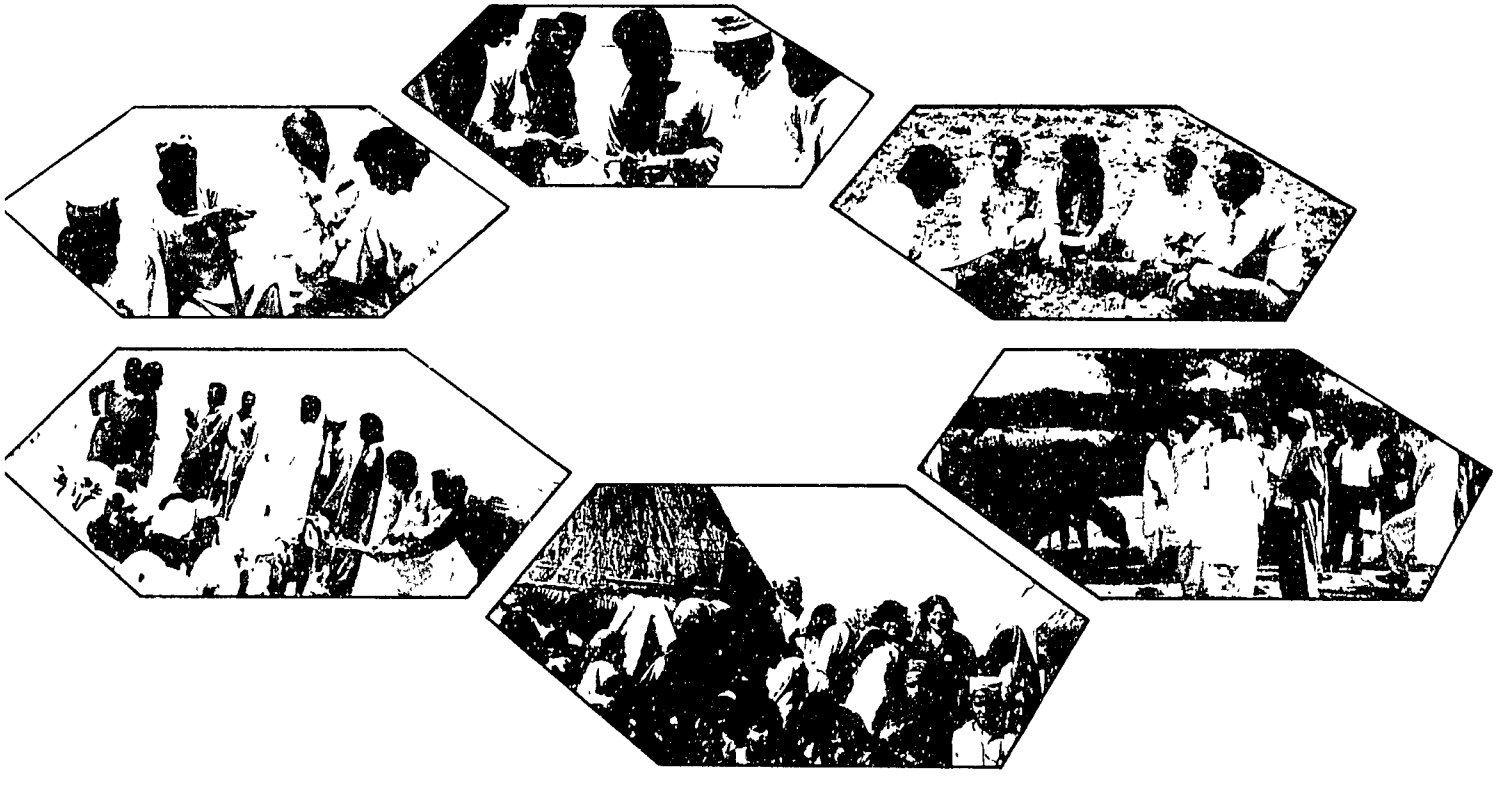
PN-ABU-748

# FSR in Pakistan – recent developments and trends



PAKISTAN AGRICULTURAL RESEARCH COUNCIL
ISLAMABAD

**PARC**
FSR in Pakistan-recent developments and trends / by Abdul Majid, Pervaiz Amir, S.H. Hanjra and M.D. Dawson. -- Islamabad: Pakistan Agricultural Research Council, 1989.
32p.

| UDC | DDC |
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| 631.11 | 631 |

**ISBN: 969-409-049-0**

*This publication has been prepared by the US AID funded Management of Agricultural Research & Technology (MART) Project, and the Winrock International; and published by the Directorate of Publications, Pakistan Agricultural Research Council, P.O. Box 1031, Islamabad.*

Printed at:
PrintStyle
10, Potohar Plaza
Blue Area, Islamabad, Pakistan.

*Scientists from Pakistan Research Institutes, University and Extension Department interviewing a Sind FSR participant farmer during a Travelling Seminar Study and Monitoring Tour*

# FSR in Pakistan – recent developments and trends

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*The FSR site coordinator watches the farmer with bullocks and 'Desi' plough prepare his field for planting and testing an improved technology for sugarcane-wheat farming systems*

*A multi disciplinary team discusses with a farmer in the rural village compound his production constraints and attitude towards the FSR project*

# *FSR in Pakistan – recent developments and trends*

## INTRODUCTION

Farmers have much to convey to researchers. Why should farmers produce poor wheat, low yielding maize, or inferior fodder, when through farming systems research (FSR) they have the potential of increased productivity, more income, and a better life for themselves and their families?

FSR, which makes farmers and scientists partners, has been adopted as a new emphasis in agricultural research in Pakistan. Through that partnership, the research process is better able to meet the needs of small farmers. Agricultural research becomes more relevant to solving production and management constraints. Farmers become partners in testing improved technology. Policy-makers and planners benefit from on-farm generated data as a basis for important policy decisions including farm subsidies. Coordination between extension, research, and agricultural education is advanced, while feedback is swift, dynamic, and effective. Indeed, FSR encourages multi-disciplinary research and interagency dialogue. The private and public sectors become better positioned to more effectively serve the farmer.

The purpose of this technical bulletin is to explain what FSR is and how such research is conducted. It presents accomplishments and projected increases in productivity and suggests training programs for scientists at various levels in FSR.

The FSR approach has gained wide popularity in several developing countries and is the thrust of many international research centres. Early indications suggest FSR has an important role in accelerating agricultural development in Pakistan.

### Purpose and Scope of FSR

While the scope and definitions of farming systems research differ, there is general agreement on several points. We choose to define FSR as an interdisciplinary approach to increase productivity and improve rural welfare. Scientists and farmers work together to verify and adapt experiment station technology to specific agro-ecological conditions. The distinctive features of farming systems research are its pragmatic approach, holistic perspective, and farmer orientation.

To date most agricultural research has been commodity oriented – increasing productivity of specific crops. The international agricultural research centres which took the lead in crop improvement technologies were among the first to discern that farmers' productivity depends on a complex set of factors which form "farming systems." Two international centres, that for wheat and maize (CIMMYT: International Maize and Wheat Improvement Centre) and for rice (IRRI: Internaional Rice Research Institute) recognized the need to look at these farming systems entirely to achieve productivity goals. They encouraged adoption of this concept by national research systems.

From this, came the concept of farming systems research as a holistic view of a farming operation. It is a new way of thinking about and carrying out research. It is farmer-oriented, seeking answers to problems which constrain farmers' productivity and ability to make best use of land, water, energy, and labour resources. FSR is multidisciplinary and interagency, committing researchers to work together and thus making optimal use of their resources, knowledge, and abilities.

