

8th Annual  
**FARMING SYSTEMS RESEARCH/  
EXTENSION SYMPOSIUM**

**Program and Abstracts**



Presented by

**The International Agricultural Programs Office  
University of Arkansas, Fayetteville**

in collaboration with

**Winrock International Institute  
for Agricultural Development**

**October 9-12, 1988  
Center for Continuing Education  
Fayetteville, Arkansas**

# **Contributions of FSR/E Towards Sustainable Agricultural Systems**

1988 Farming Systems Research/Extension Symposium  
October 9-12

## ***Conference Themes:***

- o FSR/E Accomplishments in the Field*
- o Methodologies for Assessing the Impact of FSR/E*
- o Gender and Intra-Household Issues in FSR/E*
- o The Role of Information/Communication Systems in FSR/E*
- o Special Topics*

To address the special regional concerns of developing countries, and provide a forum for the growing interest in Farming Systems in the United States, the first full day of the Symposium, October 10, will be organized around concurrent sessions with a regional focus on:

Africa  
Asia/Near East

Latin America  
United States

## 1988 FARMING SYSTEMS RESEARCH/EXTENSION SYMPOSIUM

Sunday, October 9				Monday, October 10, cont.			
Time	Room	Session Number	Session	Time	Room	Session Number	Session
1:00 pm-5:00 pm	CCE 2nd Floor Lobby		Symposium Registration	1:30 pm-3:30 pm	CCE 402	4	"Description, Analysis and Implications"
5:00 pm-8:00 pm			Regional Sessions Coordination Meetings	3:30 pm-5:30 pm	CCE 402	5	"Methods and Techniques of Doing FSR/E"
	CCE 402		Africa	<b>ASIA</b>			
	CCE 405		Asia	9:00 am-11:15 am	CCE 405	6	"Impact Evaluation"
	CCE 107		Latin America	11:15 am-1:15 pm	CCE 405	7	"Farmer Led Experimentation"
	CCE 409		United States	1:15 pm-2:30 pm	open		Lunch
8:00 pm-8:45 pm	CCE 204	1	Opening Remarks and Welcoming to the 1988 Farming Systems Research/Extension Symposium	2:30 pm-4:45 pm	CCE405	8	"Extension Linkages"
8:45 pm-9:00 pm	Hilton/Sequoyah Ballroom		Symposium Opening Reception	<b>LATIN AMERICA</b>			
<b>Monday, October 10</b>				9:30 am-12:00 pm	CCE 107	9	"Methodologies for Assessing FSR/E Projects"
7:00 am-8:00 am	CCE 2nd Floor Lobby		Continental Breakfast	12:00 pm-1:30 pm	open		Lunch
8:00 am-9:00 am	CCE 204	2	Welcome to the Fayetteville Campus - Dr. Daniel Ferritor, Chancellor	1:30 pm-5:00 pm	CCE 107	10	"Gender and Intra-Household Issues" and "FSR/E Accomplishments in Latin America and the Caribbean"
			Keynote Address: "FSR in Evolution: Past and Future" Dr. Michael Collinson Consultative Group on International Agricultural Research/World Bank	<b>UNITED STATES</b>			
			Introduced by Dr. Hank Fitzhugh, Winrock International Institute for Agricultural Development	9:00 am-10:15 am	CCE 409	11	"Federal Initiatives" Introduction of Mr. Charles Culver, Legislative Aide to Senator Dale Bumpers, by Dr. Preston La Ferney, Vice President for Agriculture
9:30 am-10:00 am			Break	10:15 am-12:00 pm	CCE 409	12	"Domestic FSR/E Accomplishments"
<b>CONCURRENT REGIONAL SESSIONS</b>				12:00 pm-1:30 pm	open		Lunch
<i>Concurrent sessions focused on four major regions of the world will occupy the remainder of the afternoon. Break times for each session will be announced by session leaders.</i>				1:30 pm-3:00 pm	CCE 409	13	"Methodologies for Domestic FSR/E"
<b>AFRICA</b>				3:00 pm-4:30 pm	CCE 409	14	"Special Topics"
9:30 am-12:00 pm	CCE 402	3	"Lessons from Experience with FSR/E in Africa"	7:00 pm-9:00 pm	Hilton/Sequoyah Ballroom		Cash Bar & Buffet FSR/E Steering Committee Report Poster Sessions
12:00 pm-1:30 pm	open		Lunch				

Tuesday, October 11			
Time	Room	Session Number	Session
7:00 am-8:00 am	Hilton/ Sequoyah Ballroom		Continental Breakfast Informal Breakfast Meeting: Regional FSR/E Networks All Regions Invited. Contact Person: George Axinn
8:00 am-4:30 pm	CCE 2nd Floor Lobby		Symposium Late Registration
8:00 am-9:30 am	CCE 204	15	Regional Sessions Synthesis:  Africa Asia Latin America United States
9:30 am-10:15 am	CCE 204	16	Methodologies Keynote Address: "Assessing Institutional Impact of On-Farm Research Programs: Lessons from a Nine-Country Study" Dr. Deborah Merrill Sands International Service for National Agricultural Research, The Hague, Netherlands Introduced by Dr. Tom Westing International Agricultural Programs, Univ. of Arkansas
10:15 am-10:45 am			Break
10:45 am-11:30 am	CCE 204	17	Gender Issues Keynote Address: "Gender Issues in Farming Systems Research and Extension" Dr. Susan Poata, Gender and Agriculture Project, Population Council, New York Introduced by Dr. Richard Harwood, Winrock International Institute for Agricultural Dev- elopment
11:30 am-12:15 pm	CCE 204	18	Information/Communications Keynote Address: "Back to the Future: The Power of Commu- nications and Information" James W. King and Charles A. Francis, Univ. of Nebraska Introduced by Dr. Richard Harwood, Winrock International Institute for Agricultural Dev- elopment
12:30 pm-1:45 pm	Hilton/ Sequoyah Ballroom	19	Luncheon Panel Assessment/Inventory Results Presentations Facilitator: Bob Hudgens, Winrock Institute for Agricultural Development

Tuesday, October 11, cont.			
<p>Panel Members: Kerry Byrnes, USAID Billy DeWalt, Univ. of Kentucky Tim Frankenberger, Univ. of Ariz. Hal McArthur, Univ. of Hawaii</p>			
<b>CONCURRENT GLOBAL SESSIONS</b>			
<p>Concurrent global sessions will address the main themes of the Symposium:</p> <ul style="list-style-type: none"> <li>o FSR/E Accomplishments in the Field</li> <li>o Methodologies for Assessing the Impact of FSR/E</li> <li>o Gender and Intra-Household Issues in FSR/E</li> <li>o The Role of Information/Communications Systems in FSR/E</li> <li>o Special Topics</li> </ul>			
2:00 pm-3:30 pm	CCE 402	20	"FSR/E Accomplishments in the Field"
	CCE 404	21	"FSR/E Methodologies: Economic Perspectives"
	CCE 107	22	"Gender and Intra-Household Issues in FSR/E"
	CCE 407	23	"The Role of Information/Communications Systems in FSR/E"
	CCE 405	24	"Special Topics: Agroforestry"
	CCE 409	25	"Special Topics: Descriptions of Agricultural Production Systems"
3:30 pm-4:00 pm			Break
4:00 pm-5:30 pm	CCE 402	26	"FSR/E Accomplishments in the Field"
	CCE 404	27	"FSR/E Methodologies and Approaches"
	CCE 407	28	"Gender and Intra-Household Issues in FSR/E"
	CCE 409	29	"Special Topics: Natural Resource Management"
	CCE 405	30	"Special Topics: Linkages with Policy Analysis Units in Less Developed Countries"
7:00 pm-9:00 pm	Hilton/ Sequoyah Ballroom		Poster Sessions Cash Bar

Wednesday, October 12			
Time	Room	Session Number	Session
7:00 am-8:00 am	Hilton/ Sequoyah Ballroom		Continental Breakfast Informal Breakfast Meeting: "Institutionalization of FSR/E" All interested parties invited. Contact person: George Axinn
8:00 am-9:00 am	CCE 204	31	FSR/E Steering Committee Panel Presentation: "Concept Paper for Future FSR/E Activities" Facilitator: Steve Kears, Univ. of Florida Panel Members: Robert Castro, USAID James Chapman, Chemonics, Inc. Michael Collinson, CGIAR Robert Hart, Rodale Institute Rosalie Norem, Iowa State Univ David Norman, Botswana ATIP/ Kansas State Univ.
9:00 am-9:30 am	CCE 204	32	Remarks from Symposium Organizers: Dr. Tom Westing
9:30 am-10:00 am			Break
CONCURRENT GLOBAL SESSIONS			
10:00 am-11:30 am	CCE 404	33	"FSR/E Methodologies: Recommendation Domains"
	CCE 402	34	"Innovative FSR/E Methodologies"
	CCE 107	35	"Gender and Intra-Household Issues in FSR/E"
	CCE 407	36	"The Role of Information/Com- munication Systems in FSR/E"
	CCE 409	37	"Special Topics: Research/ Extension Linkages"
	CCE 405	38	"Special Topics: Regional National or Sub-National FSR/E Program Descriptions"
11:30 am-1:00 pm	open		Lunch
1:00 pm-2:30 pm	CCE 402	39	"Methodologies for Assessing the Impact of FSR/E"

Wednesday, October 12, cont.			
	CCE 404	40	"Methodologies for Learning about Gender Roles in FSR/E: A Panel"
	CCE 407	41	Video Presentation and Discussion Session: "Communication Strategies for Inventors and Users of New Technology"
	CCE 405	42	"Special Topics: Regional, National or Sub-National FSR/E Program Descriptions"
1:00 pm-2:30 pm	CCE 409	43	Project Sharing Session: University of Arkansas
2:30 pm-3:00 pm			Break
GLOBAL SESSIONS SYNTHESIS			
<i>Facilitators for the global sessions will present a synthesis of these sessions by major Symposium themes, summarizing overall comments and policy recommendations for the future.</i>			
3:00 pm-5:00 pm	CCE 204	44	Synthesis: "Gender and Intra- Household Issues in FSR/E"
			Synthesis: "Methodologies for Assessing the Impact of FSR/E"
			Synthesis: "The Role of Information Communications in FSR/E"
			Synthesis: "Special Topics"
			Synthesis: "FSR/E Accomplishments in the Field"
7:00 pm-9:00 pm		45	Open Meeting of the FSR/E Network

## PRE- AND POST-SYMPOSIUM SHORT-COURSE OFFERINGS

**TRAINING FOR TRAINERS**  
Sponsored by the Gender and Agriculture Project  
October 2 - October 7, 1988  
7:00 p.m. Sunday through 5:00 p.m. Friday  
Walker Room, Hilton Hotel

This short course will utilize case study teaching and practice in analysis as a method of assisting agricultural practitioners in incorporating gender into on-going agricultural research and extension projects. It will provide a basic foundation and the skills necessary to conduct training programs in-country and other settings on the application of gender analysis to agricultural research and development.

Fee: \$650.00

**FARMING SYSTEMS RESEARCH METHODOLOGIES: THE NEXT DECADE**

October 13 - 17, 1988 8:00 a.m. - 5:00 p.m.  
Walker Room, Hilton Hotel

A five-day intensive workshop on Farming Systems Research and Extension methodologies will immediately follow the 8th Annual FSR/E Symposium. The course content will be tailored to meet the needs of International Agricultural Practitioners, who have some experience in the design, implementation, and analysis to field research. Workshop will emphasize management techniques for integrating crop, livestock, and forestry experiments, operational problems related to inter-institutional linkages, in-service training, gender issues and data management, successful research techniques, as well as the interplay between FSR methodology and natural resource management concerns.

Fee: \$750.00

**HEIFER PROJECT INTERNATIONAL LEARNING AND LIVESTOCK CENTER**

**SMALL FARM PROJECT LEARNING TRAIL**  
Perryville, Arkansas

October 13, 1988 6:00 a.m. - 7:00 p.m.

The Small Farm Project Learning Trail - a sustainable, small farm - will be available for tour. Tour will highlight a two-acre section of a steep hillside where this productive, diversified farm demonstrates use of livestock in the developing country context, use of solar energy in cooking, brick making, utilizing weeds within the household and farm system, and limited cage aquaculture.

Fee: \$65.00

**THE MICROCOMPUTER: AGRICULTURAL APPLICATIONS**

October 5 - 9, 1988 8:00 a.m. - 7:00 p.m.

Business Administration, University of Arkansas campus

THE MICROCOMPUTER: Agricultural Applications is offered in response to training needs generated by expanded use of microcomputers in the developing country. It is designed for Agricultural Practitioners and Researchers who have responsibility for managing data and conducting statistical analysis. Training emphasis is on the microcomputer operating system, and on the use of a microcomputer to analyze field trial data and survey data. This five-days course of intensive training in computer applications provides each participant with individual computer access. Course format includes lecture-demonstration using overhead projection panel, "hands-on" experience four hours per day and open laboratory two hours per day. Training is on MS-DOS, dBASE III Plus, and a comprehensive statistical package.

Fee: \$850.00

**WORKSHOPS FOR PRESENTERS AND PANEL MODERATORS**  
Sunday, October 9, 1988

Four Sessions: 10:00, 11:00 a.m. & 2:00, 3:00 p.m.  
Center for Continuing Education

Workshop for Presentators will focus on methods to finalize presentations and plan for effective use of time allocated for presentation. Session one at 11:00 a.m. is repeated at 3:00 p.m.

Workshop for Facilitators will focus on specific skills for effectively integrating ideas from the conference sub-themes into open discussion following presentation of papers. First facilitator session at 10:00 a.m. is repeated at 2:00 p.m.

Fee: None

**GENDER AND AGRICULTURE PROJECT  
WOMEN PROFESSIONALS IN AGRICULTURE: A DISCUSSION**

Thursday, October 13: 8:30 a.m. - 10:30 a.m.  
Walker Room, Hilton Hotel

This discussion will provide a forum to examine the issues and of research, training, and programming relative to the subordinate position of women agricultural professionals and the efficiency of agricultural research and development.

Fee: None

**ENGLISH FOR AGRICULTURE**

October 3 - 7, 1988 8:00 a.m. - 5:00 p.m.  
Hotz Hall, University of Arkansas campus

This pre-symposium workshop for international agriculture practitioners is designed to improve English - English that is actually used in communicating about agriculture. Workshop will focus on vocabulary of agricultural English, structures of agricultural English, reading and writing in agriculture, giving and understanding oral presentations in agricultural English and editing the agriculture paper.

Fee: \$250.00

**VIDEOGRAPHY: RESOURCE MANAGEMENT AND PLANNING**  
October 7-8, 1988 and October 14-15, 1988

Walker Room, Hilton Hotel

This course will offer in-depth discussion of videography. Videography is the acquisition and interpretation of images obtained with a video camera. It is a powerful tool with wide application to resource and crop management, yield forecasting, stress management, and other disciplines. This course will provide training in utilization of this resource management tool, provide experience with image capture and analysis, and offer farming systems application. Two sessions are offered: A half day session for individuals seeking an overview is available with a two-days session for individuals requiring more information. Sessions are repeated post-symposium.

Fee: 1/2 day is \$75 with 2-days at \$260.00

**CONTRIBUTIONS OF FARMING SYSTEMS  
RESEARCH/EXTENSION TOWARDS SUSTAINABLE  
AGRICULTURAL SYSTEMS IN ARKANSAS**

October 9, 1988 8:00 a.m. - 5:00 p.m.  
Center for Continuing Education

This day long session is planned preceding the 1988 FSR/E Symposium to focus specifically on Arkansas, bringing together those organizations in the state already familiar with farming systems, and seeking out other groups and individuals working on farming systems issues. This program is grant-supported by the Winthrop Rockefeller Foundation, Little Rock, Arkansas.

Fee: \$15.00

**University of Arkansas Symposium Coordinating Staff**

Dr. Tom Westing  
Associate Dean, College of Agriculture  
Director, International Agricultural Programs

Dr. Donald Voth, Chair  
Acting Head, Department of Agricultural Econ. and Rural Sociology

Beth Barham  
Project Director/Development  
International Agricultural Programs

Pamela Styles  
Program Coordinator, International Agricultural Programs

Nancy Christman  
Short Course Coordinator and Gender Issues Liaison  
International Agricultural Programs

Dr. Robert Hudgens, Symposium Liaison  
Winrock International Institute for Agricultural Development

**Program Support Committees**

Special thanks to the special program support committees for gender issues, co-chaired by Hilary Feldstein and Dr. Susan V. Poats, and for information/communications, chaired by Steve Kearn, for their participation in program formulation.

**Regional Symposium Organizers**

The Symposium Coordinating Staff wishes to express its appreciation to the following Regional Symposium Committees for their assistance in organizing the regional portion of the program.

**AFRICA REGIONAL SYMPOSIUM ORGANIZERS**

Dr. George Axinn  
Michigan State University

Dr. Jim Bingen  
Michigan State University

Dr. Russ Freed  
Michigan State University

Dr. Delane E. Welsch  
University of Minnesota

Dr. Woods Thomas  
Purdue University

**ASIA/NE REGIONAL SYMPOSIUM ORGANIZERS**

Dr. Randy Barker  
Cornell University

Dr. Clive Lightfoot  
Visiting Fellow, Cornell University

Dr. Walter Coward  
Cornell University

Dr. John S. Caldwell  
Virginia Polytechnic Institute & State University

Dr. James L. Collom  
Consortium for International Development

**LATIN AMERICA REGIONAL SYMPOSIUM ORGANIZERS**

Dr. Michael F. Nolan  
University of Missouri

Dr. Constance McCorkle  
University of Missouri

Dr. Robert Hart  
Rodal Institute

Mr. Loren Schulze  
United States Agency for International Development

Mr. David Bathrick  
United States Agency for International Development

**U.S. REGIONAL SYMPOSIUM ORGANIZERS**

Dr. Jerry B. Eckert  
Colorado State University

Dr. W.R. Schmehl  
Colorado State University

David McNeal  
Extension Service/U.S. Department of Agriculture

Dr. Michael S. Joshua  
Virginia State University

**1987 FSR/E Steering Committee**

The following individuals were selected as Steering Committee members for the Farming Systems Research/Extension Network during the open Network meeting held at the 1987 FSR/E Symposium.

Jerry B. Eckert  
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501-575-6857

The open meeting of the FSR/E Network for the 1988 Symposium is scheduled for 7:00-9:00 pm on Wednesday, October 12.

### **The University of Arkansas**

The University of Arkansas, organized under provisions of the Federal Land-Grant Act, was instituted by the General Assembly of Arkansas, March 27, 1871. Fayetteville was chosen as the site, and the first students were enrolled January 22, 1872. The purpose of the Land-Grant Act was to provide a system of public higher education which would offer college opportunities to all qualified persons, regardless of their economic or social status. The University of Arkansas, as a land-grant institution, is committed to this policy. Its basic aim is to provide the finest educational opportunities to all students, regardless of race, color, or creed.

The Fayetteville campus covers approximately 319 acres and is situated in the Ozark Mountains of Northwest Arkansas at an elevation of 1,400 feet. The population of the city of Fayetteville is estimated at 40,000 in 1988, not including the 14,000 students enrolled on the Fayetteville campus for the fall semester of this year.

Four separate institutions are also part of the University of Arkansas System; the University of Arkansas at Little Rock, the University of Arkansas for Medical Sciences (located in Little Rock), the University of Arkansas at Pine Bluff, and the University of Arkansas at Monticello.

