and planted more Mott than any other individual and logged more miles in a project vehicle, but he never complained that he was being overworked. He was always ready for more, whenever we were ready.

Thus far my acknowledgements have been copious and effusive, but anonymous even though there are so many people who deserve mention by name. Some of them I have mentioned in the main body of this report when opportunities presented themselves or situations warranted. I ask forgiveness of those whose names I failed to include in this report.

I cannot conclude my acknowledgements without naming two people who have contributed the most to my work in Pakistan. One is my wife of 40 years, Doris Mieko Sanbei Izuno, who enabled me to travel 70% of the time by accompanying me wherever my work took me. She contributed in more ways than was apparent. During visits and workshops, she talked with people, especially, but not restricted to, ladies, and as a result, it was as if I were having discussions with twice as many people as one person possibly could. In fact, I could honestly say that I often learned more through her because she listened better and remembered more than I usually did from these discussions. The best thing was that she reported what they said rather than

editorialized. She edited and proofread most of my own reports and helped with the consultant reports for which I was responsible. Finally, she kept pushing me to do more and reminding me of what I needed to do, what promises I had to keep.

The other person who I feel compelled to acknowledge by name is Dr. Zafar Altaf, who has done so much more than he could imagine to make our tenure with the MART Project professionally satisfying, invariably challenging, always enjoyable and I would like to believe, reasonably productive. I first met him and worked with him as Secretary of Agriculture and later as Secretary of Livestock and Dairy Development and finally as Chairman of the Pakistan Agricultural Research Council. He has provided constant support and useful advice to me throughout these seven good years. We owe much to his positive leadership and sustained friendship.

TERMS OF REFERENCE

Research Operations and Support Advisor

The Provincial Research Operations and Support (PROS) Advisor is the principal representative of the MART Project in the provinces and, as such, he necessarily will be involved, or at least keep himself informed, of all project activities that take place in the provinces. Conversely, he will be a principal source of information to the MART Project about research activities in the provinces. A main task of the PROS is to interact with provincial research officers to assist them in identifying activities that MART Project can undertake to strengthen and enhance provincial research institutions. The tasks of the PROS Advisor shall also include but shall not be limited to the following:

- i. Draft or provide input to the scope of work for short-term consultants assigned to the advisor's assigned province(s), supervise their performance, and be responsible for all followup activities.
- ii. Assist the RPM Advisor in sub-contracting with and overseeing the performance of the Pakistani management/accounting firm, and coordinate the use of expatriate short-term consultants to supplement the activities of the firm.
- iii) Assume primary responsibility in arranging for systems analyses, specific studies, and follow-on management improvement interventions in the assigned provinces, including but not limited to the areas of budget allocation process, the role of the private sector in agricultural research, and in developing an adequate system of financial records and financial reporting in PARC and the provinces.
- iv) Assist the provincial officials to strengthen the linkage between research and extension to improve the flow of information from research to extension and from extension to research. He should also aid the flow of information from the provinces to the federal research organization, PARC, and vice versa.
- v) Assist the FSR Specialist in farming systems research activities in the assigned provinces.
- vi) Assist the RPM Advisor in developing the administrative sections of the NARC Master Plan by providing input from the provincial level.
- vii) Assist Pakistani officials to identify specific training requirements, recommending specific individuals and proposed training courses and institutions able to meet training needs in the assigned provinces.

The Advisor will reside in the Punjab but shall work with all four provincial research directorates. The Advisor's primary counterparts will be the Director-Generals of Agricultural Research in Punjab and Sind Provinces. The Director-Generals of Agricultural Research in Balochistan and NWFP will be the principal counterparts in those provinces. His counterpart in PARC will be Director Coordination. It is expected that he will spend about 50% of his time in the Punjab, about 30% in the Sind, and about 10% each in the NWFP and Balochistan.