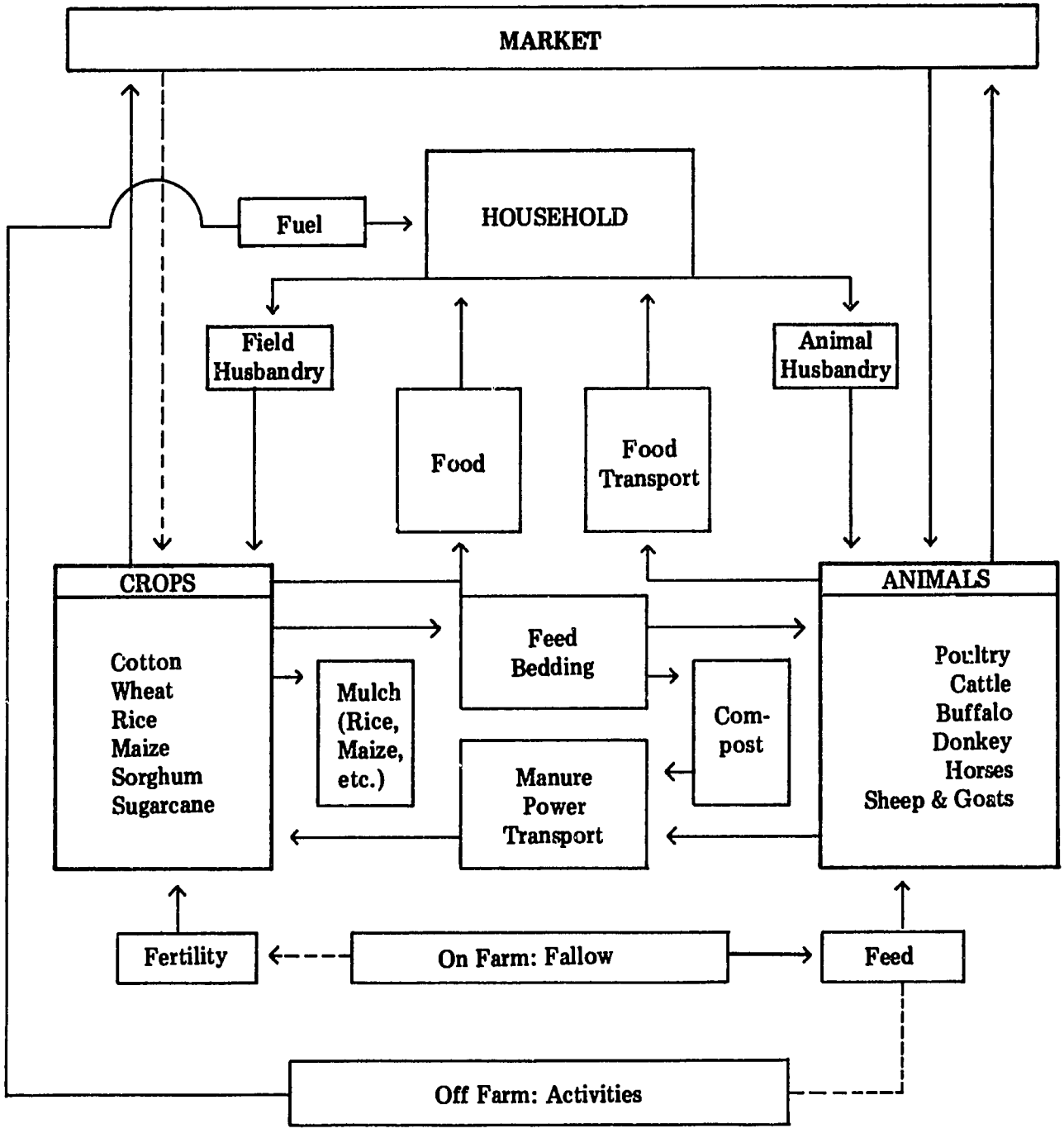
FSR offers the promise of being able to overcome many of the gender biases inherent in most other agricultural development strategies. It offers hope that all farmers, male and female, will grow as individuals through knowledge and improved farming skills.

A model showing farming system components and relationships appropriate for much of Pakistan is presented in Figure 1. The integration of crops and animals on a typical small farm shows linkages to the market directly and through the farm household. Crops provide livestock feed and bedding while animals provide sustained soil fertility, transport, and draught power. This integrated farming system predominates on most farms in Pakistan. Any change in either crops or livestock technologies affect the entire farming system.

Social sciences occupy an important place in FSR. Knowledge about specific farm circumstances is necessary if improved productivity and increased income are to be generated under varying socioeconomic conditions. Rural sociologists, social anthropologists, and agricultural economists assist in site characterization and assess the impact of farmer adoption of improved technology. Economists analyze experimental data to ensure that research recommendations are economically sound for farmers.

As FSR improves farm productivity and farmer welfare, efficiency of agricultural research is also improved through use of existing technology and generation of new technology to help farmers. The direct participation of the researcher and farmer in the design and testing of new technology, tailored to the farmers needs, contrast with the traditional extension and farm management approach.

Figure 1. A Farming System Model for many Pakistan small farms showing integration of crops and livestock with the household and market. The solid lines depict strong flows or linkages among the parts, while the dotted lines depict weaker flows or linkages.
(As modified from Shaner et al., 1982)



*Rural women and children are now becoming involved in FSR activities at each Target Area. Training of women in the use of pesticides for grain storage and rodent control has been initiated*

*Interviews with the village women conducted by female scientists assist in the diagnosis of problems and plan strategies for FSR project interventions to improve women income*

Pakistan has an agricultural research system in place, but the challenge is how to build on its strengths to better serve farmers. Success depends on a commitment to this approach and development of leadership to organize and operate it.

**FSR Targets**

Establishment of FSR methods to increase and sustain small farmer productivity throughout Pakistan is an urgent agenda. It requires development of an organized network of institutions. To effectively conduct FSR programs, these institutions will require leadership training, incorporation of FSR approach and methodology; necessary resources support, and lines of communication with both internal and external links.

**Two-year FSR Achievements/Targets are:**

- An institutionalized FSR program in each province, both at the Agricultural University and Agricultural Research Institutes, which integrates soil, water, crops, and livestock under sound management.
- Strenghtened links between the federal, provincial, and education research systems to serve the farmer, assist the policy-maker, and motivate the scientist.
- A FSR organization structure for the federal and provincial systems linked to the private sector with identified FSR coordinators and assigned responsibilities
- A core of multidisciplinary biological and social personnel trained in the methodology of FSR and motivated to collaborate in the diagnosis and resolution of farm problems.

*During interviews with farmer this FSR multidisciplinary te with puffs from the traditional pipe*

*a Punjab village share interludes of acquiring information*

- Teams of interdisciplinary scientists and extension officials who select and plan as FSR domain with a cluster of farmer participants.
- Identification of priority and marketing constraints of small farmers with improved interventions designed to increase productivity and farmer welfare.
- Establishment of FSR achievement indicators, including production and socioeconomic targets
- An effective system for transfer of FSR technology developed in collaboration with communication specialists and extension personnel.
- An improved capability to analyze production, marketing, and institutional constraints, and to provide policy-makers information helpful in establishing subsidies, effective services, and production incentives.
- Improved university curricula and learning situations together with workshops, seminars, and study tours which develop FSR manpower capability

These are being implemented by the Pakistan Agricultural Research Council (PARC), through Management of Agricultural Research and Technology as one of MART's five elements. Funding is provided by USAID with CIMMYT assisting in maize and wheat, the International Centre for Agricultural Research in the Dry Areas (ICARDA) on arid land, and Winrock International for FSR management training and information transfer. Under the MART project, systems research activities are coordinated by a FSR national committee, with a representative who collaborates with provincial FSR leaders and site coordinators.