The following colleges and schools are part of the University of Arkansas, Fayetteville: the Colleges of Agriculture and Home Economics, Business Administration, Education, and Engineering; the J. William Fulbright College of Arts and Sciences; the Schools of Architecture and Law; the Graduate School; and the Division of Continuing Education. The University's Division of Agriculture includes, in addition to the College of Agriculture and Home Economics, the Agricultural Experiment Station and the Cooperative Extension Service. The College of Business Administration includes the Bureau of Business and Economic Research; the College of Engineering includes the Engineering Experiment Station and the Engineering Extension Center. The Graduate Institute of Technology is located on the Tech Campus in Little Rock.

The University of Arkansas is a member of the North Central Association of Colleges and Secondary Schools.

### **Winrock International Institute for Agricultural Development**

Winrock is a world leader in technical assistance to agriculture. The people of Winrock are making it easier for farmers in the third world and other developing areas to produce more and better food and fiber, thus improving the quality of life for them and their families. Winrock has a long-term commitment to reducing poverty and hunger in the world through sustainable agricultural and rural development. Two basic beliefs guide this work: the importance of developing individual human potential and the need to carefully manage natural resources devoted to agriculture.

Winrock works in partnership with the people of developing areas. Together we strengthen their agricultural research and extension systems, develop their human resources, encourage appropriate food and agricultural policies, manage their renewable resources, and improve their agricultural production systems. It provides research and analysis, graduate education and nonformal training, communication, development assistance, and resource mobilization.

Winrock has more than 225 staff members, half of whom are located at Winrock's headquarters in Arkansas. Nearly 30 are in the office in Washington, D.C., and about 70 are assigned to Winrock projects in 18 other countries.

Winrock was created in July 1985 by merging three respected international organizations rooted in the Rockefeller family's philanthropic tradition: the Agricultural Development Council, the International Agricultural Development Service, and the Winrock International Livestock Research and Training Center. Winrock's activities are funded by grants, contracts, and contributions from public and private sources, and by its endowment. As a private, nonprofit institute, Winrock is classified as a 501(c)(3) organization by the Internal Revenue Service and recognized as a private, voluntary organization by the U.S. Agency for International Development.

**FARMING SYSTEMS RESEARCH PAPER SERIES – ORDER FORM**  
 Kansas State University  
 Manhattan, Kansas 66505, U. S. A.

Title of Paper	Hardcopy		Microfiche		Total cost
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2 - Proceedings of Kansas State University's 1981 Farming Systems Research Symposium - Small Farms in a Changing World: Prospects for the Eighties Edited by Wendy J. Sheppard (April 1982)	_____	\$5.00	_____	\$1.50	\$_____
3 - The Farming Systems Approach to Research (by David W. Norman) and Farming Systems Research and the Land-Grant System: Transferring Assumptions Overseas (by Cornelia Butler Flora) (October 1982 - FSR Background Papers)	_____	\$5.00	_____	\$0.50	\$_____
4 - A Farming Systems Research Bibliography of Kansas State University's Vertical File Materials (Revised) Edited by Gretchen A. Graham (July 1986)	_____	\$10.00	_____	Microfiche Unavailable	\$_____
5 - Proceedings of Kansas State University's 1982 Farming Systems Research Symposium - Farming Systems in the Field. Edited by Cornelia Butler Flora. Compiled by Wendy J. Sheppard (April 1983)	_____	\$10.00	_____	\$2.00	\$_____
6 - Proceedings of Kansas State University's 1983 Farming Systems Research Symposium: Animals in the Farming System. Edited by Cornelia Butler Flora. Compiled by Penny P. Nichols (May 1984)	_____	\$15.00	_____	\$5.50	\$_____
7 - Third World Women: A Select Bibliography Compiled by Martha Tomecek	_____	\$2.00	_____	\$0.50	\$_____
8 - Farming Systems Research & Extension: Implementation and Monitoring - Abstracts (1984 Symposium Abstracts). Edited by Cornelia Butler Flora (October 1984)	_____	\$2.00	_____	\$0.50	\$_____
9 - Selected Proceedings of Kansas State University's 1984 Farming Systems Research & Extension Symposium: Implementation and Monitoring. Edited by Cornelia Butler Flora and Martha Tomecek	_____	\$15.00	_____	\$4.00	\$_____
10 - Farming Systems Research & Extension: Management and Methodology - Abstracts (1985 Symposium Abstracts). Edited by Cornelia Butler Flora and Martha Tomecek (October 1985)	_____	\$3.00	_____	\$1.00	\$_____
11 - Farming Systems Research and Extension: Management and Methodology (Peer reviewed selections from papers given at Kansas State University's 1985 Farming Systems Research Symposium). Edited by Cornelia Butler Flora and Martha Tomecek (August 1986)	_____	\$15.00	_____	Microfiche Unavailable	\$_____
12 - Farming Systems Research and Extension: Food and Feed - Abstracts (1986 Symposium Abstracts). Edited by Cornelia Butler Flora and Martha Tomecek (October 1986)	_____	\$3.00	_____	Microfiche Unavailable	\$_____
13 - Selected Proceedings of Kansas State University's 1986 Farming Systems Research and Extension Symposium: Food and Feed. Edited by Cornelia Butler Flora and Martha Tomecek	_____	\$15.00	_____	Microfiche Unavailable	\$_____

13a - Addendum to Selected Proceedings of Kansas State University's 1986 Farming Systems Research and Extension Symposium: Food and Feed. Edited by Cornelia Butler Flora and Martha Tomecek	_____	\$3.00	Microfiche Unavailable	\$ _____
14 - How Systems Work. Farming Systems Research Symposium 1987: Abstracts (October 1987)	_____	\$9.00	Microfiche Unavailable	\$ _____
15 - How Systems Work. Proceedings of Farming Systems Research Symposium 1987 (October 1987)	_____	\$25.00	Microfiche Unavailable	\$ _____
16 - Contributions of FSR/E Towards Sustainable Agricultural Systems. Farming Systems Research/Extension Symposium 1988: Program and Abstracts (October 1988)	_____	\$5.00	Microfiche Unavailable	\$ _____
17 - Contributions of FSR/E Towards Sustainable Agricultural Systems. Farming Systems Research/Extension Symposium 1988: Proceedings (October 1988)	_____	To be de- termined	Microfiche unavailable	\$ _____
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## ABSTRACTS

### SYMPOSIUM KEYNOTE ADDRESS

#### 1. The Evolution of Farming Systems Research

Michael P. Collinson

An increased awareness of the inadequacies of the traditional research system for reaching resource poor farmers led to the development of a farming systems research process. There have been significant achievements, but institutionalization of the process has been hampered by conservative attitudes among scientists, budget and institutional problems within the developing countries, fads and a lack of coordination amongst donors.

Though there is considerable agreement on a useful approach for national agricultural research programs, the process is still evolving. Important future areas of research are on the institutionalization of the process, its use in the formulation of policies appropriate to technology mobilization, and greater direct participation by farmers and communities in the planning and evaluation of technologies.

### REGIONAL SESSION: AFRICA

#### 2. On Farm Recommendations in Farming Systems Using Expert Systems

Suresh Chandra Babu, Arne Hallam, & Motoko Yasuda Lee

This paper discusses the development and use of 'FARMEXPERT' an expert system for on farm recommendations to locality specific problems within the framework of farming systems research. The knowledge base is constructed based on the farm level research trials involving parameters from agronomic field evaluations, livestock production systems, nutritional and subsistence needs of farm families and economics of small scale farming.

Given the nature of farming system, resource availability constraints, price of inputs and outputs and employment needs of the farm households the 'FARMEXPERT' provides recommendations on crop allocations, livestock production, other pertinent production activities, optimal input uses and the technologies to achieve the objectives of maximizing income, full employment and adequate nutrition.

An attempt is also made to incorporate linear programming with the 'FARMEXPERT'. The advantages of the program include, easy use with personal computers and lotus data management system without requiring any additional programming skills. The program is demonstrated using the field level data from Zambia and South India. The program could be highly practical in field extension programs, in regions where adequate manpower is lacking.

#### 3. Methodology for Data Collection in a Farming System Research Approach in Burundi - Africa Central

Bernard Delaine & Jean Rugerinyange

One of the key concepts in Farming Systems Research is that FSR is farmer oriented. It views small farmers as the clients for agricultural research and technology development. Its goal is to generate, test and extend technology relevant to their goals, needs and priorities. Two major components characterize FSR: Farming System Development, and agricultural data gathering, processing and dissemination.

While the literature is abundant regarding the first component, especially those aspects dealing with technology transfer to small farmers, few articles deal with the methodology for data collection, which is fundamental to describing, classifying and finally understanding the existing farming system. Moreover, if farmers are more and more integrated into the research process, they are usually not integrated into the data collection process. There is a general tendency to overlook existing formal or informal social structure, which can be the best and most reliable source of information.

In Burundi, the basic administrative unit is the "colline", or hill. In the Bugenyuzi Commune, there are 25 hills, each with a "chef de colline" (head of the hill). The "chef de colline" is responsible for the "Nyumba-kumis" or heads of ten households. In fact, the nyumba-kumis are really head of 10 to 30 or more households, depending on the hill. These nyumba-kumis are close enough to the population to give relevant and accurate information on the households they direct. Working with the "chefs de colline" makes it possible to obtain a complete list of all the nyumba-kumis of the hills and thus to get a good sampling frame for cluster sampling. Working with each Nyumba-kumi allows in the same way the establishment of a complete list of all the heads of household of the Commune. Through the Nyumba-kumis, a census on the population and number of animals was completed, offering a good base line set of data. Different techniques were then used to draw a sample from that population to conduct an extensive livestock survey. Additional samples can be drawn from that population for future surveys according to the type of analysis and data required.

Using the existing social structure and involving the farmers themselves in the process of data collection has proved to be a perfect instrument in Burundi, allowing the team to get reliable information even on sensitive issues such as number and type of animals owned by each farmer.

#### 4. Incorporation of Extension Agents into the Research Process

Martha Gaudreau & Joachim Nurwakera

The SFSR Project team has worked closely with the Bugenyuzi Commune Extension personnel since the beginning of project activities in February 1987. The participation of extension agents in the diagnostic survey and the establishment of research priorities was reported on at the last FSR symposium. The second phase of activities, implementing on-farm trials, has led to further cooperation between project staff and the local agents. Because of their work schedules during the coffee campaign, their most important extension responsibility, the agents were minimally involved in the dry season trial and in the first season hillside trials. They helped to identify farmer-collaborators and to do plant counts. During the second season, thirteen of the fourteen communal extension agents contributed substantially to the installation and followup of 4 types of experiments (bean varietal trials, seed coating with insecticide trials, seed coating with liming material trials, and use of chemical fertilizer trials) on a total of 170 farmers' fields. Their participation has included the selection of collaborators, the establishment of the work plan, filling out farmer and trial harvesting and evaluating results. At each stage they have been trained by project staff to carry out these functions. At the end of the season the local agents participated in meetings with farmers and with project staff to identify future research needs and to establish the workplan for 1988-89.

This combination of training and incorporating the extension personnel into the research process was beneficial to the researchers, the extension personnel and to the farmers. The work that the extension agents were doing in the research process

allowed a larger number of trials to be installed. This is particularly important at the pre-extension stage to be able to evaluate the acceptability of the new technologies. The technical capabilities of the agents were enhanced and their familiarity with the technologies was improved. The agents were able to listen more effectively to farmers and learned to pose appropriate questions.

The relationship with the Bugenyuzi Commune Extension Personnel to date has been informal, i.e. no formal document or agreement signed. It is based on good relationships with the local administration and a willingness on the part of Project staff to provide training and minimal logistical support to the extension structure.

Incorporating extension personnel into the research process is an essential part of the Farming Systems Research approach to assure field-level feedback to the research institutions and to facilitate the ultimate diffusion of appropriate, acceptable technologies to the farmers, the primary client group of both research and extension.

#### 5. Incorporating a Socioeconomic Component into the Malawi National Adaptive Research Program

Thomas Edward Gillard-Byers & Grasiano Bulla

The methodology and criteria for evaluating FSR/E projects is dependent on the methodology used in setting up the initial program. The operational structure which evolves from the initiation of such a program then determines the type, quantity and quality of results to anticipate.

The Malawi Adaptive Research Program (FSR/E) was designed as a national program to link researchers, extension and farmers more effectively. This has been accomplished through, among other things, locating Adaptive Research Teams at Extension offices and the combining of recently trained socioeconomists with career agronomists.

This paper will focus on areas within which a developmental methodology has been employed and the results of this accomplishment/process. The discussion focuses on four main issues of the program's socioeconomic component. In part one, it deals with national program implementation, the need for the socioeconomic component, its integration into ongoing programs, program objectives and the anticipated results from the inclusion of the socioeconomic component.

Part two draws on the Malawi experience with respect to farming systems program development. It gives some examples of independent program activities and how linkages between research, extension and the farmer have been forged. It also outlines the program from a national perspective, dealing with such issues as autonomy amongst Adaptive Research Teams, opportunities for comparison of cross sectional research results, the Adaptive Research Coordinating Unit technical services and the training of socioeconomists.

Part three deals with experiences of the initial effects of the superimposing of socioeconomists on a station based research program. Issues covered in this section include economic and social analytical capabilities, the need for linkage with experts and the ability to participate in program development.

The last part deals with suggested plans for the future role of socioeconomists in the program.

#### 6. The Gandu & Iyali Family Structures & the Adaption of Appropriate Technology in Northern Nigeria

N. A. Gworgwor

Labour provision for the subsistence farming activities in northern Nigeria is mainly from the family unit. The family units are of two types: a simple or Iyali family unit, which consists of one married man with his wife (or wives) and dependent children, and a composite or Gandu, which is composed of two or more

male adults, usually married, together with their wives and children. In a study conducted in northern Nigeria, in general, simple family units were found to be more common than composite families. An average of 38% of the farming families were, however, organized under the Gandu system. Traditionally, the Gandu family was the preferred type for its socio-economic benefits but nowadays it is fast disappearing, giving dominance to Iyali family structure.

The structure of these two family units considering its technical and human resources, its operation in the system of agricultural production, relevance to new technological adaptation and how it affects the process of FSR/E are being discussed in this paper with suggestions for effective implementation of FSR/E methodologies in the face of a changing family structure.

#### 7. Farm Tools for Women: A Case for Their Development on Gender Basis

Ravindra N. Kaul

Women in Africa are estimated to contribute up to 70% of labour in food production and nearly 100% for rural food processing. Their range of daily activities like food preparation, water and fuel carrying, farm weeding, crop threshing, and preparing dairy products, etc. are far wider than men and demand high human energy, which consequently results in low output and induces health hazards.

Despite awareness of above, most technologies developed for small scale farmers are geared for men with no concern for their 'appropriateness' for women who possess different anthropometric geometry and energy levels in comparison to men. The availability of separate bicycles for ladies as distinct from men's bicycles illustrates a commonly understood case of providing equipment based on gender issues.

This paper examines the range of farm tools and processes that are predominantly used by women and explains, with available research data, the inadequacies of such tools and processes when linked to women anthropometric measurements and energy levels. It also illustrates, with adequate data, the need and scope to design and develop farm tools specifically for use of women so as to ensure overall ease of drudgery, safety and effective integration of women in farming systems innovations.

#### 8. Farm Counselling as a Method for Research and Development: Experience from Mali

Paul Kleene & Yacouba Kone

In the cotton production area of Southern Mali (annual rainfall 700-1200 mm), cash- and foodcrops' production rose considerably during the last 25 years, as the result of the introduction of improved technology packages for cotton based on animal traction. Under this process farms differentiated widely; FSR/E distinguishes 4 main types according to availability of, and access to equipment and livestock. FARM COUNSELLING was introduced first at a "village laboratory" level by the FSR/E team, and was then further elaborated and tested in more than 30 villages, in close collaboration with the extension service. The method was adapted to fit in the adult literacy programme for farmers. They learnt how to assess their resources and results, how to differentiate between gross and pro rata figures (e.g. production vs. yield), and to understand the need for technology change in case of investments.

Being involved in a continuous dialogue with farmers, evaluating their results, extension personnel and researchers learnt at least as much as farmers did. They discovered the complex whole of farming, and learnt how to translate this in simpler categories for understanding. The success of FARM COUNSELLING encourages R-D to adapt and simplify the method for the majority of non-literate farmers' groups.

9. **Farming Systems Research in Sierra Leone: Achievements and Lessons Learnt from On-Farm Research**

M. T. Lahai, M. T. Dahniya, & A. Lamin

Farming Systems Research Project (FSRP) is being undertaken in six villages in Sierra Leone. The overall objective of the Project is to identify appropriate methods of crop and land management to enable sustained and gradual improvement of the farmers' present systems.

Results of the three years of operation of the Project indicate that interventions such as the use of improved varieties of rice, maize and sweet potatoes and of fertilizers have met with great success in farmers' fields. The high yielding and/or early maturing abilities of these improved varieties, and the significant response of both local and improved rice and maize varieties to fertilization have caused rapid acceptance of these interventions by farmers.

Lessons learnt which have helped to gear research towards farmers' needs include the rejection of the improved cassava and cowpea varieties because of poor cooking quality and lack of white seed colour, respectively. Emphasis is now being placed on selecting cultivars with appealing characteristics to farmers, and recently a white-seeded cowpea variety has been released and tested on-farm with a high potential acceptability.

10. **Farming Systems Research Along the Senegal River Valley: Integrated Fish Farming with Irrigated Perimeters and Natural Water Sources in the Sahel**

Marsha Lin & Mark B. Lynham

The aim of this paper is to discuss the integration of various forms of fish culture with other types of agriculture currently being done on the Senegal River. Discussion of environmental factors, economic feasibility, farmer interest, working with cooperatives and independent farmers, growth, production, reproduction and maintenance, methods of extension, direct and indirect integration of fisheries, use of crop residues and animal by-products, use of various sources of water will be included. In addition, past, current, and future of fish culture on the river will be examined.

The Senegal River Valley is primarily a Sahelian region of West Africa, where the environment is arid and agriculture is done by irrigated perimeters, recession, and rainfed farming. The development of farming systems that integrate cultivation of crops, livestock production and gardens enable farmers to produce independently all their nutritional needs with low inputs (intensive farming) and add greater product diversity for market (extensive farming). The addition of fish farming into the system will add another source of income and increase protein to the diet.

Cultivation of grains such as rice, sorghum, and corn are currently being done in irrigated perimeters along the river. Integrating fish culture activities that are direct integration, such as stocking of fish into rice paddies and indirect integration such as construction of ponds within fields. Even if natural sources of water are stocked, cages set in rivers and catch basins formed from depressions, the utilization of farms residues as feeds (rice, sorghum, and corn brans) and by-products such as peanut cake, sesame cake, blood from animal slaughter have shown great potential. Livestock wastes have also shown to be excellent pond fertilizers alone or in conjunction with synthetic fertilizers to encourage feeds of phyto and zoo plankton.

The paper will review past fisheries projects by farmers, government, and outside funding participants, their successes and failures and finally, a discussion of groups currently encouraging fish culture in farming systems along the river.

11. **The Role of Farmer Testing Groups in Research and Extension: Some Experiences in Botswana**

Synai Masikara, F. Worman, & G. Heinrich

Recently there has been growing interest in farmer participatory research and participatory technology development. The Agricultural Technology Improvement Project (ATIP) has worked with farmer testing (research) groups for three years, using several different approaches. ATIP has also collaborated with the extension service in forming a pilot farmer testing (extension) group during this cropping season.

Farmer testing groups have added significantly to the ATIP research program by providing a capability to do extensive testing of a wide range of technologies, many more than could be tested under a researcher managed testing program. During the current year more than 130 farmers in three villages have volunteered to test from one to three new technologies on their own fields. The group format provides an opportunity for farmers, researchers and extension staff to work together testing new technologies.