Illustrative Job Description
for
Provincial Coordinator (PC)

The tasks assigned to the erstwhile PROS aka PROS I for the period October 1, 1991-March 31, 1993 were:

The PC's duties, in general, are to assist Pakistani research institutions, agricultural universities and private sector institutions and growers in ways which will strengthen capacity to conduct and utilize agricultural research. He will have the responsibility to ensure that all MART Project activities in Punjab Province are carried out properly. He will assist other MART Project personnel, especially FSR and IT, to do the work in those areas. Though based in the Punjab where he will concentrate a high percentage of his work, the PC will have nation-wide responsibilities.

Because the TIPAN Project is fully funded and the MART Project has been reduced, TIPAN will cater to the needs of the NWFP. MART will be only minimally involved in the NWFP.

After the departure of the COP, the PC will also oversee the overall management of the Winrock-executed component of the MART Project. He will rely heavily on the services of the Administrative/Program Officer to manage project affairs.

Some specific tasks of the PC will include, but are not limited to the following:

1. Promote Private Sector Investment in Setting the Research Agenda

The PC will promote the idea of involving representatives from the private sector in planning research projects. Together with Winrock's Agribusiness Specialist, PC will organize seminars and workshops on various research topics attended jointly by research scientists and managers together with agribusinessmen and growers from the private sector. He will encourage research institutions and the UAF to establish Agribusiness Cells to promote better contact and exchange between researchers and the private sector.

2. Help Establish Farmers' Seed Improvement Associations (SIAs)

The PC will work toward the establishment in the Punjab of SIAs to ensure adequate supplies of good quality seed. These associations will be farmer owned and operated and they will be financially independent. They will obtain basic seed from research stations, increase it and maintain its purity and quality. The seed will be marketed by

members of the associations. A small percentage of the sale price will go to the association to support its activities which will be technical assistance to members in seed production, quality assurance, processing and marketing.

3. Assist Private Sector Organizations to Initiate Agricultural Research

The PC will help on-going research programs improve their relations with public sector research stations. Also he will encourage other private sector organizations to initiate research programs. The PARC/BOSTID research grant program could be used as a vehicle to help accomplish this goal.

4. Research/Outreach Integration

Under the FSR umbrella, the PC will promote coordination of the Agriculture and Livestock Departments through their research and extension organizations.

5. Reviews and Special Studies

Considerable follow up is needed of studies already completed such as such as the Strategic Planning Review of the University of Agriculture Faisalabad, the Review of the Soils Department of the UAF, the National Coordinated Research Programs, the Training Program Review and the FSR Impact Study.

6. Master Plan

Thus far, in spite of considerable efforts, MART staff have been unable to interest Punjab research managers in preparing a master research plan. However, because this is such an important step in research management, efforts will be renewed to convince the appropriate administrators to prepare a plan. The MART Project will then assist in preparation of the plan.

7. Other Activities

The above points are important activities for the PC, but he will also be receptive to ideas identified by provincial researchers, or himself, that are not specifically stated above.

The PC will continue to be based in Lahore, but his administrative oversight responsibilities will require frequent trips to Islamabad.

TASKS FOR RESEARCH MANAGEMENT ADVISOR/COP

The tasks assigned to the erstwhile PROS and PC for the final extension of the Winrock technical assistance contract from April 1-August 31, 1993 were;

1. Coordinate with PARC's senior management to effect increased GOP participation in research management initiatives. Promote "buy-in" of the NARC Master Plan through dynamic updating and use by research managers.
2. Provide training to the newly created Research Planning and Marketing Group in research planning, monitoring and evaluation through in-house discussions and study visits.
3. Advise PARC's Directorate of Agribusiness Relations on long range planning, identification of marketable research and research-industry linkages.
4. Motivate research managers to use planning and management tools to improve productivity of available resources and meet the research needs of the industry and farmers.
5. Prepare a close-out plan for Winrock's activities in the MART Project.
6. Prepare a consolidated final report of Winrock's activities under this contract.