# *Overview of FSR activities in Pakistan*

FSR training and extension activities are underway in Pakistan, including ongoing FSR projects in all provinces. More training and technical and resource assistance are needed. In Pakistan we propose that FSR is to supplement rather than replace conventional agricultural research/extension, with tools designed to assist and augment existing research approaches. Indeed, FSR gives traditional research an added dimension with goals that incorporate the aspirations of a target population.

Farming systems research activities in Pakistan aim to conduct interdisciplinary research based on more accurate information about farmer circumstances. This involves understanding the way a farmer thinks and allocates scarce resources. A FSR approach includes careful description and diagnosis of both production and marketing constraints. Moreover, FSR requires prioritization of constraints, identification of interventions, and incorporation of interventions to improve traditional systems. Careful examination of the internal and external links between existing research activities and the public and private sectors also should be considered.

Productivity and net farm income can be increased when scientists and farmers become partners in problem analysis, diagnosis, and resolution with technology. The FSR approach emphasizes a two-way information flow (Figure 2). New research activities on the farm and at the experiment station will emerge as FSR methods and perspectives are adopted.

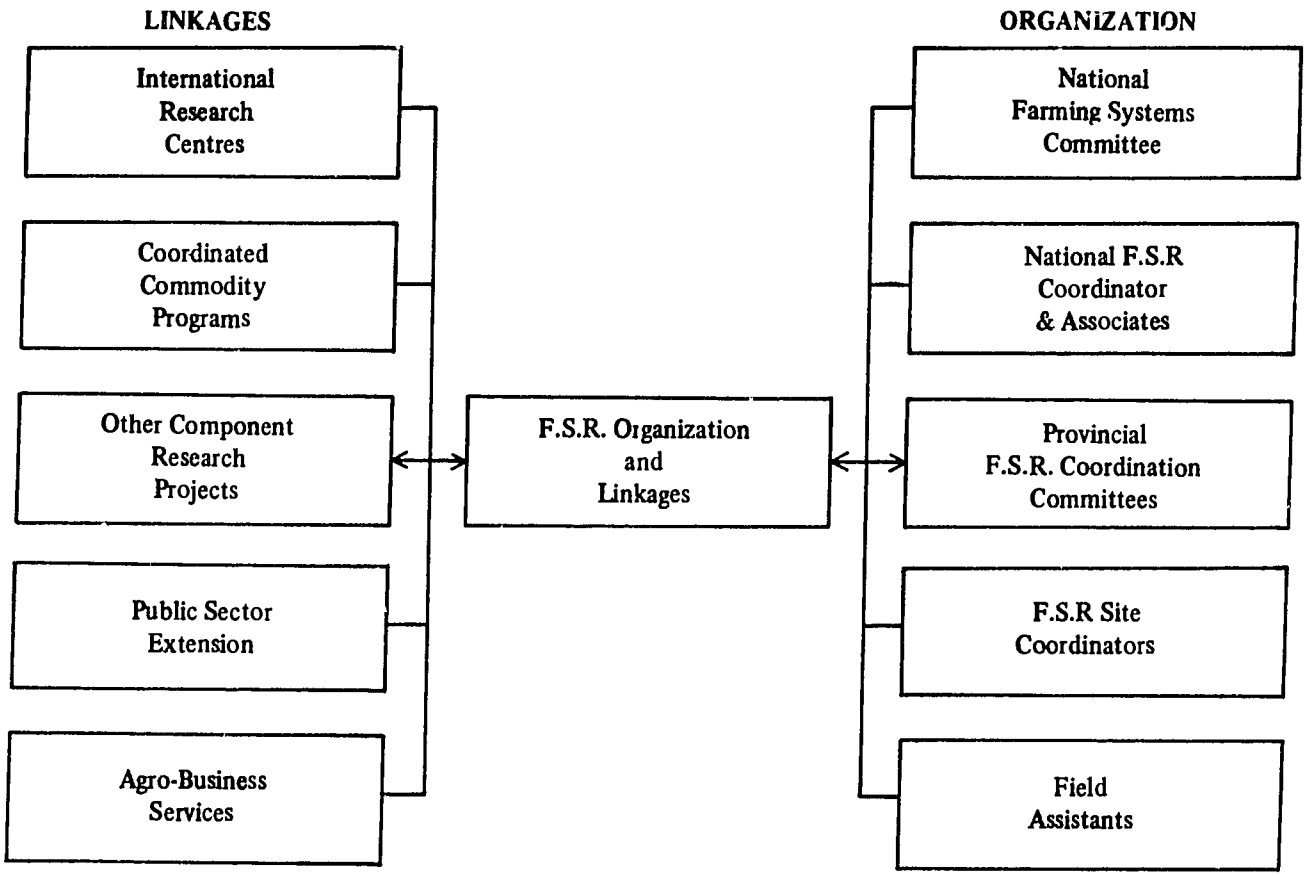
FSR methods and systems of inquiry are being used at all FSR project sites in each province of Pakistan. The FSR approach may be considered in five stages:

- Description: Outline the system sub-component in qualitative and quantitative terms.
- Diagnosis: Identify and prioritize key factors limiting productivity.
- Technology design and testing: Test appropriate interventions (technology component) on farmers' fields and verify (or modify) with farmer cooperation.
- Evaluation and feedback: Assess the socioeconomic impact derived from adoption of improved FSR technology with continued feedback to experiment station.
- Extension of results: Transfer suitable technologies through pilot projects.

*Farmers are very articulate in describing their production problems. In this instance this farmer is inquiring from scientists reasons for his low cotton yields*

*Farmer Khosa at Hala with agricultural economist Mr. Siddiqi pose after examining site records which indicate increased net farm income from FSR project interventions in his cotton-wheat system*

Figure 2. Organization Linkages and Information Flow of F.S.R. in Pakistan.




Complete packages of improved technology rarely become popular among resource-poor farmers who are unable to meet the cost requirements. However, the productivity of one enterprise is less important to the farmer than interventions that affect overall productivity and cash flow of the system. Since farm problems are complex and linked by numerous constraints, solutions usually depend upon input from several disciplines.

**Evolution of FSR in Asia**

Farming systems research perspective has evolved from an old concept of "balanced farming," which emphasized the study of the farm as a system. Development in the rural, social, and agricultural sciences as well as in computer technology has significantly contributed to the success of FSR. Some of the major international centres including IRRI, ICARDA, International Potato Center (CIP), and CIMMYT have initiated research and developed approaches to address the needs of small farmers in developing countries. Many national programs have adapted the FSR model partially or fully in the evaluation of new technology. The Philippines, Thailand, Indonesia, Nepal, and Bangladesh have had considerable experience with FSR. This has been encouraged by various donor agencies. The Asian Farming Systems Research Network under IRRI leadership has helped build a network among 11 Asian countries.

In Pakistan, numerous programs during the last 20 years have served as FSR precursors. They have all aimed at increasing yields and productivity. Initially, the village AID approach was considered to be the panacea for rural change (Amir and De Boer, 1985). By the mid-1960s, integrated rural development became popular. This in turn prompted investment in rural institutions including rural academies and training centres. The "Magic Seeds"

Project under the green revolution banner became popular in Pakistan. The increased productivity which followed was largely due to the local adoption of new varieties (except rice) and the complementary inputs. Development of new varieties of cereal crops was well publicized. While such efforts have helped sustain wheat and rice yields in the country, increased productivity has not come without cost. Production increases are closely linked to increased acreage and higher use of inputs. Often this brings risks and uncertainties which constrain farmer adoption of improved technology.

The active role that CIMMYT has played in both coordinated wheat and maize programs through the country's research system has provided FSR considerable momentum. The CIMMYT on-farm research thrust has emphasized problem diagnosis, research planning, testing, and improved technology transfer. Moreover, CIMMYT has also strongly supported the newly established Agricultural Economics Research Units in the provinces which strengthen the social science component in FSR.