ATIP and the extension service are also examining the use of farmer testing groups in extension activities. These groups will test a more limited range of proven technologies under farmer conditions. Two advantages of these groups are that they increase the number of farmers local agricultural demonstrators can work with, and they provide a forum for farmer, extension, research interaction on problems encountered in the implementation of officially recommended technologies.

Both research and extension farmer testing groups have potential for increasing the sustainability of the FSR/E activities by providing a continuing active role for farmers within the research and extension thus providing a continuum in the technology development, extension, feedback process. ATIP staff think that farmers must be included within existing governmental programs if their input and participation is to continue in the long run.

12. **The Value of Farm Family Labor in Maize-Based Cropping Systems in the Ndop Plain in the Northwest Province of Cameroon**

Dermot McHugh

In non-mechanized farming systems characteristic of much of the developing world, labor can account for as much as 80% of production costs, even when a minimal opportunity wage is imputed to farm family labor. Moreover, during critical periods in the production cycle, when labor is constraining, farmers are often forced to hire outside labor at costs well above expected returns to overall labor. This usually entails direct cash outlays for farmers who can ill afford it.

Despite general recognition by practitioners of FSR of the importance of labor, most continue to evaluate new crop innovations of the basis of returns to land (yields) or capital (marginal rate of return). Labor costs are often either ignored or only roughly estimated. This is because labor data is famously difficult and costly to quantify.

Nevertheless, in 1987, the Testing and Liaison Unit (TLU) of the Cameroon National Cereals Research and Extension Project undertook to monitor labor utilization on twenty-four (24) farms in the Ndop Plain in the western highlands of Cameroon for a period of 12 months. In addition to labor data, which was collected on a daily basis, by farm operation and by labor class, crop production and farm sales were recorded.

This paper discusses, in overview, labor use in a maize-based cropping system, and includes an estimate of net returns to farm family labor.

13. Technology Generation and Transfer System for Improving Small-Holder Farming Systems in Zambia

C. A. Njobvu

Farming Systems Research is one of the strategies adopted by the Zambian government to achieve its stated agricultural policy goals of increasing food production and greater income for small farm families. Lack of a strong institutional framework for technology generation and transfer system is regarded as the most important bottleneck hindering the efforts being made for improving the productivity of small-scale farmers. This paper examines Zambia's attempts to create an institutional framework for technology generation and transfer system with its weaknesses highlighted.

The first section considers the factors necessary for technology adoption and the weaknesses of the present technology transfer system. The second section deals with the role of Farming Systems Research team in linking research scientists with the Extension Services and the farming community in the process of technology generation and transfer.

The paper concludes that the task of Farming Systems Research must be seen not only as that of generating appropriate technologies for small farmers, but also to improve the linkages between research, extension, farmers and other input supply institutions to enhance information flow between research and farmers on the one hand and input support system on the other. It is emphasized that an improvement of the present technology generation and transfer system is an important step towards improving small holder farming systems and sustainability of agricultural development.

14. Design of Sustainable Technology Based on Cash and Non-cash Inputs in Nigerian Millet/Cowpea Intercrop Systems

K. C. Reddy, R. Deuson, & K. Maliki

Nigerian agriculture is predominantly rainfed with rainfall being highly unpredictable both in space and time. The cash input marketing system is poorly developed and serves only a minority of farmers, mostly along the Niger-Nigeria border thus leaving inland farmers with little or no access to N and P fertilizers and to pesticides. In designing a new component technology to raise yield and net return for Nigerian farms, agriculturalists at the National Agronomic Research Institute of Niger (INRAN) have been careful to incorporate both cash inputs (N and P fertilizers and pesticides applied to cowpea) and non-cash inputs (improved millet and cowpea seeds multiplied by farmers and improved crop density and geometry achieved through family labor). Both cash and non-cash inputs were tested and compared to traditional millet/cowpea intercrop systems on one hundred farms distributed among three major recommendation domains in 1985-87. ANOVA was performed to identify those inputs which raised yields significantly over traditional yields. Mathematical programming was then used to explicitly model the effects of resource constraints, risk, and access to inputs (time, place, and form) on technology choice decisions. Location-specific recommendations are made with respect to access to cash and non-cash inputs so as to promote the sustainability of the new technology within each recommendation domain.

15. Instituting Agroforestry Research and Extension in Malawi

Alex R. Saka & W. Trent Bunderson

Malawi is a small land-locked country in Southern Africa faced with declining agricultural production, escalating costs of fossil-fuel based inputs, deteriorating natural resources, and increasing shortages of fuelwood and building materials. The basic cause of these problems is a rapidly expanding human

population, currently estimated at 7 million with a growth rate of 3.2% per annum. As a nation dependent on agriculture, Malawi appreciates the urgency of developing production-increasing technologies that preserve the integrity of its natural resources. The issue, though, is not one of problem recognition, but of execution. This paper describes the process of instituting a national agroforestry program to improve the sustainability and self-sufficiency of smallholder agriculture in Malawi. Details of program structure, organization, and function are discussed in relation to a strategic plan of action, the essential elements of which are:

- (1) identifying and prioritizing smallholder problems and research need as they relate to agroforestry potentials
- (2) establishing effective research-extension linkages through technical support and training, joint-program planning, and collaborative field activities
- (3) Integrating forestry and other natural resource disciplines with those of agriculture to reduce duplication and maximize farmer impacts
- (4) enhancing technology adoption through initiatives that complement the existing practices and available resources of smallholder farmers
- (5) promoting national and international support for agroforestry by generating greater public awareness of its impacts on agricultural production and natural resource stability

16. Malawi Horticulturists Listen to Farmers, Establish Extension Linkages, and Prioritize Research

Ray D. William & I. M. G. Phiri

Horticultural diversities are recognized in Malawi as potential technologies for achieving national priorities aimed at diversifying smallholder farming systems. Although scientists organized ambitious research programs with successful crop and cultivar releases, extension of high-yielding technologies has been less successful. Two years ago, researchers began considering smallholder constraints rather than yield parameters. Informal linkages in support of extension educational programs suggested that smallholders invested in hybrid vegetable seed and low to moderate levels of manure or fertilizer, whereas fruit growers expected only to harvest and sell the product. Subsequent diagnostic surveys conducted with Adaptive Research Teams verified that cash constraints restricted both the quantities and timely purchase of inputs. Smallholder farmers also familiarized scientists with relevant cultural practices such as local plant extracts for insect control, wet and dry-season vegetable production practices, and moisture conservation involving bananas planted along drainage ways to induce water flow. Collaborative efforts with Women Program Officers and Agro-Forestry resulted in an indigenous vegetable survey and interplanting of fruit trees along contour buffer strips to enhance smallholder acceptance. Informal linkages including researchers, extension professionals, and farmers resulted in training exchanges involving apple pruning and defoliation methods for increased productivity. Program success includes scientists' enthusiasm for systematic analysis of smallholder constraints, implementation of appropriate technology trials, and respect for extension professionals with frequent linkages to transfer technologies and enhance feedback to research.

## REGIONAL SESSION: ASIA/NEAR EAST

17. **Experiences in Involving Extension Personnel in On-Farm Multilocation Trials of Technologies Generated Through Farming Systems Research**
- Md. Zainul Abedin & M. Mustaque Ahmed
- Cropping patterns were tested at different Farming Systems Research Sites of the Bangladesh Agricultural Research Institute (BARI). Several cropping patterns were identified as promising ones and therefore, it was decided to put these on multilocation testing and a few of them were put on pilot production programmes. The extension personnel at the study locations were involved in the programme and were assigned specific responsibilities. Guidelines were prepared for the implementation of the programmes. The extension personnel were trained. Committees at national and site level were established with research, extension and input supply organisations to ensure proper implementation of the programmes. A memorandum of understanding was signed between the Bangladesh Agricultural Research Institute and the Department of Agricultural Extension.
- Site Level research staffs were placed under the local administrative control of the extension officials.
- It was observed that degree of success of such collaboration was greatly influenced by the blessings from the respective higher authorities, individual initiatives, and motivation and the training of the extension personnel. The problems encountered, how some of them were tackled and suggested ways to overcome the others are discussed in the paper.
- 17a. **Farmer Participation in Research in Sustainable Hedgerow Farming Systems in Sloping Acid Uplands**
- S. Fujisaka & D.P. Garrity
- Although viewed as important for on-farm adaptive research, farmer participation has often been superficial and has not led to meaningful incorporation of farmer perspectives. This paper describes the use and application of a method involving understanding farmer perceptions, using such understanding to help determine key research issues, conducting research that integrates the different concerns and contributions of farmers and scientists, and farmer-to-farmer technology transfer. The method encourages and then builds upon a continued interaction between the researchers' agronomic experimentation and farmers' problem-solving technology adaptation.
18. **Sustainable Agricultural Systems in Remote Hill Areas of Nepal: Challenges and Opportunities for Innovative Research and Extension**
- David Gibbon & Michael Schultz
- In the remote hill areas of Nepal farming systems are not producing enough to feed people all year round. Soil fertility and crop yields are declining and fodder, an important provider of soil nutrients through livestock, is becoming harder to obtain in sufficient quantities to maintain output. Pressure on resources is also coming from outside the system as plans to develop tourism and national parks place further demands on a declining resource base.
- Providing research and extension support for these areas poses particular problems. Because of their relative inaccessibility, an approach that demands less regular contact with research and extension workers than has been the case in more accessible areas is needed.
- The paper examines the problems involved in developing research and extension methods for remote areas using a case study of a remote panchayat in Solukhumbu district, Nepal. A number of key areas are identified. Research needs to go beyond understanding the complexity of the physical farming system based on individual farm families, to include the communal management of resources, local group structure and organisation, and the identification of areas for innovation that do not require sustained inputs from outside. Extension efforts must involve existing local groups when drawing up resource management plans and must work as far as possible through existing credit and extension support systems.
- The future stability and sustainability of these systems in the face of pressure from outside in the form of tourism, national park development and conservation initiatives requires a national policy that recognizes the importance of existing systems of resource management and the need to involve local groups in plans to manage, conserve and develop local resources.
19. **Farming Systems Research and Development in Central-North China**
- Richard Hardiman & Xiao Hu Zhang
- A Farming System Research & Extension project was conducted in Qingyang Prefecture (27,000 Km<sup>2</sup>) on the Loess Plateau of Central North China. The farming system is a subsistent wheat-based system and is supplemented by cash income from cattle and sheep.
- A prefecture liaison committee (PLC) was established to discuss, identify and resolve agricultural problems in the region. It comprised of representatives of the extension service, animal husbandry and agricultural bureaus, local agricultural research stations, livestock feed company and soil conservation institute. A Baseline survey was carried out in the region by conducting intensive interviews with government bureaus and 85 farm households. The survey identified shortage of winter feed to be a major constraint to livestock production.
- Foreign experts to the local research station introduced the concept of urea supplementation to ruminants to relieve this problem. Ensiled straw and a urea block comprising local resources was developed. On-station and on-farm experiments with sheep indicated positive results using these two treatments.
- A research station field day was the initial means to introduce the technologies to farmers and PLC members. As a result of the field day and further discussion with the PLC, a program was developed for extension of both technologies throughout the prefecture. The government guaranteed supply of urea; research staff provided training programs for county and township extension officers and key farmers; and extension personnel selected monitoring farmers for on-farm trials and on-farm field days. Ensiled straw could be disseminated without difficulty. However the urea block required manufacture, resulting in the local research station to form a development company for its propagation.
20. **Small Ruminant Farmers Participating in FSR/E in West Java, Indonesia**
- Patrick J. Ludgate<sup>1</sup> & Atien Priyanti<sup>2</sup>
- The main tasks of the Outreach Pilot Project (OPP), since its beginning in 1984, have been to raise the performance level of small ruminants by introducing innovative management techniques on a trial basis to small farmers. The OPP began with the establishment of 17 groups of farmers and has now increased to 29 groups which incorporate 14 rural villages in the Bogor district of West Java.
- Intensive efforts were placed on improving the extent and rate of small ruminant production innovations within the socio-economic constraints of the small farming systems represented in West Java. This emphasis was added due to the concerns of the scientists with the OPPs limited success in transferring innovative

technologies from the research station to the small ruminant farmers. This research report presents preliminary findings concerning the development and extension/transfer aspects of farming systems research. This research effort was concentrated on three objectives: (1) Improving the communication channels between the scientists, farmers and local extension staff, (2) Providing appropriate field-tested training materials and methodologies for farmer and extension staff training (3) Increasing the farmers' groups village organization in order to stimulate each groups' management and problems solving abilities.

A preliminary evaluation of this FSR/E program indicate that satisfactory progress is being made in building the proposed communication linkages between the farmers and researchers but, more intensive effort is required to bridge the communication and training gaps between the livestock extension staff and the farmers and research toward transferring innovative production technologies.

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21. **Linking FSR With Extension and Farmers:  
A Pakistan's Perspective**

Waqar Malik

The longevity and successful implementation of FSR calls for, besides a team of research scientists, substantial involvement of extension agents and farmers in its operation since inception to the end. The research scientists who are a rare commodity, cannot plan, supervise, and implement all FSR projects/experiments all over the country. On the other hand, extension personnel who blanket the countryside are in a better position, if involved in a right way, not only to coordinate the FSR efforts at the field level but also to purvey the site-specific technology with more vigor and confidence to farmers and make sure of its utilization. Similarly, farmers being the ultimate consumers of the technology have an important role in identification, development, dissemination, and utilization of the proposed technology.

Although there is no denying of involving these three groups in FSR, the problem arises at the level of their involvement, and the role they are supposed to play. It is generally observed that an FSR team visits a site, a village, or a location and contacts the local-resource persons who could be reached easily for investigation. Likewise, the extension agents are consulted in a cursory manner up to the extent where they are useful in providing certain kind and amount of information which the FSR team deems essential to conduct a survey.

This paper discusses the various principles, issues, and complaints involved in linking FSR with extension and farmers and also proposes some meaningful measures to achieve institutional linkages among FSR, extension agents, and farmers in the light of the FSR experience gained in Pakistan.

23. **Incorporating Intra-Household Dynamics in Training  
and Visit Extension in Developing Countries**

Robert A. Martin & B. Fajasekaran

Training and Visit Extension has been proved to be successful in transferring technologies in nearly thirty developing countries for almost a decade. However, practical field experiences in the operation of TV Extension shows that it does not consider intra-household dynamics which is an integral part of Farming Systems Research in its on-farm research trials. The technologies though evaluated for their environmental suitability, not scaled for their sustainability of small and subsistence farmers.

This paper focuses on evaluating the methodology of on-farm trials conducted by the TV system using data collected from selected households in South India. The gap in the methods of technology evaluation between TV Extension and Farming Systems Research approach are explained using the analysis.

Policy suggestions to modify the TV Extension to incorporate intra-household dynamics in on-farm research trials are made. Guidelines to consider the gender bias in employment, subsistence in consumption, effective resources, incentives and allocation of labor are also presented. The procedures developed to diagnose, evaluate and incorporate these factors into on-farm trials are the salient features of the paper. It is argued such an approach to extension would provide a strong base for sustainability in agriculture in those countries where TV is already practice.

24. **Farmers' Willingness to Collaborate in On-Farm Research  
at Farming Systems Research sites of Nepal**

S. B. Mathema

For a decade or more, the farming systems approach to agricultural development has been gaining immense popularity in many developing countries of the world, and Nepal is no exception. Research in farmers' fields in Nepal has been carried out for the last 10 years, under the Cropping Systems Program (CSP) and the Farming Systems Research and Development Division (FSRDD). Lumle and Pakhribas Agricultural Centres (LAC and PAC), supported by the Overseas Development Administration are also conducting trials on farmers' fields under their farming systems program. In this way, a large number of Nepalese farmers have been collaborating in on-farm research (OFR).

The important feature of farming systems approach to agricultural research, is that farmers are involved at all stages. Factors limiting production are identified by talking to farmers, proposed alternatives are tested in their fields, the results are discussed with the farmers. In this way, any ideas which are not acceptable to farmers are screened out at an early stage, before much effort and money has been spent in developing them. Thus farmers should be involved as full co-operators in as many steps of the FSR process as possible. Thus farmers should be involved in: a) Recurrent diagnosis (or tailored, follow up surveys); b) Trial design, refinement and redesign; and c) innovation technology multiplication and dissemination. OFR is characterized by farmers' willingness to participate in OFR on their own land. This participation varies according to the nature of the experiments, farmers' field trials, cropping pattern trials, and component technology trials are common trials conducted at FSR sites of Nepal. All of these trials are farmer-managed trials, but with strong support and supervision of site researcher. From the survey, it reveals that collaborator farmers understand the objectives of these experiments and are willing to participate in such experiments as long as they are supported and supervised by the site researcher. In most FSR sites, there is a strong relationship between the collaborators farmers and site researcher.

One of the objective of FSR at Nepalese FSR sites is to increase yield per hectare, but in Pumdri Bhumdi site, farmers are after not only higher yield, but also byproduct. Farmers were also concerned about taste, grain color, crop production, crop duration, straw height and quantity. Farmers at Lele site were keen interested to participate in the trial. All collaborator farmers had participated in the trials on their own will, where site researcher's pressure on farmer did not occur at all. However, at Pumdri Bhumdi, a majority of farmers participated in OFR of their own will (70%), while only 30% of farmers mentioned that they participated due to the researcher's pressure. Farmer collaborators expressed their views that they get benefits being the participants of OFR because they receive free seed, fertilizer, pesticides and other inputs, help in increasing production, help in controlling insects and diseases and gain knowledge of new method of cultivation.

25 . **A Case Study of Sustainable and Self-Revolving Programme of On-Farm Research**

D. M. Maurya, K. C. John, R. A. Singh,  
K. R. Tiwari, & Anil K. Gupta

An innovative methodology of linking informal experimentation of farmers with formal research has been evolved at Narendra Deva University of Agriculture & Technology, India. The advanced breeding line is matched with local land races. Farmers are encouraged to grow these lines under their management. The appraisal of performance is also done as per the farmers' own implicit and explicit criteria. However, continuity of this programme is dependent on availability of seeds of advanced lines in bulk. In order to make on-farm rice research sustainable a self-revolving methodology has been formulated. It envisages compensation of losses, if any, due to experimentation, on the one hand and collection of seeds from participating farmers to ensure continuity as well as self expansion of the programme on the other hand. The dynamic process of negotiation among researcher and cooperating farmers are described. The conflicts, tension and the resolution of such conflicts are highlighted. Issues have been raised with regard to methodological improvement in OFR in rainfed regions.

26 . **An Assessment of the KABSACA Farming Systems Research Program in Iloilo, Philippines**

M. T. S. Medialdia & N. F. C. Ranaweera

The adoption of improved technology developed for rainfed agricultural conditions in the province of Iloilo in Philippines, revolutionized paddy production there. The new technology replaced the traditional single rice crop with two crops of rice or a single rice crop followed by two other food crops. Over a 10 year period, an approximate 35,000 ha. were introduced to this new technology.

A study was conducted to assess the impact this new technology has had on the farmers, from and its effect on the livelihood of farmers. A sample of "adopters" and "non-adopters" were taken from a representative site and total household activities were monitored for one year.

The results indicate that the overall income and expenses of adopters are higher than those of the non-adopters, with incomes from the farm being higher among non-adopters. The yield differences between the two groups are not consistent, however income from the paddy crop is higher among non-adopters. Consumption levels are higher among adopters. The nutritional aspects of the two groups are now being examined.

The Marketing, Credit and Extension aspects in relation to institutional support for farmers within an FSR project area indicated that these activities are still provided on a monocrop basis and has no relationship to the whole farm or such.