Training in FSR methods has recently been initiated in Pakistan. PARC has organized several workshops to teach FSR methods and approach. Field practitioners, researchers and extension officers from all four provinces have participated. Contrasting agro-ecological conditions as well as different socioeconomic circumstances suggest that FSR training in Pakistan requires site-specific, on-farm, teacher-learning situations.

**FSR Workshop, Lahore**

In February 1987, a 12-day FSR Methodology Workshop was conducted at the Water Management Training Institute, Lahore. Punjab Secretary of Agriculture, inaugurated the workshop with Director General of Agricultural Research, Extension, and Water Management. Some 40 interdisciplinary scientists and extensionists representing all provinces participated. Classroom work focused on the approach and perspective of FSR while "hands-on" experience included farm problem diagnosis, informal diagnostic surveys, and interview techniques with farmers. Interdisciplinary teams of three or four members interviewed farmers each morning and discussed issues and viewpoints during the afternoon. Villages selected for the field work included the command water management project of Shahkot and the Barani target area of Chakwal. A Winrock International/ SEARCA Research Fellow and an IRRI staff member were the senior workshop instructors. Along with CIMMYT and Pakistan scientists, they provided considerable FSR-related literature and some microcomputer training. Printed reports which described each FSR target area were compiled. Detailed climate, soil, water, and irrigation management information was analyzed. Farm size, ownership, social structure, and ethnic groups, together with available input/output systems, were described. Cropping patterns, livestock husbandry, pests, and diagnosed constraints were noted relating to different components of the farming system. The FSR team suggested preliminary interventions to resolve priority constraints.

Ensuing discussions with the farmers, scientists, and extension staff resulted in a series of prioritized interventions to resolve constraints. Workshop participants appreciated and strongly endorsed this FSR thrust. In the age of specialization and discipline isolation, weak interdisciplinary and interagency linkages have not encouraged such dialogue.

**SIND Agricultural University (SAU) FSR Workshop**

Tandojam was the centre for the first FSR workshop in Sind province March 29-31, 1987. Scientists who participated in the Lahore training assisted in planning.

*At all FSR Target Areas in Pakistan livestock are importan the farmer daily rations of urea treated straw to ascertain ef*

Preparations for the workshop included reconnaissance of FSR target areas and compilation of secondary data. This included soil survey maps, cropping systems, irrigation scheduling, input/output services, and socio-economic information. The Chairman, PARC, emphasized that FSR encourage interdisciplinary studies. He stressed the need for scientists to come forward and communicate, especially with small farmers, to determine more accurately their resources and needs. Technical competence, motivation, and qualities of character of the scientists involved will ultimately determine the success or failure of FSR endeavour.

A CIMMYT wheat agronomist, stressed both the farmers role in FSR and the need for interdisciplinary efforts in solving production constraints. Using the successful Wheat Coordinated Program as an example, he vividly illustrated the usefulness of a system perspective in conducting on-farm research. Senior Sind Agriculture University scientists in soils, agricultural engineering, plant protection, extension, and animal and social sciences discussed their respective contributions to FSR projects.

*e small farm enterprise. Here buffalo are being fed by*
*ı milk production and costs*

As in Lahore, interdisciplinary teams did field work, using the FSR target areas of Hala Taluka and Tando Mohammad Khan Taluka. Hala subdistrict features a cotton-wheat based farming system while Tando Mohammad Khan has a rice-sugarcane based system. Livestock are important in both areas. Small farmers and the landless had expressed interest in cooperating with SAU. Both areas are irrigated and located on major soils of the region. Using secondary data and farmer interviews, farmer circumstances were analyzed and constraints diagnosed. In subsequent sessions, interdisciplinary teams addressed specific topics and created preliminary work plans. This material provided the basis for component action plans and an FSR proposal from SAU. Target areas were selected based on accessibility, cooperative farmers, and an opportunity for rapid adoption of improved technology.

**FSR Workshop at Mansehra**

The Vice Chancellor, North West Frontier Province (NWFP) Agriculture University, encouraged the selection of Mansehra as the initial FSR target area for this province. A PARC/MART/NWFP Agriculture University/ Extension FSR Training Workshop was held in April 28-30, 1987, at the Dhodial Agricultural Research Station. On-farm interviews and diagnosis were conducted in the villages of Bajna, Tanda, Trangri Payeen, and Dhodial.

Interdisciplinary research and extension teams found that farmers identified low-quality seed, shortage of agricultural chemicals, and inadequate credit as priority problems. Some also said that technical assistance was unavailable. Livestock production could be improved by introducing superior husbandry, feeding, and veterinary service. The workshop concluded with group work sessions, led by Vice Chancellor focusing on potential interventions with cooperating farmers.

Several graduate students attended the Mansehra FSR Workshop. A FSR project work plan includes provision for NWFP graduate theses research funded as assistantships under project MART/PARC. Some 25 to 30 farmer cooperators in the three villages now constitute the FSR domain in which faculty, graduate students, and extension collaborate in a joint FSR exercise.

**FSR Crop-Livestock Workshop**

In Pakistan, livestock constitute an important part of most farming systems. Contrasting agro-ecological zones provide the basis for very different mixed-livestock enterprises. In a country where animals are primarily kept by small farmers for draught power, milk, meat, and wooi on forage/fodder diets, the challenge for research and development programs is both urgent and complex. The landless manage and produce much of the livestock.

Comparative neglect of the livestock component in farming systems prompted the need to conduct a seminar/workshop on livestock in farming systems, April 8-15 1987. The workshop highlighted the importance of crop and livestock integration to make better use of all resources held by a small farm household. Integration means dependence of one operation on the product or by-product of the other as in mixed farming systems.

Livestock improvement potential in traditional agriculture and characteristics and management of livestock in mixed farming systems were important topics at the workshop. Much interest has been generated in social forestry and viability of nonconventional feed resources for small farmers. A 2-day field trip which included overnight at the Bahadurnagar Livestock Production and Research Institute provided opportunity to study the linkages between experiment station and on-farm livestock research in farming systems. In the final session, specific work plans and action strategies were developed on such topics as:

- Livestock on-farm experiments.
- Curriculum and training for livestock systems.

Information was provided about animal production constraints and potentials in Sind, Baluchistan and NWFP mountain areas by Animal Scientists/Consultants. Other

*Improved small ruminant husbandry is being tested by participant farmers. Interdisciplinary animal scientists are assessing goat response to improved feed rations*

important presentations focused on rangeland sheep and goat production systems, Barani fodder livestock systems, strengthening:

- International linkages for livestock cropping systems and;
- livestock information transfer and extension services

Proceedings of this seminar/workshop on livestock in farming systems have been published and are available through PARC.

**FSR Travelling Seminar**

The first Farming Systems Research Travelling Seminar was conducted September 13-17, 1987. The main objective of the seminar was to visit various FSR sites to see the impact of various interventions and their possible application to other target areas. About 25 scientists representing crops, soils, livestock, and social sciences, participated from various provincial and federal institutions actively involved in farming systems research activity. This team visited Mansehra, Chakwal, Fatehjang, Shahkot and Proka areas. They discussed methodology and layout of a farm trial. On the final day, scientists presented reports about the progress farmers from each FSR site were observing in the validation of improved technology. Adoption of improved practices among farmers was evident.

*Caution is taken where FSR scientists introduce new livestock technology for farmer to test. Prof. Akram is explaining to the farmer expected benefits from improved fodder*

# FSR Organization

To establish and sustain a national FSR program as an integral part of the national research/extension system requires infrastructure linkages and information flow. Effective coordination of a national FSR program is made possible by a simple but sound organizational plan. Coordinating responsibilities in each province and linkage to the national FSR coordinator are defined (Annex I).

Effective FSR starts and ends with participant farmer. Each province through its FSR Committee in concert with the farmer provides the interdisciplinary thrust to diagnose problems, design and test improved technology. Besides commodity and component research other agencies are mobilized. The public and private sector collaborate in the FSR enterprise. Information flows in two way direction between province and National FSR Coordinator and from farm back to the experimental station.

The FSR organizational linkages and information flow is presented in Figure 2. In the right-hand column the FSR organization indicates the relationship between various provincial collaborators and the national FSR coordinator to provide effective coordination with other programs. Input supply agencies and international centres are indicated in the left-hand column. The FSR national coordinator and his associates collaborate with the FSR advisor in the planning, execution, and review of the Pakistan FSR program. This includes integrating research, extension, and training programs that transfer improved technology to the farmer. The national coordinator also works with interdisciplinary FSR technical specialists throughout the country to conduct FSR activities. He assists provincial coordinators in developing linkages with appropriate agencies in both the private and public sectors. The FSR national coordinator monitors progress and synchronizes support services, communications, materials and fund disbursement that are important functions of this cell.

National and provincial FSR committees are presented in Annex I. Job description must be defined and strategies executed to institutionalize the national FSR program as an integral part of the national research/extension system.

*Dr. Nissly USAID is receiving from Dr. Hanjra Associate Professor Animal Husbandry an answer to his question on silage feeding*

*Graduate students are used in several FSR projects. Mr. Bhatti graduate in animal science is examining the quality of silage made from a low cost constructed pit*

# *Many happy returns*

Despite resource constraints farming system researchers are amassing a wealth of information on existing and improved farming systems and putting it to use. Some of the exciting improvements coming from FSR Target areas and recommendation domains include:

* At Mansehra in NWFP, farmers working with Dhodial Experiment Station and university scientists have demonstrated highly significant maize increases with variety, 'Azam' under improved cultural practices. High rates of return by participating farmers can revolutionalize Maize system/livestock enterprises in the Mansehra district. Sharp increases from a new Basmati rice variety on low land soils in the rice-wheat-maize system have also aroused much farmer interest.

* At Fatehjang, the introduction of sunflower into the cropping pattern has provided farmers on these *barani* lands an alternative crop which has yielded well. Traditionally the farmer depended on one wheat crop annually due to uncertain rains. An improved health control program of sheep and goats has given farmers much incentive to adopt improved husbandry. From external parasite and vaccination interventions farmers have noted increased productivity and diminished mortality giving a 6:1 cost benefit ratios to better husbandry. In addition, animal scientists working with farmers and a fodder specialist have introduced green feed oats as a nutritious feed supplement. Sheep and goat weight gains, decreased mortality and better lambing are being observed. The agricultural economist has projected a partial budget which suggests a significant gain in net farm income from improved livestock health care and feeding over traditional livestock practices.

* To offset the wheat *bhoosa* shortage, farmers in the irrigated Shahkot FSR domain have discovered that the introduction of sorghum sudan grass (Sadabahar) is a very successful intervention. Together with Ipil Ipil (*Leuceana*) and lucerne these introductions are producing multi-cut high quality feed for dairy buffalo. There is more milk in the pail! The introduction of short duration rice variety, 'Basmati-385' followed by direct drilling of wheat into rice stubble enabled the farmer to plant wheat on time. Moreover, rice yields and quality are maintained and wheat production increased giving a combined result of increased net farm income. Farmers are enthusiastic and are adopting the low cost zero tillage technology.

* At the Proka site the FSR Team of the University of Agriculture, Faisalabad, is working with farmers in low cost silage making. The use of pit silage lined with plastic helps ferment excellent silage from surplus cane and forage legume. Multicut Sadabahar has also captured farmer interest. Rapid adoption of this fodder is assured.

* Intercropping of sugarcane at Tando Mohammad Khan in Sind with onion and radish has helped farmers increase productivity and raise net farm income. In the Hala FSR Target area, the introduction of mungbean and soybean into a wheat-cotton cropping pattern appears as an improved intervention. Much interest among the FSR domain farmers in growing improved mung and some soybean is evident

Improved technology as interventions into traditional farming systems generally require that farmers apply more inputs as seed, labour, agricultural chemicals or in the form of farm equipment. Many such inputs even double the investment the farmer is already making. The return on the improved technology is continually being monitored. Partial budget and cost benefit analyses indicate that returns among farmer participants vary up to at least 6 Rupees/1 Rupee invested in good years. Returns are less in dry years among *barani* land FSR farming participants. Improved technology tested by farmers under the FSR project has not only significantly increased net farm income but raised questions about relevance of certain technology generated at the experiment station. Research conducted in isolation of farmers fields reduces the chance of generated technology being adopted.

*Dr. Crowder Fodder Specialist appears impressed by this good legume stand*

# *Training opportunities in FSR*

Training for FSR workers varies according to level, nature of assignment, and individual expectations. The curriculum, facility, and learning experience are geared to the level of desired training.

**Farmer-level Training**

An accelerated change by farmers from centuries-old practices to improved farming systems requires training in modern technology and management skills. As partners in the research process, farmers in FSR target areas learn improved farming practices, crop varieties, and livestock husbandry. Field days, farm visits, workshops, and travelling seminars combine to provide farmer-level training in FSR.

**Middle-level Training**

Understanding the farmers' socioeconomic circumstances, recognizing important farm operations, and diagnosing problems are important FSR functions required of site assistants and field workers. Interesting experience on the farm with farming systems research/extension team members will be featured for the middle level FSR/E staff. Besides a developed capability in the agronomic and livestock husbandry skills, middle-level workers will be trained in record keeping. The systematic keeping of weekly farm records on designed formats will require on-farm workshop training.

**Undergraduate Training**

The growing complexity of farming and the need for increased farm production increases demand for qualified young scientists with a practical understanding of farmers' circumstances. The FSR/E approach developed among interdisciplinary scientists who understand well the farmers' resources and constraints deserves to be enhanced by changes in undergraduate training. Improved university curricula and facilities to encourage such training seems imperative.

One strategy would be to effect small changes in the existing agricultural university degree program to incorporate a FSR training thrust. For instance, in the present eight semester animal husbandry program (Annex II Appendix 1), the four hours allocated to practical training could include student on-farm visits. Students would analyze the present farm resources and management with the farmer.

*In the Kalat FSR Target Area of Baluchistan Scientists are testing a new technology to control weeds in a wheat-potato/onion system*

*Soil scientist Mr. Nizami assists in site characterization of a FSR target area*

*Poor lambing and high mortality in sheep diagnosed by FSR scientists suggest improved livestock husbandry interventions*

*Socio-economic circumstances of small farmers are documented in the FSR target area. Training to conduct farmer interviews and analyze information is an important FSR function*

An introductory one-semester farming systems research course (Annex II Appendix 2) would support the present farm practicum. Presently eight semester animal husbandry students are assigned farm tasks such as housing and feeding of livestock under real farmer conditions. Internship training on farms would provide senior students experience in problem diagnosis in the testing of improved technology. To accompany this farm practice, senior students may take a farming systems and farm management course through the final year as (Annex II Appendix 3). In addition to agronomy, agricultural economics, animal husbandry and soils, team teaching should include agricultural education and extension. A modified Semester VIII on farm extension work (Annex II Appendix 4) may be instituted.

Suggested practical work should include:

- not less than 6 weeks farming under three different systems of contrasting cropping patterns and livestock management.
- approval to substitute upto 12 weeks of student practicum in agricultural servicing sector including research and (or) extension.
- completed statement by student of work performed on prescribed formats.