27 . **A Methodology to Assess the Impact of Farming Systems Research in Asia**

N. F. C. Ranaweera

A farming systems research perspective has been in the forefront of agricultural research and development programs for well over the last two decades. With the maturing of these programs a valid question being posed by researchers and policy makers is what benefits has this approach had on overall agricultural production and, consequently, on the farmers themselves.

A research study to assess the impact of FSR programs was undertaken in four Asian countries. The methodology used in the study categorized farmers into adopters and non adopters, based on the degree of use of the recommended technology. Monitoring of production and consumption activities of the farmers over a 12 month period provided information on all sources of income (farm, off farm, non farm and home garden) and all sources of expenses (production and consumption).

Results from the study in Oton-Philippines revealed a differential pattern between adopters and non adopters in the sources of income. Adopters obtained more income from the farm as well as from non farm sources. Consumption levels between adopters and non adopters differed. The nutritional differences are now being analyzed.

28 . **Economic Analysis of On-Farm Crop Livestock Research, Sta. Barbara, Pangasinan, Philippines**

Roberto F. Ranola, Jr.

An approach to the economic analysis of the crop-livestock research is the use of the whole farm and crop and livestock enterprise analyses. Whole farm analysis is useful in assessing the benefits from the integration of livestock into the crop enterprise as well as assessing farmer's decision to integrate livestock into the system. The integration comes in services and waste useful for the crop enterprises. A further issue is the fuller utilization of farm resources, more especially family labor. On the other hand, the enterprise analysis is useful for identifying the profitable and non-profitable farm enterprises. The analysis is very important for farm decision-making.

The form presently used is the result of the refinement and integration of previous forms over the last 4 years. It has been repeatedly tested and is being adopted by the crop-livestock research sites of the Regional Integrated Agricultural Research System (RIARS) of the Department of Agriculture. Based on the whole farm analysis, a substantial portion of the return from farm activities are non-cash. Most of the cash returns come from crop enterprises rather than the animal enterprises, reflecting that these are basically crop farmers with livestock providing supplemental income. While the farms suffered from severe draught and lost from the crop enterprises, the loss of income was alleviated by the returns from livestock enterprises, thus acting as income buffer.

29 . **The Incorporation of Women's Concerns in the Design and Impact Assessment of a FSR/E Project: A Case of Northern Thailand**

Benchaphun Shinawatra

The district of Phrao, Chiang Mai Province, Northern Thailand is characterized by lowland glutinous rice production and several upland patterns which include groundnuts, soybeans, upland rice, chili, and mungbeans. The FSR/E Project which began in 1986 focused on upland crops. A study of women's roles in production was undertaken in 1987 and revealed further aspects to be included in the FSR/E Project, including extensive female out migration during the second season. Greater attention is now being given to lowland rice, inter-relationships between upland and lowland subsystems and labor supply at different seasons and to specific time saving activities to relieve women's labor. Trials for the introduction of mungbean before rice in lowlands and a mechanical weeder for uplands are being monitored for effects on men's and women's labor and household enterprise expenditure and income. Methods include fortnightly record keeping and informal interviews and measurements will be compared to benchmark data from the first study. Paper will discuss methods being used to collect and analyze data for monitoring the trials.

30 . **Assessment of Impact of Systems Research  
In Two Selected Sites of Bangladesh**

M.R. Siddiqui, R. Islam, A.H. Khan, N.P. Magor, & M. Hossain

The extent of adoption of farming systems technology and its impact on farm productivity, farm income and consumption pattern was assessed at two rainfed lowland sites in Bangladesh during 1987. The sites were Kamalganj in the Northeast, which is rice surplus and characterised by remoteness, and Sitakunda in the Southeast, which is rice deficit but has ready access to major markets. The cropping patterns recommended for the two rice crop systems covered varietal sequence choice, timing and fertilizer levels; and allowed for variation in the onset of monsoon, land type and draft and labor availability.

Sixty farmers, weighted by land size, were randomly selected from six to eight villages at each site. Villagers were identified according to land type. Farm families were monitored daily over nine months for all household income and expenditure and crop production activities. Food consumption was assessed before and after the harvest of the main rice crop. A farmer who cultivated over 60 percent of his land area to the recommended sequence of varieties was classified as an adopter in the initial analysis.

In Kamalganj, the level of adoption had increased during the last 5 years, with adopters achieving over 600 kg/ha more total production and a higher net return than non-adopters. However, fertilizer level had not changed from the 1981-82, which was approximately one third the recommended. For Sitakunda, adopter production was 1880 kg/ha higher than non-adopters and net returns were similarly higher. Adoption at Sitakunda for cropping sequence was lower than Kamalganj but fertilizer levels were higher as was subsequent total production per hectare. For both sites, expense on education was significantly higher for adopters, and on loan repayment it was significantly lower. It cannot be concluded whether this was the result of the new technology. The income base from other farm enterprises and off-farm employment was far higher for Sitakunda with rice production only contributing 27 percent of total income compared to 58 percent for Kamalganj. Cash investment in agriculture was four times higher in Sitakunda and production and income per unit land were also higher. The level of credit for agriculture was negligible at both sites. This may have been offset at Sitakunda by the more diverse cash base, but in Kamalganj the cash squeeze resulted in a lower production level. The contribution of home produce to energy and animal protein consumption was higher in Kamalganj and slightly above recommended levels. At Sitakunda, energy consumption appeared to be lower for non-adopters.

Limitations and constraints of the study are discussed. An implication of the results of the study are that for sites dominated by a single income source such as rice production, crop diversification and development of other enterprises may be important components to both increased production and income for farmers. Coupled with this is a major need to address infrastructure support.

31 . **Analysis of Management and Productivity Interactions  
Over Time in Multiple Cropping Systems**

A. J. Singh & Derek Byerlee

A farming system is the result of interactions among several interdependent components such as crops, livestock, etc. Whereas farmers often operate complex farming systems reflecting strong interactions among enterprises, research systems are generally organised along commodity lines, with weak linkages between commodity programs. A major impetus for farming systems research has come from the fact that commodity programs were not addressing to the reality of complex farming systems. These farming systems interactions reflect a complex

mix of biological, physical and socio-economic processes so that research oriented to solving farmers' problems can usually be more effective when a multidisciplinary approach is used.

The present study is, however, limited to the analysis of management and productivity interactions over time of a specific sub set of the farming system, i.e. the rice-wheat cropping pattern. In the central region of Punjab state where rice in the kharif season followed by wheat in the rabi season is the dominant crop rotation. These two crops in this region. But there is little documented information on these crops grown as a system even though the rice-wheat system is grown on 8 million hectares in South Asia. The present study is designed specifically to fill this gap. It seeks to analyse the rice-wheat cropping pattern in a sequential manner from the stage of crop establishment to its final disposal as an integrated whole. It attempts to examine particularly the effects of one crop on the productivity of the other crop grown in rotation on the same fields. Besides analysing the impact of different production and management practices such as soil characteristics, sources and number of irrigations, tenurial patterns, tillage practices, dates of sowing/transplanting, varieties sown, seed sources, timing and rate of application of fertilisers and weedicides, this study also examines the relative economics of rice-wheat rotation in comparison to the alternative rotations in vogue in the study region to find out the scope for diversifying the cropping pattern. The main focus of the study is to evaluate the farming system in the Central Punjab with a view to draw out policy inferences for achieving sustained increases in productivity through exploiting the benefits of the most appropriate crop rotations.

32 . **Impact of Emerging Agricultural Technology on Production,  
Income, Employment and Livelihood of Resource Poor Farmers  
Under Unfavourable Rice Growing Environments of North Bihar**

Chakradhar Sinha

A collaborative Farming Systems Research programme is being carried out jointly by social scientists of L.N.M. Institute of Economic Development and Social Change and biological scientists of Rajendra Agricultural University for improving the agricultural productivity of resource poor farmers of chaur lands (rainfed low lands) in Vaishali district of North Bihar. The FSR broadly covers the activities of interdisciplinary on-farm trials, socio-economic surveys and different types of communication methods. The multi-disciplinary approach includes not only improving the rice based cropping systems but also rice-fish culture, duckery and piggery activities for which market mechanisms are well developed. Time allocation surveys of different households have been conducted showing that women have been involved in many of these activities besides such activities as storage, packaging, agricultural and household.

The paper presents the impact evaluation of these FSR efforts. The agro-ecological and socio-economic conditions of the unfavourable rice growing environments of resource poor rice farmers are first described. The impact of emerging agricultural technology as a result of FSR efforts on agricultural production, income, employment and livelihood of poor rice producers and consumers will be then discussed. Quantitative evaluation of technological change on the livelihood of the poor, including possible differential impact on members of the households will also be attempted.

32a. **Applying Farming System Research Tools in the Development of  
Multiple Cropping Systems**

Nongluk Suphanchalmat, Keith Fuglie, & Viriya Limpinuntana

The development of more intensive and sustainable agricultural production methods, yet within reach of farmers with limited resources, is a fundamental objective of FSR/E. This paper

reviews and evaluates one such project, namely, the development of a peanut-after-rice cropping pattern to replace traditional monocrop rice patterns in rainfed areas of Northeast Thailand. The main contribution of the paper is its application of methodologies for evaluating and monitoring the adoption of new agricultural techniques at the farm level. In particular, the authors discuss the integration of quantitative data from structured farm surveys and qualitative data from rapid appraisal techniques.

Growing peanuts-after-rice in rainfed areas of the Northeast Region has been practiced by some farmers in a southern part of the region for over a decade. Researchers sought to transfer such peanut-growing techniques to farmers in another part of the region where the agroclimatological conditions were judged to be similar. Farmer-to-farmer discussions were organized to facilitate technology transfers and multilocation on-farm trials were conducted.

Formal surveys were able to provide quantified information on the marginal benefits from the new technique using partial-budgeting methods and sensitivity analysis. This information also revealed the sensitivity of the performance of the cropping pattern to site selection. The water table level in the early dry season was identified as a key performance indicator. Rigorous screening of sites is needed to identify promising areas for this cropping pattern.

The rapid appraisal methods gave qualitative information on constraints to adoption, such as the availability of quality seed and nearby markets, and identified the major competing enterprises for farm resources. Households with certain resource endowments were more likely to adopt this pattern. For example, underemployed labor in the dry season and land located near the household (so that peanut plots could be protected from grazing livestock) were two important factors.

Combining qualitative and quantitative information in this manner can be an effective way of identifying important social, technical, and economic factors associated with farmer's adoption of new technology.

33 . Impact Evaluation of FSR at the Katupotha (Sri Lanka) FSR Site

N. Vignarajah & A.R.M. Mahrout

The Katupotha FSR site is situated in the intermediate agro-ecological region of Sri Lanka. The site has a distinct crest area, mid slope and valley. Before the commencement of FSR in 1970, farmers grew rice in all areas of the site during the main cultivation season. But, during the minor cultivation season, rice was grown only in the valley; the crest and mid slope were left fallow or sometime cultivated with rice (if the initial rains were normal) but with marginal or not returns. Rice management with particular reference to adoption of improved varieties, balanced use of fertilizers, especially use of basal fertilizers, and weed control was poor.

Cropping systems research (1978-83) resulted in the farmers growing mungbean, cowpea and groundnut on the crest and mid slope areas during the minor season. Rice management also improved especially in relation to adoption of new improved varieties, fertilizer management and weed control.

The 'with' and 'without' method was primarily used in 1987-88 to evaluate the impact of research. With the limited baseline data, some estimates on a 'before' and 'after' basis was also done.

As for rice cultivation, none of the farmers used basal fertilizer before project, but 54 percent of the farmers used basal fertilizers in 1987-88. While only 33 percent of non-adopters used basal fertilizers, 66 percent of adopters used basal fertilizers. The adopters also used more basal fertilizers (12 kg/ha) than non-adopters (6 kg/ha). Adopters used more labour for weeding rice (28 md/ha) than non-adopters (20 md/ha).

The mean annual net income of adopters was US \$404 compared to US \$324 of non-adopters. The per capita income of adopters was US \$62 compared to US \$52 of non-adopters, both levels falling below the poverty line of US \$67. This emphasizes

the need for a more aggressive and holistic FSR programme.

Due to insufficient baseline data, a more realistic assessment could not be made.

**REGIONAL SESSION: LATIN AMERICA**

34 . Self-Reliant Development Tempo in Resource Poor Farmers' Areas versus Urgency to Act for State Institutions (A technical proposal in North Argentina)

Christophe Albaladejo

The topic of this paper is methodological. How could state institutions in resource-poor farmers' areas without risking to increase cultural and economic dependency and so without damaging self-reliant development potential of the peasants' communities? The purpose is not to impuse nor to institutionalize participation in development but to preserve favorable conditions so as it could occur spontaneously. It is also a way to qualitative evaluation - in social and cultural terms - of development.

The research, in collaboration with the Agricultural Ministry of the Province of Misiones - North Argentina -, took place during 1984 in the settlement front with crops and tobacco cultivators. The project focused on a peasant community of 350 members. Does it represent the genesis of an agrarian system? In fact it was the first landless farmers' association to form spontaneously - during the research stage - in Argentina and to get land titles.

The approach, linking the farmers' communication networks to the technical ways of land occupation analysis, aims to evaluate clearly the aspirations and potential of the peasant community in its ecological context - actually an important soil erosion - and aims to be suitable to the local extension services.

35 . The Deforestation Process in the Sierra Region of the Dominican Republic and Small Farm Practices Inappropriate for Soil Topography

Jose Rafael Rosado De Moya

In this presentation I will describe the processes of deforestation that have been recorded in the Sierra region. It will analyze the problems of the small mountain farmers who have been using agricultural production methods that are not in accordance with the soil topography (migrational agriculture), which has caused progressive soil impoverishment. As a result, the mountain inhabitants also have become progressively impoverished with the lack of food for their sustenance being a critical situation.

I consider the alternatives that I suggest an adequate solution toward the farmer's self-sustenance and also for the problem of depletion of natural resources. These alternatives are based on the establishment of agricultural and forestation systems, of coffee and lumbers which include the production of cultivated foodstuffs, using biological or organic technologies of production.

In conclusion, I will present two agroforestral models that we are implementing in the Sierra region of the Dominican Republic, which are based on coffee (conuco-cafe), and lumbers (conuco-foresta).

36 . Domestic Fuelwood Use in Rural Households Near Durango City, Mexico

Hallie Dozier & Barbara A. Holt

Women and their uses of fuelwood have been the focus of literature in world development in the past few years. Little of this, however, has been concerned with Latin America, where many families still depend on wood or charcoal for most or all of their heating and cooking needs.

The primary objectives of the study reported here were to determine the percentage of households which depended on wood for energy in two villages near Durango City, Mexico, and to learn what wood usage habits were practiced in those households.

A group of interviewers used a detailed interview schedule to collect data in Spanish from 168 households in the two villages. Individual households were chosen by random sampling. Utilization customs of a sub-sample of women in a designated age range who used wood or charcoal for the majority of their cooking or heating needs were reported in this study.

Data were collected on the types of wood preferred, amounts used, sources of the wood, and patterns of collection and use. Information such as this should be of interest to people working in developing countries in agroforestry, energy conservation, and with women in development programs.

37. **A Risk Assessment of Some Recommended Technologies for Rainfed Corn in Plan Puebla, Mexico**

Claudio Esquivel-Alvarez

On-farm agronomic research has been a key component in Plan Puebla's strategy to achieve its aim of increasing corn yields among small farmers in a rainfed area. Due to the variability in soil and weather factors and to the particular circumstances of the farmers, the research program developed recommendations for seventeen different producing conditions or agrosystems.

Taking into account farmers' cash limitations and their risk perception in using the new practices the recommendations were designed for an unlimited capital level and for a limited capital level.

In a previous study, corn yields in the area for a 20-year period were analyzed showing that because of the yearly variability the corn cropping seasons can be considered as excellent in 25% of the years, 40% as favorable, 20% as limitative and 15% as disastrous. These findings pointed out a considerable level of risk in the corn production in the area which may affect the adoption of the proposed technologies.

In order to assess the effects of the yearly variability on the performance of the recommended technologies, a study has been carried out since 1974 which consists of a series of on-farm small plots that include the recommendations for each agrosystem and other treatments.

In this paper, the data from these plots for the period 1974-1987 is analyzed to assess the risk involved in some recommended practices for the more important corn agrosystems in Plan Puebla's area.

38. **Farmers' Evaluations of On Farm Experiments in Honduras**

Jonathan Hubchen

The purpose of the analysis component in FSR/E is to find whether the innovations involved result in a feasible and acceptable improvement for the farmer. This is closely related to farmers' adoption rate. Farmers' first opinions provide useful information for an initial evaluation of FSR/E programs. These programs can use the evaluations to plan later activities appropriate to their clientele.

The Proyecto de Desarrollo Rural (PDR or Project for Rural Development) of the Escuela Agrícola Panamericana at Zamorano, Honduras has adopted a FSR/E program. Its activities include on farm experiments. The researcher was to find whether the farmers felt that any of the innovations in each experiment were worthy of initial adoption. If so, the farmers' preferred innovations in each experiment will be recorded with reasons. These impressions were to be compared with those of the research staff.

The author designed a survey to measure the following: execution of each experiment, characteristics of each participating farmer, impressions of each farmer and staff member and

conclusions for each experiment. The research staff administered the surveys. Data is to be analyzed both within and between experiments.

The researcher encountered several problems in this survey. will describe these problems and suggest ways that future researchers can avoid them. The author hopes that this will help the design and execution of future FSR/E evaluations.

39. **Alternative Technology Project: Ceara Section Exchange Network and the Alternative Technology Center of Quixeramobim**

Pedro J.B.F. Lima, Angela T.D. Tjerrien, Elizira M.R. Saraiva

This report describes and analyzes a three-year period of the ESPLAR-sponsored Portuguese Project for Alternative Technology of Quixeramobim (PTA) within the Center for Research and Dissemination of Alternative Technology of Quixeramobim (CTAQ). General project goals are:

1. Identify, conduct and systemize experiments that can serve as alternative solutions for modern and traditional techniques.

2. Establish an Exchange of Alternative Technologies network of small-farmer associations, rural worker unions, professionals, community organizations, and research institutions.

CTAQ ability to test PTA technologies and provide expertise and training to small producers and technicians make it integral to formation/growth of the exchange network; The Network and The Center complement and reciprocally support each other. Network technicians are supported by The Center which targets Network farmers for research and dissemination activities.

For ESPLAR, CTAQ services rural workers to increase small-production autonomy, in the context of subordination of capitalistic society. Thus, all activities seek to: -maintain farmer-generated experimentation/practices which combat dependency on the capitalistic system.-use technician-generated scientific knowledge to perfect these practices so that farmers can relatively increase their autonomy through improved techniques.-stimulate rural organizational and worker participation within CTAQ.

The Network is implemented through 1-articulation (via the three-year old EXCHANGE NETWORK-CENTER with activities in 11 municipalities and five regions of Ceara state;) 2-recovery/systemization of alternative technologies and organizational experiments in production (via an organized register of solutions containing thus far 65 technologies gleaned from surveys;) and, 3-dissemination (via information access, meetings, training, "Alternate Technologies" bulletin, Register of Solutions, et al.)

CTAQ's mandate is implemented through 1-research (via ESPLAR-encouraged systems research which has resulted in development of two systems proposals, i.e., THE PROVEN PRODUCTION UNIT ((LUPD)) which is concerned with establishing sustainable 5-person, 8-hectare production units through improved, traditional semiarid zone practices, and IMPROVED NEW GROWTH which is concerned with soil regeneration after sudden agricultural practices;) 2-training (via farmer/researcher exchange) and, 3-dissemination (via training principally, as a more diversified dissemination plan is created; the two focal points are diffusion of agricultural and organizational techniques, and CTAQ-encouraged research innovations which challenge dominant research and rural extension concepts.

40. **Linking Research, Education, and Extension for Rural Development - The Puebla Experience**

Alfonso Macias, Ricardo Salvador, & Antonio Macias

Since 1967, the Puebla Project has promoted rural development via an approach that involves team work, interdisciplinary and interinstitutional cooperation and a focus on narrowly defined

regions. Participants in the Project include agricultural institutions, a technical team and farmers, all working together under common goals and objectives that are defined mutually. The Puebla Project was originally implemented by Mexican institutions and CIMMYT as a testing ground for certain development philosophies. In 1974, the management of the Project became the responsibility of the Colegio de Postgraduados de Chapingo, which formed a special unit (CEICADAR) to oversee the Project. The purpose of CEICADAR was to expand the successful strategies explored by the original Puebla Project and to extend this to other developing regions. CEICADAR has carried out an intensive program of human-capital formation to facilitate the performance of activities related to research, education and extension. This role is supported by an active program of research in agricultural and socioeconomic aspects, including such factors as the organization of farmers' credit and crop insurance programs, price/cost analyses of products and inputs, product marketing and small scale infrastructure. The scope of the training involves participants within the institution itself, as well as audiences outside the institution. Training and education of 1000 professional personnel from various countries of Africa, Latin America and from the United States has been carried out since 1967. A master's degree in Agricultural Regional Development is offered through the institution. The general methodologies that are targeted in the training offered by CEICADAR include: 1) theories of development and characteristics of regional agriculture, 2) agricultural regional diagnoses, 3) goal setting, 4) training in research, extension, evaluation and management according with needs diagnosed by the trainees themselves, 5) plan formulation and 6) the monitoring and evaluation of ongoing projects. The features of this training are that 1) it can be offered at low cost, 2) within a time span that is flexible to the needs of the trainees, 3) it utilizes the working regions of the trainees as the field of study, and 4) it involves an actual agricultural appraisal of the working region of the trainees, together with the development of a plan of work for that region.

41. Farmer-to-Farmer Extension in Michoacan, Mexico: Implications for Adoption, Productivity and Income on Small Farms  
Robin Ruth Marsh

The failure of the government research and extension system in Mexico to achieve widespread adoption of yield-increasing practices on small rainfed farms, is widening the gap between potential and actual agricultural output, especially in basic grains. Very low average economic returns to recommended practices, under farm-level conditions of risk and limited capital, and ineffectual extension, have been suggested by agricultural and social scientists as the chief explanations for low adoption rates.

This paper reports and evaluates the objectives, methodology and achievements of an innovative, non-governmental agricultural extension project (NGO) in Michoacan, Mexico, using the government rainfed district program as a control. The analysis is based on primary data collected from interviews with 160 randomly selected farm households.

The NGO project combines elements of the Farming Systems Research methodology (recommendation domains based on local farm trial results), the Farmer-First-and-Last paradigm (full farmer participation), and non-formal education (extension linked to adult education). The project's training of local farmers to serve as extension agent farms are methods used to enhance acceptance of these practices by the target population.

Preliminary results indicate the NGO project has had greatest impact in promoting low cost innovations that are new to the area (pest control), and less impact on changing established production practices (plant densities, fertilizer formulas). The level of technology adoption achieved has resulted in only moderate gains in maize/bean yields and net returns to farming, and even smaller improvement in overall annual income. The paper addresses the reasons for this limited impact, including opportu-

nity costs of labor and macroeconomic explanations.

Finally, the paper turns to qualitative aspects of the project: education, community organization and self-reliance (autogestion).

42. Assessing the Impact of FSR/E in Lesser Developed Countries (LDCs)

Carlisle Pemberton

This paper sets out a methodological framework for assessing the impact of FSR/E in LDCs with particular reference to the Caribbean. First, the nature of the LDCs is discussed particularly with respect to their agricultural sectors.

Then, a general assessment process is set out which forms part of the managerial control function. Main elements are: (i) Goal Setting; (ii) Techniques for measuring attainment; and (iii) Comparison of attainment with goals. The emphasis is on (i) and (ii).

Three goals are developed for FSR/E. The first two are the usual static goals for social welfare in economics: efficiency in allocation of resources and equity in allocation of welfare gains or costs. The third goal is the temporal or dynamic goal of sustainability of welfare gains which will be given special attention in the paper.

The paper goes on to deal with techniques for measuring attainment of these goals. With respect to efficiency, the techniques of linear programming and budgeting and their relevance to developing agriculture will be discussed. With respect to equity, focus will be on measuring the impact of FSR/E in bringing welfare gains to the client farm households. Techniques of farm records and accounting and formal and informal surveys will be among those discussed. The measurement of sustainability of welfare gains will feature the development and use of the technique of pre-conditions assessment.

The methodological framework is then used to discuss the assessment (especially of sustainability) of CAEP - the Caribbean Agricultural Extension Project - a joint project of the University of the West Indies, the Mid West Universities Consortium for International Activities (MUCIA) and the United States Agency for International Developments.

43. Andean Farming Systems Research and Development in Puno, Peru

Mario Tapia

After three years' work with *comunidades campesinas* (CCs) in Peru, quantitative and qualitative analyses of the components and functions of CC farming systems are presented. The study area is the southern Peruvian Department of Puno. The region contains an estimated 900 CCs, composed of about 100 families each. The area lies mainly in highlands of over 3800 m., and is dedicated to livestock and high-altitude crops like potatoes, barley, quinoa (*Chenopodium quinoa*), and faba beans. Agricultural systems are strongly influenced by agroecological variation in the area. Five different ecological zones can be identified. One or more CCs have been studied in each zone, and their resources (climate, soils, range), area cultivated, and agricultural technology inventoried. From this research, different alternatives have been selected to improve production.

*Camellones* (ridged fields) represent a way to manage flat areas and control excess humidity and low temperatures, thus reducing frost effects and increasing potato yields 30-60%. Including a legume in crop rotation systems has increased forage production and improved lamb weights by 10%. Group marketing of alpaca fiber has raised fiber prices by 20-25%. Production of seed potatoes has been increased through new soil preparation techniques and use of organic matter and improved varieties, resulting in yields of 15 mt in comparison with only 8-10 mt under peasant conditions.

However, adoption of these alternatives is greatly influenced by family economic differences. Hence other alternatives have been introduced. Analysis of actual agricultural systems has suggested development of communal "service centers" to strengthen the ancient social organization of CCs and foster rural development in the area.

44 . **Development of Production Activities at the Family Level to Improve Family Member Work Participation**

Sergio Uribe, Jose L. Zuniga, & Rene Camacho

In the Mexican countryside there is a marked separation between agricultural activities and livestock production. This creates a situation where many agricultural and industrial subproducts have little value to the small farmer, and where a considerable portion of the work force, represented by women and children, has only seasonal work when the annual crop production demand is not met by adult men. Upon promoting the integration of confined livestock with annual crop production, family gardens, and the development of fruitculturing, it is possible to encourage a greater participation of family members in work.

From 1981 to 1987 an improved technology was developed for the subhumid tropics of Mexico which includes active participation of small farmers. Among other components, this improved technology includes the integration of dairy livestock, the implementation of family gardens for vegetable production, and the development of fruitculturing without affecting production of basic grains. The obtained results indicate that work done by women and children has increased from 11% to 22% and 6% to 14% respectively. The participation of these family members in work has also been more continuous during the year, compared to families that carried out only agricultural activities.

It was also noted that the coefficient of employment of the family has increased from 43% to 58% with the implementation of the aforementioned production activities.

45 . **Accomplishments of Farming Systems Research Projects Towards Sustainable Agricultural Systems in Brazil**

Eduardo Zaffaroni

Applied agricultural research with a Farming Systems Research (FSR) perspective has been undertaken by the Brazilian Agricultural Research Enterprise (EMBRAPA), State Agricultural Research Enterprises, and Universities. To investigate main accomplishments on the field by FSR institutions. The objective of the survey was to assess contributions, problems, and success of FSR projects. Based on questionnaire answers, an analysis was carried out in order to extract broader recommendations for future projects.

Main topics addressed in the survey included: project objectives, methodology, components, accomplishments and contributions which are available to farmers, critical factors to be considered in design, formulation, and implementation of FSR project seeking sustainable agricultural systems. The discussion of the information considers experiences in other countries of Latin America. General recommendations, and conclusions arising from the survey concerning small farm development which emerged from FSR projects are presented.

46 . **Managing Information for FSR/E Evaluation**

David J. Zimet, Chris O. Andrew, & Edwin C. French

A strength of the FSR/E methodology is that it encourages unique design of each project by accounting for the total environment of the project area. The uniqueness of the projects, however, makes comparisons and, ultimately, evaluation difficult. Technical recommendations are not usually repeated from one project to the

next, but the way in which the FSR/E methodology is applied is repeated. Through improving the process FSR/E can be made more effective and efficient. Comparisons and evaluations are important because the results serve for improvements in project implementation.

An evaluation team fielded by the Farming System Support Project was asked to evaluate the methodology used in 13 FSR/E projects in Central America. All of the projects employed a common process in application of a FSR/E methodology comprised of seven steps starting with site selection and ending with institutional follow-up. Each step, except site selection, was evaluated in each project to provide project composites and overall methodological analyses. This approach to evaluation proved to be useful because it separated a complex methodology into components, provided a way to focus and summarize much of the discussion of the team, elicited a good deal of constructive comment from involved institutions, helped to pinpoint relative strengths and weaknesses in each of the 13 projects and yielded valuable experience for other FSR/E project evaluations.

A principle finding of the team was that institutional follow-up by host country institutions could be a critical element of the process of applying a FSR/E methodology to research and extension. Follow-up depended upon the commitment of those national institutions. The commitment to specific projects could be strong in a situation as difficult as that found in El Salvador or weak in a place as favorably disposed towards FSR/E as Guatemala. And despite excellent technical recommendations concerning maize production in Costa Rica, the team believed that the recommendations would be spread by the efforts of the farmers and not national institutions.

**REGIONAL SESSION: UNITED STATES**

47 . **Use of Farming System Research Approach to Conserve Soil and Increase Productivity of Limited Resource Farms in North Alabama**

U. R. Bishnoi, Cathy Sabota, & Tommy Coleman

Soil losses on limited resource farms in North Alabama are serious and have often been neglected. Most small farmers can not afford high initial cost to implement conservation measures and also have poor contact with area's district conservationists as well as with extension agents. In an effort to reduce soil erosion and increase income for these limited resource farmers, four small farms each with a soil loss of 12-15 tons/acre/year were selected. Based on reconnaissance surveys, the FSR/SCS project's interdisciplinary team (Agronomist, Soil Scientists, Horticulturist, etc.) developed several soil conserving intervention's with the use of vegetable and field data from demonstrations indicate that: (1) Some farmers are unaware of soil erosion problems as well as assistance available to improve eroded soils, (2) Interventions on one farm create interest and motivate other farmers in the area to experiment with the new techniques to control their erosion problems, and (3) results from a cropping system using vegetables and brambles in demonstrations conducted on the small farms showed that sweet potatoes were the most effective in reducing soil and run off losses followed by soybean, blackberry, and raspberry. Income generated from the sweet potatoes sales was significantly higher than the soybean sales.

48 . **Integration of Farming Systems, Farm Water Management, and Irrigation System Management Approaches in the San Luis Valley of South-Central Colorado**

Alan C. Early

Professionals from Agricultural Economics, Agronomy, Rural Sociology, Agricultural Engineering and Civil Engineering at

Colorado State University have had diverse Farming Systems experiences in several African nations, in a ten year farm water management project in Pakistan and ten years of irrigation systems management and system improvement experience in Egypt, plus 6 years in main system management and farmer participation experience in the Philippines and 3 years of farmer participation experience in Thailand. These professionals and the corresponding traditional disciplinary approaches were integrated in an IRRIGATED FARMING SYSTEMS RESEARCH AND EXTENSION PROJECT in the San Luis Valley of South-Central Colorado beginning in early 1984.

The mode of operation of the project, the procedures used and the results from the first four years are highlighted to present background on the integration of the three diverse but nonetheless very much parallel approaches. The complementarities and conflicts arising from the integration process are shown in the light of the systems' social-economic-biological-physical problems and constraints. The evolution of definition of the client population and target area, the focus on local problems, the local farmers' inputs to project design, the communication process, the steps taken by the resident team to integrate into the community and the iteration on project goals and objectives provide insight on the integration process, an important new iteration on the Farming Systems Research and Extension methodology.

Assessment of project costs and perceived benefits from the four year but continuing project indicate an appropriate mix of approaches, a method by which a Land Grant Experimentation Station and Cooperative Extension Services can work together, and important INTEGRATION OF TECHNIQUES and a significant REVERSE TECHNOLOGY TRANSFER to the USA from the Third World.

49 . U.S. vs Third World Differences in the Environment  
for Farmer Decision Making: Implications for FSR/E Projects

Jerry B. Eckert

There is growing interest in the use of FSR/E techniques in domestic (U.S.) programs of agricultural development. Many university based FSR/E practitioners see this movement as a domestic spin-off of lessons learned through Title XII involvements abroad.

However, even small, limited resource farmers in the U.S. are further along the development spectrum than most Third World farm producers. Their developmental status provides both new opportunities and additional vulnerability compared to the Third World scene. U.S. decision makers operate with different sets of constraints, different relative resource availabilities, and different relative goals than their Third World counterparts.

This paper examines a number of comparisons between the two environments from the perspective of designing and/or implementing an FSR/E project. On the whole, the viability of FSR/E methods is sustained for certain U.S. settings. However, the U.S. farm management environment suggests important modifications to project emphases and methods. These modifications are elaborated as possible means of increasing the success of domestic programs, whether implemented through Cooperative Extension or as separately mounted projects. Conclusions are supported by comparisons between actual U.S., African and South Asian projects.

50 . Cooperating with Farmers to Promote  
Sustainable Agriculture in Iowa

Derrick N. Exner & Richard L. Thompson

A recent convergence of interest has brought together the Cooperative Extension Service in the state of Iowa and a small indigenous farmers' organization (Practical Farmers of Iowa) that is involved with ecologically sound farming. The cooperative

arrangement helps Extension by expanding its knowledge base and credibility in the area known as sustainable agriculture. The farmers' group gains both greater ability to communicate to the rural community and greater ability to attract scientific researchers to study sustainable agricultural methods. This farmer-Extension relationship, while it did not develop out of a formal FSR/E project, may have value for other regions as a model of opportunistic bottom-up communication.

About two dozen of these farmers conduct their own on-farm trials to evaluate technologies and practices. Side-by-side comparisons deal with, for example, fertilizer crops. Replication and randomization allow statistical inferences to be made. This has helped the trials' credibility with scientists, whose involvement enhances the information yield from these trials.

Other states have similar organizations, but relations with the Extension Service have not so far been as formalized or cordial as in Iowa. At least three factors are responsible:

1) Practical Farmers of Iowa has from its inception been concerned with a broad range of farmers, not only "organic" farmers of those most strictly limiting inputs.

2) Replicated, randomized, farmer-managed trials have made scientists and administrators more comfortable with conclusions drawn by these farmers.

3) Environmental problems and the recent financial crisis in American agriculture have emphasized the need for input efficiency, resource conservation, and risk management. Funds to address these issues have recently been made available.

51 . Sustaining Food, Income, and Families:  
Future Perspectives on Low-Input Agriculture

Charles A. Francis

Future success of agriculture to provide food and income will depend on our ability to develop sustainable crop and animal production systems. These systems must be profitable in the short term and environmentally sound in the long term. Low-input farming practices now under discussion and development provide one logical approach to improving and sustaining food production and income where other more capital-intensive strategies have not been successful.

Sustainable agricultural development strategies depend on maximum reliance on internal, renewable resources. Crop rotations, nitrogen fixation, nutrient cycling, genetic resistance to insects and pathogens, and efficient water and nutrient use are among the key components of such systems. Better understanding of the biological structuring of both natural and human-designed ecosystems can lead to design of more efficient and ecologically sound food production systems. The "process" of resource and need identification, farmer and scientist evaluation of alternatives, local involvement in testing viable options, and ownership of the activity through all its stages -- essentially the FSR/E model -- is proving more effective than conventional application of a commercial "product" or use of a "standard production package" to increase productivity over a wide range of situations. This is especially critical with low-resource farmers, where there is a need for family and community involvement, value-based decisions, and security of food and income.

Much of the success of low-input systems will depend on effective development, organization, and application of information in farming systems. Choices of appropriate new components of technology and their rational integration into current production systems are critical steps in the process. We will realize most success with a blend of new science with conventional farmer wisdom and experience in the development of sustainable agricultural systems.

52. The Resource Reservation Price and Hierarchy of Task Preferences for Farm Women: The Case of Dona Ana County

Wilmer M. Harper & Rossana Alvarez

Farm women are major participants in agricultural production. Depending upon the society, they participate in various aspects of farm operation and management. In many cases, the tasks performed by farm women are not fully recognized or counted as contributions to the farm operation. As a consequence, this resource is unacknowledged and/or misallocated. However, farm women may have a significant impact on the farm structure, allocation of resources, and net income. The role of women becomes even more important as the agricultural sector interacts with a growing urban/industrial sector. Women may seek off-farm employment or they may assume more farm tasks as their husbands move to the non-farm sector for full or part-time employment.

A Farming Systems Research and Extension (FSR/E) approach is essential if assistance is to be provided which will allow farm families to adapt to the changing environment which accompanies economic development. The tasks performed by family members and the hierarchy of preferences for new tasks which may be assumed are important components of the farming system. Therefore, they are important to research and extension programs. The paper reports the results of research to determine current participation in the labor and management by farm women in an area in which the rural, agricultural sector of the economy is experiencing a rapid transition as it interacts with the growing urban/industrial sector. The traditional crop mix is changing and the pool of human resources for labor and management tasks is undergoing a transformation. The research examines the reservation price for the labor/management resource represented by farm women and demonstrates the use of a paired comparison methodology to determine the hierarchy of preferences for new tasks.

Surveys were conducted with the wives of farmers in Dona Ana County, New Mexico to obtain the data. The data were used to estimate female labor resource availability, the level of women's participation in farm labor and management, and the reservation price of the resource. Paired comparisons methodology was used to develop a preference ranking for farm tasks.

53. U.S. vs Third World Research and Extension Institutions: Their Effect on Farming Systems Methodology

Peter E. Hildebrand

The institutional settings of research and extension organizations and of farmers in the U.S. and in the Third World were compared with respect to a number of characteristics. The implications of similarities and differences on the capability to use farming systems methodology and of the kind of farming systems methodology to use were evaluated.

With respect to the research institutional setting, the sense of mission, the nature of the research being done, the availability of resources, and personnel evaluation all favor the undertaking of farming systems research in the Third World relative to the U.S. With respect to the extension institutional setting, conditions favor the use of farming systems research in the U.S. over the Third World. This is particularly true, potentially, in states that have research and extension combined on regional experiment stations. Although farm conditions are quite different in the U.S. and most of the Third World, there is little to suggest that characteristics of farms and farmers make them any more or less amenable to farming systems research. Little in the above analysis suggests that basic farming systems research methodology needs to be much different whether working in the U.S. or in the Third World.