A scheme of study for B.Sc. (Hons.) Farming Systems is urgently needed for each agricultural university in Pakistan. An illustrative FSR curriculum is given in Annex II Appendix 5. Required courses for the undergraduate would include plant, soil, and livestock sciences as well as economics and system management. The farming system and (or) management courses taken each year would prepare the undergraduate for leadership positions in the public and private sectors. In addition, this proposed farming system scheme of study could also prepare the student for postgraduate studies.

**Postgraduate Training**

Curriculum and training towards a postgraduate degree in FSR would emphasize quantitative management methods of farming systems. Students may enter the FSR postgraduate scheme with a soil, crop, livestock, economic or education extension background. Thesis work in each instance would conveniently include studies within FSR target areas.

Multidisciplinary postgraduate team research would be encouraged. It is proposed that once postgraduate FSR interdisciplinary thesis research has been established, the university initiate the advanced farming system and management analysis course. One such course is illustrated in Appendix 6.

**In-country Seminars, Workshops, and Short-term Courses**

FSR-related courses, workshops in problem diagnosis, on-farm research design and travelling seminars for participant farmers will accelerate student and faculty understanding of the FSR approach. Library services provided through NARC will enable the FSR/E team to keep current with all pertinent information.

**International Training in FSR**

Most of the international centres including International Rice Research Institute (IRRI), International Maize and Wheat Improvement Centre (CIMMYT), International Institute of Tropical Agriculture (IITA), and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) provide training in FSR. The FSR Institute at the University of Philippines at Los Banos offers regular graduate-level instruction. Course work is offered at several Thai universities, particularly Chiang Mai, Khon Kaen, and Kasetsart. These universities also have established programs to provide the necessary field exposure. In addition, Bogor and Padjadjaran Universities in Indonesia provide instruction in FSR. A number of American universities offer graduate-level training in the theory of FSR for their M.S. and Ph.D. students. Other universities that provide formal FSR training include Florida State at Gainesvile, Colorado State, Cornell, Hawaii, and Michigan State. A listing of universities offering FSR training is presented in Appendix 7.

*Frequent S.T. Training and workshops are conducted fc scientists are participating in FS*

*Frequent farm visits by multidisciplinary scientists enable continued diagnosis of production problems. Here the team looks at pests in a NWFP farmer's field located within the Mansehra FSR target area*

# FSR and the agricultural network

*entists and extension officers on specific topics. These*
*nning and review meeting*

An expanded FSR thrust will increase farm productivity and create an agricultural research system with a strong farmer orientation. By providing policymakers with valuable data at the micro level, FSR can effectively influence input subsidies, food policy, and marketing strategies. FSR will provide information about physical and biological responses under farm conditions and about constraints in credit, seed, fertilizer, irrigation, and marketing services within FSR target areas.

Sustained farming systems research depends on 1) supplementing rather than replacing commodity programs, 2) strengthening linkages and multidisciplinary collaboration between research, extension and social and biological scientists, and 3) making immediate changes in the agricultural curriculum and training environment.

*Agro-forestry is practiced among some of the FSR project farmers. Suitability of leguminous trees to augment fuel and fodder needs have been well recognized and are under test*

# ANNEX I

## FUNCTIONS AND MEMBERSHIP OF FSR COMMITTEES, COORDINATORS AND FIELD ASSISTANTS

**FSR National Committee (meets biannually)**

*FUNCTIONS*

- formulate policies to achieve FSR objectives and strategies to guide provincial coordination
- approve overall research/extension/training direction and plans
- approve staff, resource allocation, budgets and financial monitoring
- strengthen linkages among federal and provincial agencies

*MEMBERSHIP* (Proposed)

| | |
|---|---|
| – Chairman PARC/Representative of Chairman | |
| – Technical Members/Research Directors General | 4 |
| – Vice-Chancellors of agricultural university/Representatives | 3 |
| – Provincial Agric. Secretaries/Representatives | 4 |
| – FSR National Coordinator | 1 |
| Total: | 12 |

**National FSR Coordinator and Associates**

*FUNCTIONS*

- provide overall leadership and coordination to the Pakistan Farming Systems Research Project with assistance from associate coordinators for livestock and social sciences
- strengthen linkages with each provincial FSR leader/coordinator in planning, conducting, and monitoring the FSR project including the FSR women's component
- collaborate with the international centres for the development of FSR training materials and research pertinent to Pakistan
- integrate and supervise the NARC components of the FSR project work plans
- develop resource needs, including FSR budgets, and guide the process of FSR project review and budget approval

**Women's FSR Associate Coordinator**

*FUNCTIONS*

- develop methodology that advances our understanding of the role of women in selected target areas of Pakistan
- establish priority resource and training needs for effective diagnosis, testing, and evaluation of improved interventions in FSR
- provide suitable training of FSR women's teams for effective participation in FSR projects
- institutionalize concerns for women's role in agricultural research and extension programs on farming system
- develop, test, and disseminate technology tailored to the needs of women engaged in agriculture
- evaluate the extent to which researchers' concerns promote women's interests and contribute positively to households
- articulate a policy framework that will enable farm women laborers to participate actively in technology development and to benefit from technological innovations

**FSR Provincial Coordination Committee (PCC)**

*FUNCTIONS*

- assist development of policy plans, implementation of FSR programs and allocation of resources within the province
- coordinate the technical specialists and line agency inputs at the provincial level
- maintain liaison between the provincial agencies and private sector for timely inputs (seed, agricultural chemicals, credit, etc.)
- review, revise as appropriate, and sanction annual work plan
- monitor project progress in achieving FSR goals and take remedial action where needed

*MEMBERSHIP*

| | |
|---|---|
| – Chairman (appointed by agricultural university Vice-Chancellors or Provincial Directors General/Research or Representative) | 1 |
| – Provincial Directorate-General/Extension (or Representatives.) | 1 |
| – Technical Specialists* | 4 |
| – FSR Site Coordinator(s) or Director | 1 |
| – Farmer Representative(s)* | 2 |
| – Co-opted Member(s)* | 2 |

| | |
|---|---|
| – FSR specialist (Secretary) | 1 |
| Total: | 12 |

**Appointed by PCC/FSR Chairman*

**FSR Target Area Coordinators and Assistants**

*FUNCTIONS*

- conduct and monitor on-farm trials
- coordinate all research, extension and training plans and activities in the FSR target areas
- collaborate with the provincial FSR technical specialists in supervision of constraint diagnosis and development of problem resolution strategies including the implementation and monitoring of interventions
- supervise farm site assistants in their respective tasks, arranging training and logistic support as needed
- develop resource needs such as operational budget, facilities and equipment as well as transport
- update target area work plans and prepare reports/publications in concert with FSR advisor
- strengthen linkages among all input/output services

**On-farm Site Assistants Selected from Appropriate Villages**

*FUNCTIONS*

- provide liaison among farmers, coordinators, researchers, and extensionists in all FSR activities
- assist in selection of fields for and timing of interventions
- record (for the farms under his charge) daily on prescribed formats all farm activities, farm inputs, and outputs together with cash transactions
- assist the FSR coordinator (to whom he is responsible) as requested in the collection of relevant data

**Technical Specialists Work Groups**

*FUNCTIONS*

- assist identification of target area, select participating farmers, and define research domains
- identify and prioritize problems and design/test interventions under farmer management
- provide improved germplasm/technology as needed and initiate priority component research (experiment station and on-farm)
- prepare technical papers and published reports and assist in the effective transfer of tested improved technology

*An agricultural economist from Sind Agriculture University, Mr. Siddiqi has told the farmer that his income was doubled due to a FSR intervention. However, this farmer apparently needs more convincing.*