54. National Initiatives in Low Input Sustainable Agriculture: An Executive Branch Perspective

Dixon Hubbard

The world has changed and American agriculture must change with it. We must view approaches such as low input sustainable agriculture (LISA) as opportunities, and be willing to objectively evaluate them. As we move forward in addressing the many public issues related to agriculture, we must remember we are confronted with differing scenarios for the future. The point is that American agriculture needs effective tools for the job to be done. We must develop strategies that are appropriate for all futures—those which include world food sufficiency, and those which include world food shortage. Systems approaches to problem solving will provide the most logical response to uncertain and rapidly changing economic, environmental, and cultural conditions on this planet.

Congress has provided an opportunity for establishment of a network for LISA development across the U.S. Subtitle C of the 1985 Food Security Act and the funding of this Act in FY-88 have enabled USDA and the Land Grant System to embark on a LISA initiative involving many public and private organizations and individuals in research and education programs. With full cooperation of all parties, this initiative can result in farming systems which are both competitive and sustainable. We will describe the objectives and process of the USDA response to this challenge through LISA.

55. Using Replicated On-Farm Research Trials to Address Farmers' Questions About Low-Input Cropping Systems

Rhonda R. Janke & Ken McNamara

The Rodale Research Center and Rodale Institute are currently collaborating with fourteen farmer cooperators in nine midwestern states to conduct on-farm research and demonstration trials. Farmers in the network were chosen based on their interest in reducing the use of purchased inputs on their farms, and their motivation to answer questions for themselves through on-farm research. Trials are designed by the farmers with technical assistance from Rodale staff, and usually include only 2 or 3 treatments, and 6 or more replications in a randomized complete block design. Plot width is determined by the farmer's equipment size, and plot length is the length of the field. In 1987 and 1988, experiments tested reduced rates of nitrogen fertilizer following green manure and animal manure plow-down (compared to conventional rates of nitrogen), reduced rates of phosphorus and potassium on a manured field, ridge tillage without herbicides, and delayed planting dates for cultural control of weeds. Demonstration (non-replicated) trials included screening various legumes for use as overseeded green manure crops, a rotational grazing system for a forage-based dairy farm, and organic vegetable and fruit production.

The midwestern on-farm research network is a valuable addition and supplement to the research currently being conducted on low-input technologies are being tested on actual farms by farmers themselves. This is the most reliable test of these technologies in terms of confronting actual farm conditions, and also provides a source of feedback in terms of ideas and priorities for future research projects at the Research Center. Farmers benefit from getting first-hand information, and farmer field days at these on-farm research sites are an important component of our outreach effort.

56 . **Agricultural Technology and Ecosystem Protection**

James D. O'Connor, Chris O. Andrew, & Peter E. Hildebrand

The work of the agricultural research establishment has been shown in a number of case studies to be responsive to the needs of powerful groups in a country's socioeconomic and political spheres (e.g. deJanvry 1978, Burmeister 1987, Koppel and Oasa 1987). This sharply contrasts with the original induced innovation hypothesis which portrayed agricultural research as essentially apolitical and responsive to objectively given changes in competitive market prices. Some of the income distributional effects of serving relatively well positioned farmers and urban elites have been explored in the context of the Green Revolution. Little attention has been given to date to the ecologic distributional effects of agricultural technology. Degradation of the environment poses both immediate and long term impacts on the health of current and future generations. These effects fall differentially on the least powerful groups such as in the case of hired workers who must utilize dangerous chemicals as part of their jobs.

This paper explores some of the issues involved in planning agricultural research with consideration of the ecology and human health. Agricultural technology generated in pursuit of technical efficiency is viewed as having only distributional effects (income and health/ecology). "Economic efficiency" concerns are considered nothing but thinly veiled rationalizations for meeting the needs of owners of certain factors of production. It has become clear in the U.S. that agricultural research has focused on production per unit labor and also production per unit land. In Farming Systems Research, attention is focused on the scarce factors (i.e. the denominator in: technical efficiency = production/unit factor i). In what sense is labor and land scarce, say, relative to clean water (an unpriced input) and energy (an underpriced input)? In the U.S., even the numerator of the equation (production) is not scarce as evidenced by surpluses and expensive farm programs.

In the U.S., the concern for human health and the ecology (which of course are inexorably linked) has been largely imposed on the agricultural research establishment and farmers by environmental regulations. Options for the research establishment in developing countries to direct itself by careful selection of the scarce factors are discussed.

57 . **A Knowledge-Based System for Small Family Farms in the Southern USA: A Report of Work in Progress**

R. L. Senft

A knowledge-based system is being developed to assist owners of family farms. The target user population consists of small acreage landowners in the southern USA, with low capital, primarily using family labor. The system is intended to advise users on new enterprises compatible with their resources, suggest optimal configurations of current activities or help users design a family farm from scratch. The system consists of a main knowledge base which queries the user about his/her current activities, preferences and physical, monetary and labor resources. User preferences are extensively queried to allow the system to generate a list of acceptable recommendations. For example, the user can select between organic and traditional practices or reject individual activities or whole classes of enterprises. The system evaluates this information and suggests alternatives. The knowledge base consists of IF-THEN rules which describe an outcome or action in the THEN portion, based on a conditional statement of fact in the IF component. There are a large number of "common sense" rules that describe information that would be obvious to human experts (and non-experts) based on initial information. Additionally, a set of "meta-rules" guides the reasoning and eliminates main branches of the logic tree. Unlike conventional computer programs, the knowledge base is largely

unstructured; the flow of the reasoning is controlled by goals, user-stated preferences and meta-rules. A series of detailed knowledge bases will optionally advise the user on the details of individual enterprises. Knowledge bases are currently being constructed to describe forages, livestock and horticultural crop domains.

58 . **Integrated Systems Programming in U.S. Extension: Accomplishments Nationwide and Results from Texas**

Ellen Taylor-Powell

Declining agricultural profitability during the 1980's indicated inadequacies in the simple technology transfer and individual, finite problem solving model dominant in U.S. Extension programming. To help producers adapt to a changing environment, the Cooperative Extension System is increasingly advocating an integrated systems approach for regaining agricultural profitability and competitiveness. From a disciplinary or component approach to agricultural education, the integrated systems approach suggests a fundamental shift in Extension programming.

To assess Extension efforts in using an integrated systems approach to production, financial management, and marketing, and nationwide survey was conducted in 1987. Principal findings indicated a multiplicity in definitions and concepts associated with the integrated systems approach; an emphasis on combining biological and economic factors within a single commodity or enterprise and limited integration of the household; the relationship between problem identification and program ownership; the influence of organizational factors including administrator attitudes; and the lack of resources allocated to these programs. These findings and results from Texas are used to develop a taxonomy of integrated systems programs in the Cooperative Extension System. An inventory of results from the Texas programs indicate the range and potential sustainability of different types of integrated systems programs. Implications regarding the implementation, evaluation, and sustainability of integrated systems programs in the U.S. Cooperative Extension System are discussed.

59 . **Integrated Resource Management: Components, Concepts**

Gary M. Weber

The agricultural and industrial sectors of the United States (U.S.) economy experienced a period of growth and prosperity after World War II which was, in many ways, unprecedented in our history. This time period can be characterized as one in which the U.S. had technological superiority as well as an excellent supply of human and financial capital. In recent years, technology and capital have been widely available to develop and expand agricultural and industrial production in many countries. The increased competition has caused the agricultural and industrial sectors in the United States to carefully evaluate production areas where we may have a comparative advantage. As the world moves toward a more free trade position, comparative advantages will be more significant than policy dependent competitive advantages.

The Extension System and the beef cattle industry have made a decision to pursue a unified approach to ensuring a competitive, profitable and sustainable beef production system in the U.S. This unified approach is termed Integrated Resource Management (IRM). A national IRM Leadership Conference is planned to identify, illustrate and discuss this interdisciplinary approach to ensuring the comparative advantage of the U.S. beef cattle production system. Members of the research and Extension community as well as agricultural leaders and agribusiness people are invited to attend the Conference.

IRM is a systems approach which requires a holistic study of the interrelationships between various system components. This process requires a commitment to establishing an interdisciplinary

team which can help producers develop a competitive, profitable and sustainable production system. This system must balance profitability goals with environmental and societal concerns such as sustainable production consistent with the goals of human health and wellness.

The Cooperative Extension Service in several states, in concert with the beef cattle industry, have successfully implemented IRM programs which have improved the competitiveness and profitability of the industry. Example of these programs will be discussed with emphasis on the concepts of IRM so as to provide a basis for understanding the IRM approach, independent of commodity or focus.

Gary M. Weber, Program Leader, Animal Science, ES-USDA

#### FSR/E ACCOMPLISHMENTS IN THE FIELD

#### 60 . The Transfer of Results Obtained at Horticultural Research Stations: A Research Agenda for Mauritanian Researchers

Mamadou Lamine Ba

Since 1970, the CNRADA has been conducting a research program on fruits and vegetables.

Among other goals, it has taken on the selection of species, varieties and agricultural techniques that could be proposed to the farmers using the various agricultural systems of Mauritania. Thanks to the topics studied: varietal testing, testing of agricultural techniques, conservation and production of basic seeds which were established on-station in the study areas spread out over the national territories, and the on-farm tests, the research has been able to identify the species and varieties with high yields which have adapted to the climate and are pest tolerant.

They have been able to complete the technical itineraries for each crop, and to propose a technical package to the developers. But in spite of the convincing results obtained, the transfer of these results is still inefficient because of the rather incoherent way of approaching the farmers. We can attribute this to three reasons: 1. the fact that in research programs the farmers' real needs are not taken into account; 2. the lack of communication structures between farmers and researchers, accentuated by the small number of interviewers; 3. little involvement of the researchers in the daily activities of the farmers, which does not allow the feedback process to operate as it should. These are the three factors which have led the CNRADA and the AGRES II Project to consider a more realistic approach which would take into account the farmers' needs.

Therefore, an exhaustive survey was carried out with a multidisciplinary team and has made it possible to bring out the important problems that the farmers encounter and to identify the farmers' needs.

The factors which have been brought to light are irrigation and irrigation management, the scheduling of production, plant health protection, seed supplies, and the packaging, storing and processing of products. For the past 2 years the CNRADA and the AGRES II Project have set up research alternatives based on real problems which allow them to meet the demands of the farmers' world. Along the same lines, the CNRADA has systematized on-farm experiments to help the farmers solve their problems, and this step is strongly supported by the national structures for development which are more closely associated with the programming of research activities.

#### 61 . Towards Sustainable Improvements in the Productivity of Bhutan's Rice Farming Systems

Glenn L. Denning, G. B. Chettri, & Arsenio R. Samiano

Rice is the staple food of most Bhutanese. With an average national yield of about 2 t/ha, current rice production meets less than 70% of national requirements. With funding from the International Development Research Centre (IDRC), the Royal Government of Bhutan (RGOB) and the International Rice Research Institute (IRRI) have collaborated since 1983 in developing and introducing more productive rice farming systems. This paper describes the project methodology, current rice farming systems, research highlights, project impact, problems encountered, and the wider implications of experience gained over the past 5 years.

The IRRI-RGOB Project employs a farming systems approach that emphasizes sustainable improvements to component technologies of currently grown crops. Labor shortages and high transport costs influence research priorities. The rice-wheat pattern predominates on rice lands at all altitudes (150-2400m), although oilseeds and vegetables are increasing in importance as winter crops. In the mid altitudes (800-1800m), significant progress has been made in identification of high yielding, early maturing, semi-dwarf rice varieties (e.g. IR36, IR64). Top-dressing these varieties with nitrogen appears a cost-effective supplement to farmyard manure, significantly increasing grain and straw yields. Applying green manure with sesbania shows promise on infertile soils especially at the lower altitudes.

#### 62 . Accomplishments of the FSR Activities in the "Plan Comitan" Mexico

Nestor Estrella-Chulin, Nicolas Perez-Ramirez, Carlos Aragon-Gutierrez, & Benito Ramirez-Valverde

In 1967, Plan Puebla was started with the objectives of a) increasing corn production under rainfed conditions, and b) proving a methodology to be applied in different environments. As a consequence of the success of this plan, begun in the 1970's, several programs were started throughout the country using the same approach.

One of these, Plan Comitan, was one located in the State of Chiapas, which borders Guatemala. The region has 1.0 x 10<sup>6</sup>, 10% is crop land, and corn and beans are the main crops. The soils are "vertisols" and are flat. The average rainfall is 1000 mm, and most of the agriculture is conducted under rainfed conditions. The region is inhabited by campesinos, of which the tojolebal dominates. The munitundio exists in the region. To obtain a technological package to increase crop production, on-farm experimentation has been carried out since the beginning of the program. The experimental variables under control have been: nitrogen and phosphorus doses, plant density, variety adaptation, cropping systems, and soil preparation. These variables have been studied over 12 years, and the results show: a) a technological package is able to increase corn and bean production, depending on regional variability, b) rainfall and pests are the limiting factors to increased crop production, c) it is necessary to improve research and extension links, d) in order to take full advantage of research results, accrued information should be provided with the opportunity to use it, and e) in depth knowledge of the production units and farmer type must be obtained for full use of the results of the FSR/E efforts.

63 .

**Elaboration of Adapted Techniques**

Urs Galliker

In a population of self-supplying farmers in Rwanda, a rural development project (PAK) has gathered long-term experience in extension of basic topics. In 1984, different circumstances initiated a new approach, covered in: "Elaboration of Techniques, Adapted To Situations and Possibilities of the Peasantry" (EAT). The situation and problems of peasant families were analyzed and discussed on five confined areas. Each group chose various solutions with determined activities. Assisted by project collaborators, interested people or groups implemented these solutions and adjusted their activities according to their own ideas.

After two years, results have been obtained on two levels:

- If dialogue is used as the main method of extension, the techniques will be spontaneously adapted. This dialogue can only be possible and successful if an intensive follow-up is guaranteed.

- This collaboration can bring about important improvements and innovation, but, depending on the topic, a "definitive" result can not be expected after only one or two seasons.

Questions about the meaning of an extension project are getting new interpretations through the use of this approach.

Conditions for success should be official recognition and the intention to proceed after the basic described method.

In order to get a definition of EAT, one may compare this approach with FSR (Farming Systems Research), OFR (On-Farm Research), and R-D (Recherche-Developpement).

64 .

**Accomplishments of a Farming Systems Research Project in West Bengal, Eastern India**

Sudhin K. Mukhopadhyay

This paper attempts an empirical assessment of the accomplishments of a farming systems research project implemented in rainfed rice agriculture in the state of West Bengal in Eastern India.

The project was initiated in 1982 in a number of villages, and it has been continuing till now. The components of the project include experiments on farmers' fields in new technologies and cropping combinations, as well as concurrent, comprehensive socio-economic surveys in both the experiment villages and selected control villages. The study thus makes available data for the farm-households and landless households in all the nine villages and more than two thousand households covered in the project.

On the basis of these data, the paper examines the impact of the project since its inception, both at the village and the household levels. Analysis is conducted to assess the extent and nature of changes in: (a) technology, (b) production, (c) labor use, and (d) consumption. Comparative data over time and across villages and households make it possible to examine this impact.

Results show varying patterns of change in the villages in respect to the four aspects mentioned above, and an attempt is made to explain the determinants of these variations. Results also throw light upon the sustainability of the farming systems technology introduced. Finally, implications are explored for both research and development policies in farming systems.

65 .

**Institutionalizing FSR/E: Experiences in the Public and Private Sector**

M. E. Swisher &amp; E. E. French

Sustained use of farming systems methodology in international agricultural development depends to a large degree on how well the approach is institutionalized within existing national and international organizations. Without firm embodiment

within institutions, Farming Systems Research and Extension (FSR/E) can become another bygone buzzword of international development. With successful institutionalization, the approach will continue to be used in many cases.

The University of Florida was a pioneer in utilizing the FSR/E in domestic programming. The Panamerican School of Agriculture (EAP) in Honduras represents an attempt to utilize FSR/E in a private institution.

Institutionalization is difficult to achieve within structured institutions, where the roles of individuals, administrative units and organizational structure are well defined, and units within the system depend on established reward mechanisms which are adapted to respond to existent behavior patterns and priorities. At EAP, structure is more fluid, rewards are not mediated by outside actors, and personnel and roles are less stringently defined than in most land grant institutions. This makes it relatively easy for the institution to adapt to and adopt the FSR/E approach. However, the institution's highly fluid nature may not contribute to long term incorporation of FSR/E.

The authors conclude that: (1) every attempt should be made to incorporate the farming systems approach into existing institutions rather than build new, possibly short-lived organizations to accommodate the approach; (2) acceptance of the methodology within the land grant systems remains a top priority for the community of FSR/E practitioners; and (3) adjustment of reward systems, organizational structure, funding strategies, and lines of authority will be necessary to achieve successful institutionalization of the FSR/E approach.

66 .

**A Domestic Application of Farm Systems Methodology**

The SLVR/E Team &amp; Warren L. Trock

Application of farm systems methodology is always affected by and unique to the area of study and circumstances surrounding research. In the case of the San Luis Valley Research/Extension Project, application was affected by several factors, some deriving from the agricultural setting and others from the institutional setting of the university where the project was administered.

Methodological orientation has been the most significant issue for SLVR/E members. There has been an awareness that the system should be defined to reflect the circumstances of the situation being researched, as well as the needs and resources of project clientele and participants. Definition has also been important to team members, who each brought a disciplinary perspective to the project, as well as a knowledge of the need for comprehensiveness. The team resolved this issue by using the concept of a larger or more general system within which sub-systems could be separately and dependently considered.

The methodology also causes the research to be goal oriented, i.e. problem-solving. With improved acquaintance with project clientele, the team found the goals first specified for the project (greater efficiency in irrigated agriculture and a larger monetary return for farm families) to be ill-defined. Farmers expressed their concern for survival—for operational stability, for reduction of risk, so that optimal use could be made of currently available resources. With this greater specification of interests and needs, research design and implementation were made easier, and we were assured of increased relevance.

A third characteristic of the methodology which the team learned to appreciate is the inherent feedback in researching. It was found to be necessary for redefinition of goals, refinement of approaches, and coordination of research activities. A significant result of re-evaluation of earlier decisions was redefinition of project boundaries, which provided for a more homogeneous population in terms of resource constraints and farm enterprise characteristics.

Other characteristics of the methodology also influenced the thoughts, plans and activities of the team and are described in "The Methodology and Its Application, A Supplement to the Activities Report of the SLVR/E Project".

- 67 . Progress Towards Farmer Participation, Breadth of Focus and Action Orientation in FSR/E

Ignacio Villa

This paper sheds some light on progress being made in the field of farming systems, as reflected in the literature, towards stated goals of increased farmer participation, a broader disciplinary focus, and action-oriented research. To do this, symposia proceedings of the last six years are studied to search for observable trends in these areas. The discussion centers around what the author believes are the constraints to progress towards these goals of Farming Systems Research and Extension efforts. In the conclusion, suggestions are made that would facilitate this progress.

- 68 . Assessing FSR/E Impact in Lesotho through RAP

David V. Youmans

Farming Systems Research is an approach to agricultural development in which farmers join scientists in mutual, interdisciplinary problem-solving activities on farmers' lands. Extension education plays a central and vital role in the dissemination of information and the diffusion of innovations generated by such activities. In 1986, the reflective appraisal of programs (RAP) (Bennett, 1982) method was used to assess the impact of several years of FSR/E in Lesotho. The program had been funded by USAID and implemented by Washington State University through the Ministry of Agriculture. Unapologetically subjective, the RAP method produced systematic reflective evidence of changes which were highly indicative of program effectiveness. Real benefits among farmers were perceived to include better meals for families, higher crop yields, improved condition of animals and increased incomes. Adapting and using RAP in the rural African setting led to some interesting dynamics for further study.