# ANNEX II

APPENDIX 1

## SCHEME OF STUDY FOR THE DEGREE OF B.Sc. (Hons.) ANIMAL HUSBANDRY

| | | Credit hours |
|---|---|---|
| **Major Courses** | | |
| ABG–401 | Farm Animals | 4(3–2) |
| LM–411 | Sheep Production | 4(3–2) |
| NUTR–421 | Minerals and Vitamin Metabolism | 4(3–2) |
| PH–431 | Incubation Principles and Practices | 4(3–2) |
| NUTR–423 | Pakistan Studies | 4(3–2) |
| **Supporting Courses** | | |
| VAR–580 | Reproduction in Livestock | 5(3–2) |
| FM–501 | Planning for Livestock Production | 3(3–0) |
| SSH–502 | Pakistan Studies | 2(2–0) |
| ABG–502 | Breeding Systems and Plans | 4(3–2) |
| LM–512 | Principles of Milk Secretion | 4(3–2) |
| NUTR–522 | Feeding of Farm Animals | 4(3–2) |
| PH–532 | Poultry Feeding Practices | 4(3–2) |
| ABG–503 | Farm Practices | 1(0–2) |

*Levelling of land and water use efficiency trials are being studied as improved FSR interventions at both Shahkot and Proka target area. A newly dug silage pit can be seen between farmer and scientist*

# ANNEX II

APPENDIX 2

## INTRODUCTORY FARMING SYSTEMS RESEARCH

**Duration:** **1 semester**

Offering: Department of Agricultural Economics, Department of Agronomy, and Department of Livestock Management

Level: Junior year students from agriculture and animal sciences

**Course Objectives**

- to introduce students to the philosophy of systems research
- to provide an understanding of the crop-livestock interactions and develop a framework for farm-level development
- to teach analytical approaches required in the description, diagnosis, design, testing, and evaluation of new farm technologies
- to provide opportunity to work directly with farmers and develop a senior paper that demonstrates the basic skills required for farm-level research

*Note:* *The course will be a joint offering. The relative emphasis on crops versus livestock will depend on whether the student is enrolled for a B.S. in agriculture faculty or animal science faculty. Instruction will be by an interdisciplinary team of instructors.*

**Course Outline**

A. A FARMING SYSTEMS PERSPECTIVE TO RESEARCH AND DEVELOPMENT
   1. Definition of FSR
   2. Scope of FSR
   3. Differences between FSR and traditional research approaches
   4. Philosophy of FSR in an international perspective
   5. International agricultural research system
   6. Overview of the course

B. SYSTEM FRAMEWORK
   1. System methodology
      a. description
      b. diagnosis
      c. technology design
      d. technology testing
      e. evaluation
   2. **Crop-livestock interactions**
      a. crop-crop
      b. crop-livestock
      c. crop-orchard
      d. crop-labour
      e. livestock-labour
      f. crop-livestock-off-farm
      g. other
   3. **Soil-water-land-animal-man biosystems**
      a. understanding farmer circumstances
      b. farmer decison-making under constrained environments
      c. implications of interactions on systems productivity

C. STUDY OF CROP COMPONENT
   1. Approaches to effective problem diagnosis
   2. Describing the crop component on a farm
   3. Analyzing farmer constraints and identifying possible technology interventions
   4. Quantitative approaches to crop evaluation
   5. Qualitative approaches to crop evaluation

D. SOCIO-ECONOMIC METHODOLOGIES FOR SYSTEM EVALUATION
   1. The role of the social scientist in biological research
   2. Socio-economic methods of understanding farmer circumstances
   3. Prescreening technologies
   4. Evaluation of farm level data for inducing change
   5. The technical-social scientists partners in research

E. MAJOR FARMING SYSTEM OF PAKISTAN
   1. Farming Systems of Punjab
   2. Farming Systems of Sind
   3. Farming Systems of NWFP
   4. Farming Systems of Baluchistan

F. FIELD PRACTICE FOR SOCIAL AND BIOLOGICAL WORKERS

*Notes:*

1. *Teachers should be given orientation and chance to develop training material at NARC. Teachers should be selected in groups and provided 1-2 week orientation and the necessary training.*
2. *Students normally take one course which covers the basics of production economics and farm decisions.*

# ANNEX II
## APPENDIX 3

### FARMING SYSTEMS AND FARM MANAGEMENT
### (Final Year Undergraduate)

Final undergraduate year
Animal Husbandry, Agronomy, Agricultural Economics, Soils and Extension
Seniors and M. Sc. students

**Objectives**

- to develop an understanding of ongoing farm systems and diagnose production/marketing constraints
- to understand the options available to accepted management practices and to develop an ability to conceive, research, and analyze alternative options
- to develop an ability to understand a farmer's objectives and capacity for management; to communicate with and advise a farmer; to understand what a farmer wants to do
- to investigate plausible improved technological and managerial (economic and structural reorganization) interventions into traditional farming systems
- to develop an appreciation of the functions and importance of the industries servicing agriculture and diagnose how their performance can be enhanced
- to develop an ability to work as interdisciplinary teams to exchange views and to constructively comment on other views and other decisions
- to question and to be questioned: why, how, where, when, what, and who; management must be dynamic, but use the past as a guide
- to enable a student to become technically and professionally competent in FSR approach and perspective

**Subject Areas**

- the farming systems approach – describing the farm, the management, and the finances, and drawing up management interventions based on priority constraints to improve productivity and farmer welfare
- the farmer as an individual and his family
- soil and water management
- cropping patterns and field husbandry
- livestock husbandry
- feed assessment, evaluation, and budgeting
- financial management, cash flow budgeting
- accounts analysis – cash
- ownership structure
- development and economic issues

**Field Trips**

Projects will be set for all farm visits. Discussion topics also may be set during or at the end of a visit. There will be two groups for field trips and tours. Question Masters will be appointed on a rotational basis. Their duties will include finding the way to farms, compiling climate and soil maps, and other secondary data.

Study selected farms under the following systems:

- Barani agriculture – Chakwal target area
- moderate rainfall – Fatehjang target area
- high rainfall – Mansehra target area
- high country – mixed farming sheep/goats
- irrigated – wheat rice
- irrigated wheat cotton – mixed farming milk
- horticulture and irrigated orchards
- poultry – broiler chicken – integrated industry
- fishing industry – marine, aquaculture

**Study Tours**

- livestock/crop experiment stations
- fodder/agroforestry sheep/goat experiment stations
- multicrop experiment station(s)
- horticultural experiment station (s)

**Projects**

Projects will be assigned for every field trip. These projects will be discussed and collected for marking. All project marks will be included in the year's final assessment. Students should do all projects on an individual basis unless otherwise directed. Where groups work on a project collectively, the names of all members must be shown. Students will be allocated their farm project during semester one.

**Examinations**

The mid-year test consists of a written paper. The final examination in this course consist of a written paper. The possible weighing of marks over the year is as follows:

| | |
|---|---|
| Final written examination | 30 |
| Major farm project | 40 |
| Mid-year test | 10 |
| Projects | 20 |
| Total: | 100 |

# ANNEX II

## APPENDIX 4

### DEPARTMENT OF AGRICULTURAL EDUCATION AND EXTENSION

**Semester V**

| | | |
|---|---|---|
| AEE 501 | Introduction to Communication | 3(3–0) |
| AEE 502 | Educational Psychology | 4(4–0) |
| AEE 503 | Extension Education in Pakistan | 4(4–0) |
| AEE 504 | Teaching Methods in Agriculture | 4(3–2) |

**Semester VI**

| | | |
|---|---|---|
| AEE 505 | Audio-Visual in Teaching | 4(2–4) |
| AEE 506 | Program Development | 4(3–2) |
| AEE 507 | Principles of Education and Curriculum Development | 3(3–0) |
| AEE 507 | Administration and Supervision | 4(4–0) |