- 69 . International Potato Center: Challenges for FSR in Training

Rainer Zachmann

In accordance with its research mandate, the International Potato Center (CIP) trains researchers of national potato and sweet potato programs of third world countries to address challenges of production and research. CIP recognizes that national programs must be able to generate technologies in collaboration with their farmers. Therefore, CIP is aware that, over the long term, training organized and executed with national programs is more effective than training organized independently by the center. Consequently, national programs are involved as much as possible in training, and, in fact, CIP's training strength lies in its collaboration with them.

CIP also collaborates well with researchers of many third world countries. But do researchers of these countries collaborate with their farmers to assure appropriateness of research? The lack of awareness of the role that farmers play in the process of technology generation has been a weak link that could be alleviated by training. CIP has complemented technical and scientific training in some courses by including simple social science practicals on the diagnosis of farming problems and on socioeconomic analyses.

Although trainees have reacted positively to these social science practicals, experience with the integration of FSR in training have been mixed. FS researchers could help to improve this situation by demonstrating the need for FSR training, by training of FS researchers in developing countries on how to conduct FSR training, and by collaborating with CIP.

## METHODOLOGIES FOR ASSESSING THE IMPACT OF FSR/E

### KEYNOTE ADDRESS

- 70 . Assessing Institutional Impact of FSR/E: Lessons from a Nine Country Study

\*\*\* Deborah Merrill-Sands \*\*\*

This paper focuses on assessment of institutional impact of Farming Systems Research. Drawing on the experiences and findings of a nine country study carried out by the International Service for National Agricultural Research (ISNAR) on the institutionalization and organization and management of On-Farm Client-Oriented Research (OFCOR) in developing country national agricultural research systems. The paper gives an overview of the study, highlights aspects of the study's methodology that are relevant for assessing institutional impact, and reviews the study's major findings with respect to institutional impact of OFCOR efforts in three key areas:

1. Integrating on-farm and experiment station research
2. Strengthening the link between research and resource-poor farmers
3. Developing and sustaining an interdisciplinary systems perspective within research.

- 71 . On the Monitoring and Evaluation of FSR/E: The Design, Field Testing, & Validation of a Process Documentation Framework for the Dimension of Farmer Participation

Maria Gladys Buenavista

Farmer participation is a vital component in FSR/E. Little is known, however, about its nature at the field level. This paper presents a study which consisted of the design, field testing, and validation of a process documentation framework for assessing farmer involvement in an FSR/E project; what farmers contribute to the accomplishment of project goals and objectives; the extent to which FSR/E projects have involved farmers in their research and extension efforts; and what farmers think about their participation. Instruments, consisting of a set of guide questions for a semi-structured interview, were developed to document farmer participation in the four stages of FSR/E: (a) description and diagnosis, (b) design, (c) testing, and (d) extension. These instruments were tested and validated in a farming systems project in Eastern Visayas, Philippines. From this exercise, a framework to guide the documentation of farmer participation in FSR/E and instruments to be used for the actual documentation task were developed. Insights about the project are also provided.

- 72 . Application of Principles of Design and Treatment Interactions, Treatment-by-farm Interactions, and Incremental Technology Introduction Options for Rainfed Maize in Mali

John S. Caldwell, Boubacar Coulibaly, & Alex Cunard

On-farm trials in FSR/E have multiple objectives beyond the analysis of treatment differences. These include identification of domains, or groups of farm households for whom the same technology is acceptable, and identification of incremental technology introduction options based on farm household participation. Analysis of variance is frequently used for initial biological analysis, but differences in objectives in FSR/E can require or result in design and treatment structures not common in station research.

On-farm trials for rainfed maize in 1987 were analyzed using 3 models, each with different design and treatment structures of increasing complexity but also increasing power to assess FSR/E objectives. The first model used crop cuts as experimental units, with completely random replication, no blocking by households or villages, and hence no design structure. The model used a 2 x 2 x 2 factorial treatment structure, with mechanization, variety, and other cultural practices as factors. The model did not reflect differences in treatments made to take into account existing farmer variety use. Treatment comparisons were not orthogonal.

The second model separated farm households into discrete, balanced data sets based on level of mechanization and treatment changes. The design structure of each data set used whole plots as experimental units and households as complete blocks, but did not assess differences among villages. Treatment structures consisted of 3 treatments, with orthogonal comparisons used to assess 2 steps in a single path of incremental change.

The third model used a 2-level, nested hierarchy of experimental units. Within farms, plots were grouped in incomplete blocks, where each block consisted of 2 or 3 treatment combinations of a 2 x 2 factorial treatment structure of variety by other cultural practices. Across farms, farms were grouped in a 5 x 2 incomplete factorial design structure of villages by level of mechanization. Treatment-by-village and treatment-by-farm interactions were assessed to identify paths of acceptable technology introduction.

73. **Opportunities Missed: A Collaborative Relationship Between Farming Systems & On-Farm Water Management Research & Extension**

Harold R. Capener

Food security is a problem of growing concern in developing countries. It is being exacerbated by a number of related problems, population growth, income inequality, environmental degradation, pricing policies, drought, etc. These policy issues are commanding greater attention on the part of national planning bodies and implementing agencies. There is general agreement that ministries of agriculture and irrigation represent two of the critical agencies in a nation's quest for food security. Agriculture's "Farming Systems" and Irrigation's "On-Farm Water Management," represent two nearly identical approaches which employ a wholistic systems analysis framework, i.e., bottom up and top down problems and solutions, methodologies and procedures. Both are highly dependent upon each other to achieve their own measure of success yet both stand far apart in the conduct of their planning and implementation. Opportunities for collaborative working relationships are unfortunately missed. Food security is too crucial to further sanction dysfunctional patterns of independent non-integrative program procedures.

74. **Farm Management: An Organizing Concept in Farming Systems Development (FSD)**

Virginia R. Cardenas  
Task Force on Farm Management

The development of a timely and relevant framework to operationalize farm management as the organizing concept in small farm systems development (FSD) within the context of Philippine situation was undertaken by a task force of 14 members representing different GO's and NGO's involved in farming systems development in the country. An abstract of the task force output follows:

A framework of farm management, its basic elements and the essential methodological orientation in accord to SFD were identified. Environment, farm and farmer management and skill dimensions at all levels were distinguished. To all of these elements farm management thus, serves as a tool in linking them

to effect a profitable, stable and sustainable farming operations.

Accordingly, issues related and recommended policy guidelines to operationalize farm management in FSD were presented. Among these are: the importance of a community based approach to planning; re-examination of key strategies in delivering extension strategies, re-orientation of research systems and methodologies and need for a consistent policy framework supportive of FSD.

75. **Application of Qualitative Systems Modelling Techniques for Identification and Assessment of Interventions in a Semi-arid Zone Farming Systems in Mali**

Boubacar Coulibaly, Alex Cunard, John S. Caldwell, & Y. K. Traore

Observations were made during 1987 on-farm trials on the cropping subsystem and its interactions with animal and household subsystems in a semi-arid zone village in Mali. These observations were first written in narrative form, and the narrative was then used as a basis for an integrated application of 5 qualitative farming systems modelling techniques presented in volumes I and III of the Farming Systems Support Project 1987 manuals.

Three techniques for choosing design priorities were used *ex ante*, prior to implementation of 1988 on-farm trials. First, a process model identified 3 major household goals for 7 crop or crop associations; corresponding household inputs, resources, constraints and strategies; and 8 possible interventions. A ranking of the 7 crops was then done based on prioritization of their contributions to the 3 major goals. Second, interaction flows of inputs, resources, and outputs between components resulting from the strategies of the households were mapped out using a structural model. The 3 major subsystems under the control of household members were broken down into individual components: types of crops, types of animals, and types of household members. The 8 interventions were located in the model, and their potential effects on other components were traced following interaction lines. Third, the interactions were mapped out over time, using a calendar with structural model components on the vertical axis and time in 10 day increments on the horizontal axis.

Two techniques for integrated analysis were used during the 1988 trials, based on the above *ex ante* results. Intra-household cost-benefit analysis, a modification of partial budgeting, was used to compare cost-benefit ratios of each treatment for different household members. Goal attainment scaling was used to assess achievement of goals of different household members by each treatment.

76. **Biological Simulation Models in Farming Systems Research**

J. B. Dent & P. K. Thornton

The use of biological computer-based simulation models is considered with reference to Farming Systems Research. It should be possible to design improved agricultural technology packages related to farm household resources and farmer objectives using whole-farm simulation models in which specific crop simulation models are embedded. It may be hypothesized that packages so designed have a greater chance of being accepted by farmers because they relate to prevailing socio-economic conditions. This is one way in which the efficiency of agricultural field experimentation might be enhanced, allowing the agricultural field experimentation might be enhanced, allowing the rapid assessment of new agrotechnology packages in the changing and exacting environment in which farmers have to operate.

The benefits of *ex ante* experimentation with a whole-farm simulation model are considerable: first, a much wider variety of production possibilities can be screened than is possible with field trials; second, alternatives can be screened with direct reference to the resource base of the farmer, his objectives, and his attitudes

towards risk and uncertainty; third, alternatives can be screened over many seasons, using simulated weather sequences, to investigate production stability and sustainability over time; and fourth, farm response can be aggregated over a region, and the effects of infrastructural or institutional changes on farm production and household income can be investigated for the benefit of policy makers and government.

Severe conceptual problems remain to be overcome. These have to do with the complexity of the biological and socio-economic interactions involved and with the difficulty in describing the framework whereby farmers make decisions. In addition, the biological components have to be sensitive to various factors, whilst remaining robust and transportable between radically different environments.

Certain characteristics in the design of biological models can be enumerated, which may be expected to facilitate their use in Farming Systems studies.

77. **Multi-Perspective Analysis of Sustained FSR Undertakings**

Kamal El-Kheshen

FSR, whether in project form (fixed duration) or as an existing pattern (non-fixed duration), will exist in a sustained form, only if they meet the criteria set by the concerned agents. These may, by definition, be divergent (private and social optima not always coinciding) and thus these different perspectives are taken account of when analyzing the impacts of FSR if sustainability is to be maintained. The paper goes on to show that as far as operators are concerned financial records, inter alia, are important, hence an accounting of returns to employed resources, is very valid. Two of the most applicable criteria are those of net benefits and debt service. If these could be approximated with some certainty beforehand (while taking account of quantifiable risks) then elements of the design/implementation of a proposed FSR project may be altered to improve the values of such indicators, so as to render it more profitable and, by extension, increase its chances of sustainability. From the perspective of the state, the economic analysis aspects are more relevant. Thus, issues relating to foreign exchange, terms of trade and linkages are to be considered when using techniques utilizing e.g. domestic resource cost. The paper shows that sustainability of FSR will only materialize if, from the state's perspective, the discounted measures of project worth are shown to be of the proper magnitude, because if the case is otherwise, then it will be realized at some point in time that marginal increments/returns are less than in other competing activities. For the purpose of this paper, sustainability of an FSR undertaking is taken to imply a stream of positive net benefits (both financial and economic) which will induce both operators and state administrators to continue with the implementation of the activity. A successful methodology for evaluating FSR from a viewpoint of sustainability must be a hybrid of the above mentioned issues. Such a methodology is developed in the paper, and it also accounts for non-pecuniary measures, such as the inelasticity of supply of small holder operators' labor.

78. **Research on Data Collection Methods (DOM) for Economic Evaluation of Cropping Patterns**

Anita L. Frio & Filomena R. Azogue

The assessment of the economic viability of experimental cropping patterns tested in farmers' field involves the comparison of the economic returns from these experiments with the farmers' present cropping patterns and practices.

Data from experiments in paddy include labor and power estimates for 1000m<sup>2</sup>, material inputs given and recorded by the researcher, and crop cuts for yield estimates, while farmers estimate the same data in a record keeping form.

This research attempts to identify simpler data collection

methods that will give reliable data and still be easy for FSR researchers in the national programs to follow.

Reliability of labor estimates was tested through three approaches of intensive and periodic recording and recall survey. There was no significant difference between farmers' labor estimates from nursery operation in paddy production to threshing between intensive and periodic recording. However, labor estimates tend to be significantly lower when using recall survey. Small farms generally tend to underestimate labor hours in all farm operations when the recall method was used. The interval between periodic and intensive recording was from 1-9 weeks, intensive and recall, 20-27 weeks, and 9-23 weeks between recall and periodic visits.

Mean quantity estimates for fertilizer used did not differ significantly from each method, while estimates for quantity of insecticide sprayed was significantly higher in the recall method.

Yield estimates differ significantly between periodic visit and recall survey. However, there was no significant difference in its mean yield estimates between periodic and intensive recording methods. Share tenants also tend to overestimate yield across the 3 methods of data collection when compared with lessees. Yield estimates and farm size has no correlation and that the mean yields for the 3 methods does not differ from each other.

79. **Agricultural Extension and Peasants' Organizations: The definition of new relationships and responsibilities between farmers and research/extension/development agencies**

Iram Gentil & Gret Wibaux

During the last few years, a lot of energy has been spent on evaluating various research and extension practices: T&V, FSR, the francophone RD.... It was often forgotten that these only are elements of the development process. The adoption of innovations depends on the quality of this innovation, and therefore on research activities. But it also depends on the price ratio between products and inputs, on the efficiency of the supply and marketing system, on the availability of credits at the right time.... The very notion of extension can be questioned. The term of technical exchanges would probably be preferable (exchanges between complementary sources of knowledge).

A national extension policy is required to insure a consistency at the national level. But the practical organization must allow possible adaptations to the regional diversities. The usual national pyramidal extension service often consumes most of its energy in its own bureaucratic functioning, leaving only few for the actual development-oriented work. They can often be caricatured as institutions which costs are certain, but which efficiency is uncertain.

A flexible interface between the farmers, the research, and the decision-makers is needed. In this line, the peasants' organizations (producers or service cooperatives, local groups organized for marketing or for the transformation of agricultural products....), which importance in Africa is increasing, can play a significant role, provided they are given the right supports, and the responsibilities between the different actors are clearly negotiated.

Can this affect our view of FSR and our expectations?

80. **Strengthening On-Farm Rice Research in High Risk Environments in Eastern India**

Anil K. Gupta, D. M. Maurya, & K. C. John

In view of the development of innovative methodologies for embedding on-farm research in the institutional context attempted by the first author during his one year stay in Bangladesh, a collaborative programme of on-farm research has been developed between Indian Institute of Management, Ahmedabad and Narendra Dev University of Agriculture and Technology, Kumarganj, Faizabad. The paper provides description of the methodolo-

gies evolved by the second author as well as other members of the team and their implications for similar research in other countries. The distinctive features of the research process are:

(a) The on-farm research is being strengthened simultaneously with improvement in the research management process in the university. It is assumed that one cannot have strong on-farm research unless the accountability of on-station research is complemented with autonomy of the on-farm teams. The major issues that have emerged in the research management workshop have been summarised in Part I of the paper.

(b) The innovative method developed by second author required distribution of advanced lines of rice among farmers to be grown in their own management conditions. The monitoring of farmer-to-farmer diffusion was to provide the utility of these lines for different risk and resource environments. We have recently collected data on diffusion and some interesting insights emerging from the method along with its limitation are presented in Part II.

(c) Part III of the paper deals with description of other methodologies such as ecological mapping, renewal discriminant analysis, decision through analysis, etc.

(d) The last part of the paper includes our recommendations for modification in the methodology for on-farm research in high risk environments.

81 . **Statistical Design and Analysis of On-Farm Trials**

Boyd J. Hanson, V. Batasubramanian, David B. Marx

Statistical analysis of on-farm trials in lesser developed countries poses certain statistical problems which are less important in classical agricultural research. Heterogeneity and infertility of soils, and differing cultural practices induce elevated levels of variation which would not be acceptable in agricultural experimentation in more controlled environments. Plot size is limited by the small farm size of most farmers and the number of repetitions is limited by logistical difficulties involved in taking measurements at locations which are widely scattered and often semi-inaccessible. An elevated number of results are unusable due to poor follow-up by poorly trained observers, or due to theft or other damage. Trials are generally placed with a single repetition per farm and results are analyzed by treating each farmer as a block in a randomized complete block design.

The validity of selected experimental designs and methods of statistical analysis of assessing on-farm trials have been discussed by various authors, however, there is still considerable confusion and controversy. Analysis of data from on-farm research in Rwanda is the basis of recommendations of appropriate methodologies of experimental design and statistical analysis for Rwanda. Similar recommendations may be appropriate for other lesser-developed countries.

82 . **The Importance of Investigative Models in Problem Identification in FSR/E: Relevance to the Malian Situation**

Curtis M. Jolly, Millie A. Gadbois, & Alpha S. Maiga

Farming Systems Research and Extension (FSR/E) projects, in the past decade, have been criticized for their cost ineffectiveness, their lengthy methodological approach, and the concentration of time used in defining farmers' problems through meticulous surveys. Preliminary observation models are never encouraged in the problem identification stages. In this study, models are developed to show that early model formulation can be useful in problem identification and hence increase the effectiveness and sustainability of FSR/E. Data from the rapid reconnaissance survey, previous field and experiment station trial records, plus other secondary data are used to develop linear programming models for representative farms for the identified farming systems with the research zones, delineated by the Operation Haute Valle FSR/E team in Mali. The models demonstrate the importance of

early model formulation in the reduction of the FSR/E research process. The development of investigative models at the problem identification phase enhance the use of secondary data, and primary data collected from field and experiment station trials in early farming systems research activities. On-shelf technology assessed appropriate are incorporated into the farming systems without much delay, and identified problems are classified as research, development, extension, and/or policy.

83 . **A Methodological Framework for Evaluation of Farming Systems Research**

K. K. Klein & M. G. Buenavista

A key to improving the efficiency and effectiveness of public investments in Farming Systems Research and Extension (FSR/E) is development of a proper monitoring and evaluation framework. Monitoring activities tend to be focused on the progress of physical measurements such as yields. Evaluation activities are often conducted by non-project participants, who may not even come from the same institution. The adoption of newly developed agricultural technologies depends not only on input and output prices, but also on the social processes involved in interactions among co-operating farmers, extension, and research personnel. Economic payoffs from these types of public investments in FSR/E depends on the sustainability of the new technologies.

The objective of this study was to develop methodology for monitoring and evaluating FSR/E while it is in progress. This permits feedback and the possible alteration of costly FSR/E programs, thus ensuring responsible use of public funds.

The approach developed in this study is not country specific. To illustrate, the diagnostic and extension stages of on-farm experimentation from a project in the Philippines are combined with the evaluation stage using micro and macro systems models from a project in Canada. The methodological framework exposes many of the problems inherent in the adoption and long-term acceptance of new technologies by producers. Recommendations are made for monitoring and evaluating future FSR/E.

84 . **The Formation of Recommendation Domains Using Cluster Analysis**

Steven E. Kraft, Paul L. Roth, & Angela Thielen

The success of the FSR approach relies on the identification of relevant recommendation domains. The literature in this area of farming systems is not extensive. This is especially the case with the development of recommendation domains for large areas in which a large number of farm operations are located. In this paper, we report on an effort in which empirically derived recommendation domains were identified using the numerical technique of cluster analysis. A random sample of farm operators was drawn for the 34 southern most counties of Illinois. This is an area dominated by small, part-time farm operations. A survey was sent to the members of the sample in which information about their farming operations was requested: size, enterprises, socio-economic characteristics of operator and spouse, sources of income, goals, limiting resources. Based on the survey responses and an analysis of the data, we found that the area had a diversity of farms that were basically small, with many enterprises, and high levels of off farm income. Additionally, there was a range of larger farm operations. In order to develop homogeneous sets of farm operations from these data, we used cluster analysis, keying off nine variables to create the clusters. Analysis shows that between 15 to 20 different groups of farms existed in the area. Cluster analysis showed that 20 groups captured the range of diversity within the farms in the area. Once the clusters were formed using the nine variables, additional information was collected on each cluster to verify that it was significantly different from the others.