**Semester VII**

| | | |
|---|---|---|
| AEE 602 | Approaches to Rural Development in Pakistan | 4(3–2) |
| AEE 603 | Project Development and Report Writing | 3(2–2) |
| AEE 604 | Preparing Rural Youth for Agriculture | 4(4–0) |
| AEE 605 | Research Methods in Education and Extension | 4(3–2) |

**Semester VIII**

| | | |
|---|---|---|
| AEE 606 | Lesson Planning and Practice Teaching | 5(1–8) |
| AEE 607 | On-farm Extension Work | 10(2–16) |
| AEE 608 | Writing and Presentation of Report on Field Experiences | 5(0–10) |
| AEE 609 | On Farm Extension Work-I | 5(1–8) |
| AEE 610 | On Farm Extension Work-II | 5(1–8) |

*Note: Semesters I to IV remain unchanged in the Calendar of University of Agriculture, Faisalabad.*

# ANNEX II
APPENDIX 5

## AN ILLUSTRATIVE FSR CURRICULUM

| Course description number | Course name | Prerequisite | Recommended preparation |
|---|---|---|---|
| **100 Level Subjects** | | | |
| ACCY 111 | Accounting Fundamentals | | |
| COSC 111 | Computing | | |
| ECON 111 | Economics | | |
| MATH 111 | Elements of Mathematics | | |
| STAT 111 | Statistics | | |
| **200 Level Subjects** | | | |
| FMGT 200 | Introduction to Farming Systems | | |
| ANSC 211 | Animal Science | | |
| ANSC 212 | Animal Production | | |
| HORT 211 | Principles of Horticulture | | |
| PLSC 211 | Aspects of Plant Science | | |
| PLSC 212 | Principles of Plant Protection | | |
| SOIL 211 | Soil Science | | |
| **300 Level Subjects** | | | |
| ACCY 311 | Financial Accounting | ACCY 111 | |
| ACCU 312 | Management Accounting | ACCY 111 | |
| ACCY 313 | Accounting Information System | ACCY 111<br>COSC 111 | |
| AENG 311 | Agricultural Engineering | ANSC 211 | |
| ANSC 312 | Livestock Farming System II | ANSC 311 | |
| SOIL 312 | Soil and Water System | SOIL 211 | |
| COSC 311 | Computer Programming | COSC 111 | |
| COSC 312 | Computer Concepts & Organization | COSC 311 | |
| ECMT 311 | Mathematical Economics | MATH 111 | |
| ECON 311 | Managerial Economics | ECON 111 | |
| ECON 312 | Intermediate Macroeconomics | ECON 111 | |
| ECON 313 | Intermediate Microeconomics | ECON 111 | |
| FINM 311 | Principles of Financial Management | | LAWS 311 |
| FMGT 311 | Principles of Farm Management | | SOIL 211,<br>ANSC 211,<br>PLSC 211 |
| FMGT 312 | Farm Management Analysis | | SOIL 211,<br>ANSC 211,<br>PLSC 211,<br>FMGT 311/<br>FMGT 313 |
| HMGT 313 | Farming Systems | | ANSC 212,<br>PLSC 212 |
| FORT 311 | Horticultural Crop Production I | HORT 211 | PLSC 211,<br>SOIL 211 |
| HORT 312 | Horticultural Crop Production II | HORT 211 | PLSC 211,<br>SOIL 211 |

Continued.....

| | | | |
|---|---|---|---|
| HMGT 311 | Principles of Horticultural Management | | HORT 211, PLSC 211, SOIL 211 |
| HMGT 312 | Horticultural Management Analysis | | HORT 211, PLSC 211, SOIL 211, HMGT 311 |
| LAWS 311 | Principles of Commercial Law | | |
| LAWS 312 | Principles of the Laws of Organization and Taxation | ACCY 111 | |
| MKTG 311 | Principles of Marketing | ECON 111 | |
| PLSC 311 | Plant Protection (Agriculture) Systems | HORT 211 | |
| RVAL 311 | Principles of Rural Valuation | | SOIL 211, FMGT 311 |
| ACCY 412 | Auditing | ACCY 313 | |
| BMGT 421 | Business Management | ECON 311 | |
| BMGT 422 | Business and Marketing Technology | | |
| | Econometric Methods | ECMT 311, ECMT 312 | |
| ECON 411 | Advanced Production Economics | ECON 313 | ECMT 311 |
| ECON 412 | International Economics | ECON 312, ECON 313 | |
| ECON 416 | Economic Development | ECON 311/313 ECON 311/313, ECON 312 | |
| FMGT 421 | Advanced Farm Management | ACCY 111, FMGT 311, LAWS 311 | SOIL 211 |
| MKGT 411 | Marketing Research | MKGT 311, ECMT 312 | |

# ANNEX II
## APPENDIX 6

### ADVANCED FARMING SYSTEM AND MANAGEMENT ANALYSIS (Postgraduate)

**Course Objectives**
The objective of this course is to provide the skills to apply quantitative management methods to farming systems. The course will cover:

- the farm as a system
- accounts analysis
- farming planning and control
- planning and decision-making using linear programming
- investment analysis
- cost benefit analysis
- dealing with risk and uncertainty in decision-making

The course will adopt a self-learning approach backed up by regular workshops. Required reading for each topic will be reinforced by a short lecture and further in-depth reading. At the end of each section of reading material there will be discussion question which should be prepared to discuss in class at the time of the lecture or workshop.

Regular workshops will also be held with the aim of reinforcing the theory with practical examples. These will be handed in for marking.

**Projects**
There will be three projects associated with the course. The project details will be provided.

- computer project
- linear programming
- investment analysis

**Workshops**
A number of workshops are associated with the course. The aim of these workshops is to reinforce the theory with practical examples. You will be given sufficient lecture time to complete these workshops.

**Assessment**
The assessment for the course will occur in the following manner:

| | |
|---|---|
| – computing project | 5 |
| – linear programming project | 15 |
| -- investment analysis project | 10 |
| – workshops | 10 |
| – mid-semester test | 20 |
| – end of year examination | 40 |
| Total: | 100 |

# ANNEX II
## APPENDIX 7

### WORLD FSR UNIVERSITY TRAINING

Courses in FSR/E methods were first given at the University of Florida and Cornell University (ca. 1980). From this beginning, at least eight additional U.S. universities offer FSR/E courses or courses incorporating the FSR/E approach, including Arizona, California at Davis, Colorado State, Hawaii, Kansas State, Kentucky, Michigan State, Minnesota, and Virginia Tech. In addition, the University of Florida now offers a minor in farming systems to both M.S. and Ph.D. level students and awards four assistantships annually for specific FSR/E study. The following European universities have incorporated FSR/E into their curricula: Institute of Development Studies/Sussex and the Imperial College of Science and Technology, London, Great Britain, and the Agricultural University, Wageningen, The Netherlands. In Central America, CATIE, Turrialba, Costa Rica incorporates the FSR/E approach into the curriculum. In Southeast Asia and the Pacific, the six universities of the Southeast Asian Universities Agroecosystems Network (SUAN) all offer instructions in the philosophy of FSR/E: Bogor and Padjadaran in Indonesia, Baguio and Los Banos in the Philippines, and Chiang Mai and Khon Kaen in Thailand, as does Hawkesbury College in Australia. African universities are also playing a growing role in the operation of FSR/E projects, and increasingly in teaching FSR/E methods. For example, the University of Zimbabwe has a FSR/E project with informal linkages to the national FSR/E unit, and operates an annual program with support from CIMMYT's East African Program. Sokoine University in Tanzania, Egerton College in Kenya, the University of Swaziland, Njala University in Sierra Leone and the University Center Dschang in Cameroon all have ongoing FSR/E projects, and Makerere University in Uganda is starting a similar effort. Njala offers courses in FSR/E methods and students gain hands-on experience in the field project, supported by the International Development Research Centre (IDRC), Canada.

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