These clusters have become our first cut in the development of recommendation domains for the area. Cluster analysis is a fast accurate technique that could be a useful tool in the application of farming systems to areas.

- 85 . Use of a Typology of Different Production Systems for Development Programs: The Example of the Dairy Development Project in Kilimanjaro Region (Tanzania)

Catherine Elisabeth Laurent

The Kilimanjaro region in Tanzania shows several agro-ecological areas with about 100,000 small-scale farmers.

A project has been initiated by the Tanzanian Ministry of Agriculture and Livestock Development and F.A.O., with special focus on these farmers since 1983. It is now an integrated dairy development project involving several donor agencies (including French Ministry of Cooperation) in addition to F.A.O. and the Tanzanian Government. The primary objective is to assist small-scale farmers to increase milk production.

This objective required:

- improving knowledge of the small-scale farms systems of production and identifying their main constraints,
- working out proper advice to be given to farmers,
- organizing training and extension programs,
- organizing input supply through the cooperative sector.

This paper presents some aspects of the actions in which the author has been more directly involved.

The guidelines of this work were:

- to take into account the diversity of the production systems in order to try not to exclude any group of farmers from the development scheme,
- to consider the farm as a whole and to consider milk production together with related activities.

This resulted in:

- making a typology of the different systems of production in order to identify target groups for project activities,
- and setting up a large network of farms to carry out trials and follow-up in order to work out innovations in farm conditions.

The interest of such an approach will be illustrated by three examples: molasses/urea distribution, introduction of legumes, roughage treatment.

- 86 . Impact Assessment of On-Farm Research: Employing Unobtrusive and Obtrusive Methodologies to Discern Horizontal Diffusion

D. M. Maurya, K. C. John, R. A. Singh, & K. R. Tiwari

Impact assessment of farmer participatory research poses real problems in terms of employing evaluation criteria of major stakeholders. The perspectives of policy makers, public administrators, farmers - rich and poor, breeders, other disciplinary scientists, extension workers etc., may vary. We have not studied, so far, the respective position of all these actors. The paper includes discussion mainly on the farmers' perspectives vis-a-vis the scientists. Concept of horizontal diffusion is evolved to capture the evaluation criteria used by collaborating farmers to gauge the suitability of advanced breeding lines to their micro-environmental conditions. The participating farmers experiment with these lines and compare their performance with local land races. Instead of seeking feedback only directly, the researchers withdraw from the village after working with farmers for (a) one year and (b) two years. The idea is to provide farmers opportunities to exercise their choice in the subsequent cropping season. The horizontal diffusion or lack of it, in terms of inter-farmer and inter-plot but intra-household dissemination of technological component (seed), is assessed unobtrusively by wandering around the village. During the flowering stage of crop, scientists identify different genotypes and rapidly appraising increase/decrease in area under different

lines. Separately, a survey is conducted to understand the farmers' evaluation criteria as well as the extent of exchange of seeds. The process of horizontal diffusion is traced and the determinants of the extent of the farmer-to-farmer diffusion is described.

- 87 . Classification of Farmers into Research/Recommendation Domains

M. Moussie & C. Muhitira

In recent years FSR/E has been widely accepted by both NARCs and IARCs as a viable approach for agricultural research. What makes FSR/E different from traditional commodity/discipline oriented research is that small farmers are the integral part of the research process in which researchers, extension staff, and farmers jointly determine a research agenda. The Small Farming Systems Project conducted a Diagnostic of the project area with the full participation of the groups mentioned above. In order to determine specific research/recommendation domains for specific groups of farmers, farm households have to be classified homogeneous groups according to the socioeconomic and agropastoral characteristics.

Even though too much has been written about the need for grouping farmers, there has been little effort to arrive at empirically verifiable classifications. This paper shows how farm households are grouped using cluster and discriminant analysis. Based on results of the Diagnostic (informal survey), a questionnaire was prepared that included key socioeconomic and agropastoral characteristics of the project area. The criteria for selecting the key variables used for classification were categorized into structural and strategic variables. The former deals with variables which circumscribe opportunity (more or less fixed variables), while the latter relate more to production varying by individual production units.

- 88 . An Input-Output Approach to Farming Systems Analysis

Sudhin K. Mukhopadhyay, Anupam Chakraborty, & Jill Findeis

The major distinguishing characteristics of a farming system is that it represents a comprehensive network of inter-related production and consumption activities in the context of a farm-household. Results of analysis of farms and their implications for policy differ significantly depending on whether it refers to individual activities separately or the integrated system as a whole. The input-output technique for examining inter-industry flows or transaction in a macro economic setting provides a useful model for analysing a farming system. In this study such a model has been designed and applied in selected villages in Eastern India in order: (a) to examine the structures of production and consumption of farm-household; (b) to trace the disposal of each output into intermediate uses within the farm-households, consumption by the household, and marketed surplus; (c) to determine the income flows and net economic position of the farm-household; (d) to examine the technology and input use by the farm in each of its production activities; and (e) to estimate the total demand for each input generated by the production and consumption requirements of the household. The model is also used to estimate the quantitative impact of the introduction of new farming systems by comparing different structures. The results show how in the same neighbourhoods even otherwise homogeneous villages could differ widely in terms of economic and technical performance. Useful insights are gained into the critical questions about the nature of motivation of subsistence farm-households and also the market imperfections that help perpetuate technical and economic inefficiencies. Policy implications are also explored.

89 . **Agricultural Market Research as a Two-Way Street**

Ben B. Norman, John Dunbar, S. Berry, R. Knight, & R. Miller

One of the best ways to learn is to listen in a very organized manner. "Problem driven solutions" (PDS) methodology offers many benefits to the user in providing a clear and easy to master system for collecting the thoughts and perceptions of a diverse clientele. In dealing animal and plant owners, PDS offers a coherent and relatively unbiased method for collecting perceptions from our clientele.

In 1987, the University of California - Davis, Veterinary and Animal Science Cooperative Extension Units (CE) jointly finished a report called the Beef Crisis Report using PDS methodology. The primary goal of the study was to determine if there were things we in CE could do to assist the beef industry to return to and to maintain profitability. We chose this methodology for several reasons: 1) it permitted many interviewers to be used without allowing individual bias to overly influence any interview, 2) for each problem identified, it provided a list of solutions proposed by the clientele, 3) it provided a broad view of the profitability problem, 4) the interaction with clientele demonstrated a concern to the participants by CE for industry problems, and 5) the very fact that the problems/solutions work list was generated from client perceptions makes it difficult for administrators to ignore.

A committee of 5, consisting of 2 specialists and 3 livestock farm advisors, was appointed. One of the co-chairmen had received PDS training from I.B.M. as team leader on a management information systems feasibility study. Twenty-nine livestock farm advisors (LFAs, county agents) were interviewed by the committee and trained in the interview process. In turn, they worked with the committee in interviewing 26 producers chosen at random from a county-stratified cattlemen's association mailing list, 24 producers chosen by LFAs as outstanding business cattlemen in their respective counties, 30 people in allied businesses (veterinarians, feedmen, drug sellers, truckers, feeders, etc.), and 8 well known educators in livestock agriculture from California institutes of higher education. Commercial marketing research suggests this is an adequate sample size to disclose most of the problems important to the target clientele. The question asked was, "What problems must be resolved for the beef industry to return to profitability and to maintain profitability?" These responses were summarized into a report with 8 main problem categories suggested from the data: Marketing, Consumer Acceptance, Business/Finance, Production Management, Government, Land Issues, Animal Health and Miscellaneous. The 5 most commonly mentioned problems were described within each category and a solution list was listed under each problem. This PDS methodology provides client-driven information that can be used for guiding CE program development.

90 . **Lessons Drawn From Five Years of Research/Development in Mexico: An Operational Diagnostic**

Richard Georges Pasquis

For introduction, the author presents the major phases followed by the Mexican Agricultural Investigation in its desire to be involved with the rural problem. Then some prior major attempts by the government to stimulate rural development are presented. A frame of reference is then presented in which CIRAD's project of Development Investigation is initiated. (CIRAD is the Center for International Cooperation in Agricultural Investigation for the Development of France.)

A favorable national context of Integral Rural Development not only allowed the project to quickly acquire concrete results, but also to develop a diagnostic method and a transference technology. The principle results of the Operational Diagnostic focus are presented in a concise manner.

In conclusion, some difficulties of the focus are underlined, and the phases of validation and generalization are presented, along with some proposals for adaptation methodologies.

91 . **Development and Testing Methods to Integrate Food Consumption/Nutrition into Diagnosis and Design: The Bicol Region (Philippines) FSR/E Project**

Marilyn Prehm, L. Haedrich, A.O. Borja, G.G.H. Bordado and E. de la Torre

The purpose of the presentation is to describe how project methods for diagnosis were modified to incorporate food consumption/nutrition concerns and the implications for design. The methods developed by a multidisciplinary team were integrated into the definition of research domains, the project's four phase diagnostic and planning process and tested in one measure, nutrition was found to be a useful factor in distinguishing between households for developing research domains. The usefulness of results generated by different nutrition specific and integrative methods were evaluated, and results from different phases were compared to evaluate internal consistency and to modify the diagnostic process. Methods providing more useful information included typical days food, nutrition risk estimate, food and income gaps calendar, food sources calendar, and discipline specific check sheets. Comparison of problem lists indicated four new problems identified during the household reconnaissance. Results of the diagnosis indicated that the farming system at highest nutritional risk was the landless/fisher households, with farming systems of increasing diversification at less risk. When team and community perceived problems were compared it was found that the community's priorities focused on improved production of cash crops and food security, while the team perceived these and other problems such as nutritional status which could be addressed in trials by including criteria sensitive to related consumption and production practices. Criteria for trials incorporating related problems included nutrition content of crops, harvesting time, livestock waster, watermanagement and cultivation of medicinal plants.

92 . **The Role of the Pre-Extension Division within the CNRADA**

Sidi Ould R'Chid, Abou Oumar N'Gam, & Mark B. Lynham

For the past 10 years there has been a pre-extension division within the CNRADA which constitutes an essential tool for linking research and development, and is an appropriate framework for the adaptation of technologies developed by research before their transfer to the farmers. This division is present in all the agricultural areas of Mauritania where the CNRADA has stations, study areas and multilocal test networks, and it implements on-farm tests and demonstrations, allowing the researchers not only to listen to the farmers but also to be inspired by their experiences. Recently renamed "Division for Production Systems and Technology Transfer Research" (Division de Recherche en Systeme de Production and Transfert de Technologies D.S.P.T.T.), this structure will integrate the farming systems research methodology in its procedures from now on.

With this new approach the research considers the farmer to be an active partner, and no longer a recipient of technologies developed far from his/her farm. In fact, the proposals made to the farmers by the researchers largely take into account the problems encountered by the farmers.

Another innovation in this approach is the multidisciplinary nature of the research teams. With the institutionalization of the FSR/E methodology by the CNRADA master plan, the D.S.P.T.T. (Division for Production Systems and Technology Transfer Research) is called upon to play an eminent role within the CNRADA.

93 . Institutionalising Lateral Learning in On-Farm Research and Extension Programme in Eastern India

R. K. Singh, A. K. Gupta & K. V. John

There are 7 programmes of on-farm research and extension ranging from on-farm rice based cropping system research, operation research programme, lab-to-land to experiment on cultivators' fields. The paper provides details of the process of lateral learning started by Acharya, Narendra Dev University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh, in India with the help of institutional collaboration with Indian Institute of Management, Ahmedabad, Gujarat. The objective of the lateral learning are:

(a) to identify common problems with uncommon solutions;  
(b) to generate possibilities of some treatments taken as common so that broad based results on reliability and adaptability can be achieved. This is important because different programmes are operating in different parts of 15 of the most backward eastern Uttar Pradesh districts;

(c) the feedback from on-farm research to on-station research has been weak in most parts of the world. Attempts to overcome this gap are being made by generating specific monitoring interventions at the level of Director of Research;

(d) farmers' participation in generation of research priorities and evaluation of trials has been of varying qualities in different programmes. There have not been many examples of farmer insights or critical appraisal having led to the modification research programmes;

(e) the methodologies for on-farm research that can launch the high risk upland and deep water conditions of farmers' decision making are being developed;

(f) the farmers' feedback through farmers' fair and other channels of extension is being analysed through spatial, seasonal and sectoral parameters.

Recently Directors of Research from five other regional research institutions visited Narendra Dev University of Agriculture and Technology to study this process of lateral learning so as to trigger similar activities in their own universities/institutions. This is perhaps the first time that such an effort across different programmes has been attempted in the country. Implications for future strategies have been drawn up.

94 . Managing Farmer Selection for More Effective FSR/E

Alistair Sutherland

The mode of farmer selection has been a neglected area in the development of FSR methodologies. When the selection of farmers is left to junior staff, or undertaken by senior staff who lack a clear set of selection criteria, undesirable situations can arise. Selection biases can lead to a technology being tested by farmers falling outside of the original target group, or by a particular section of the farming community to the neglect of other important sections. Unguided selection can also lead to inefficiencies in the management of trial programmes and reduce opportunities for interaction between scientists and farmers.

The paper advocates using a community approach to farmer selection in order to reduce biases and improve the efficiency of trial management and the extent of interaction with farmers. The benefits of this approach are illustrated with examples from Zambia's farming systems research programme, the Adaptive Research Planning Team.

95 . Identification of Research and Extension Domains for Fertilization of Rainfed Maize in Mali

Y. K. Traore, Rolf Jensen, Alpha Maiga, & John S. Caldwell

Integration of socio-economic survey data and agronomic experimental data is a key methodological issue in FSR/E.

Concurrent socio-economic and experimental data were collected in 1987 from 5 villages with on-farm trials in south central Mali. Survey data included demographic characteristics; loci of decision-making; percentages of cultivated land area in intercropped cereals, monocropped cereals, and cash crops; and percentages of fields worked by women and by men. Experimental data included yields, net economic benefit, and percentages of households failing to achieve the break-even point at 2 different price levels.

Both qualitative and quantitative techniques were used for integration of the 2 types of data. The qualitative technique used was to compare matrices of variables and villages in 3 tables. Rows in each table represented a variable from survey or experimental data. Columns consisted of villages. Variables had previously been subjected to individual chi-square or analysis of variance tests for differences among treatments and villages. Repeating patterns of differences among villages led to division of the villages into 2 types, based on degree of orientation towards cash or food crop objectives. The 2 cash-crop oriented villages were characterized by less participation by youth in decision-making, and lower percentages of cultivated land area in intercropped cereals but higher percentages in monocropped cereals and cash crops, in comparison with the 3 food-crop oriented villages. Two villages, one from each village type, and higher overall yield levels and economic returns to inorganic fertilization. These results suggest that previous level of management may be a more useful indicator of suitability for extension of input-intensive practices than is a cash-crop orientation. Conversely, research on less-input intensive, more locally sustainable fertilization practices is needed for villages at a lower previous management level. Comparisons of these qualitative results with results of a quantitative technique, cluster analysis, are discussed.

96 . Target Categories for Farming Systems Research

Mahinda Wijeratne

The Farming Systems Research (FSR) focuses on re-orientation of research efforts especially on agro-ecological basis. However, within any agro-ecological zone, farmers' access to resources vary from one category to the other. Hence, general recommendations are not appropriate to all of them since some may not possess the required resources. Today, this fact is sully recognized. Therefore, identification of target categories has become increasingly important in research as well as an effective tool for knowledge dissemination. In essence, the offer should be produced to the resource capabilities of a particular target market.

This paper focuses on identification of target categories. Such target categories can be utilized in FSR programmes in their effort towards knowledge generation and transfer.

**GENDER AND INTRA-HOUSEHOLD ISSUES IN FSR/E**

KEYNOTE ADDRESS

97 . Gender Issues and Farming Systems Research and Extension

\*\*\* Susan V. Poats \*\*\*

As the farming systems research and extension (FSR/E) approach has matured, in both its application and methodology, increasing attention has been focused on an area that is often defined as "gender issues." Like FSR/E, "gender issues" is shorthand or a "code" for an extensive field interdisciplinary research and practice. The application or integration of gender issues in FSR/E has not been even nor accomplished without difficulty. In some projects, consideration of gender issues was a pragmatic decision, simply a way to do better on-farm work. For others, it has been, and often still is, an emotional battle. The process of integration is not complete, but much progress has

been made and there is a great deal to learn from the experiences of those projects and institutions where gender-awareness and analysis have been achieved.

This paper examines briefly the background of the interaction between FSR/E and gender issues, and then presents the preliminary results of a questionnaire on the extent of gender analysis in current FSR/E projects that was sent to the lead authors of all abstracts submitted to this year's FSR/E Symposium. While the complete set of results are not yet available, the initial results indicate interesting trends in the institutionalization of gender issues in agricultural research and development. Drawing upon other existing secondary information, the paper lays out the lessons learned thus far in the integration of gender issues and FSR/E and proposes an agenda for the future focusing on training in methodological skills, training of trainers, and the management, staffing and development of field teams.

98. Women in Rice IPM: The Philippine Experience

Candida B. Adalla

Women's concerns in the actual implementation of integrated Pest Management technology for lowland rice at the village level was identified. Efforts to incorporate gender and intra-household issues in the extension of IPM program throughout the country were documented. The participatory approach of generating and validating appropriate location specific IPM technology was adapted and the advantages and limitations of the methodology vis-a-vis other extension approaches were identified.

The experiences gained in this project clearly indicated the need to involve the whole household (farmer, wife and working children) in future IPM demonstration/extension campaigns if it has to be appropriately adapted by the target clientele - the farming family as a household unit.

99. Major Socio-Economic Issues Confronting Poor Rice Cultivators in a North Bihar Chaur Area

Ruth Grosvenor Alsop & Madhu Sharma

The cropping strategies of poor agricultural producers in North Bihar, India are influenced by many social and economic factors. These influences differ from those that affect the agricultural decisions made by richer producers. Data from India show that to understand the nature and extent of these influences, it is important to document the linkages within the agricultural system both between rich and poor households and within these different households. An understanding of these linkages can help to identify and shape agricultural research priorities for programmes whose objectives include increasing income and welfare levels of poor agricultural producers. Central to the argument is the contention that specified social norms and economic pressures exert opposing pressures on the agricultural decision making of households.

100. Methodologies for Learning About Gender Roles in Farming Systems Research and Extension: A Panel

Hilary S. Feldstein, Susan Poats, & Janice Jiggins

Integrating intra-household and gender analysis into agricultural research and extension is improving the targeting and specification of technology development. In the past five years, a number of researchers have developed innovative methods for collecting and analyzing such information in a timely and resource-efficient manner. This presentation will give an overview of methodologies being used in field and an opportunity to learn about and discuss methods being used by four practitioners.

Format: The session will open with an analysis of methodologies currently being used with special attention to resources

required and output of various approaches. Four practitioners will describe the methods they have used in the field. Time will be provided for small group discussion with each participant.

Presenters: Hilary Sims Feldstein, Co-Director, Gender and Agriculture Project—methodologies overview; Dr. July Leesberg, Wageningen University—a board game used with non-literate farmers in Colombia for recording agricultural activities and output by gender and age on a daily basis; Nongluk Suphanchaimat, Khon Kaen University—household record keeping as a means of understanding farmers' intentionality and decision making; Dr. Barbara Grandin, International Laboratory for Research on Animal Diseases—technique for wealth indexing as a means of stratifying samples and learning about local concepts of ranking; Maria Fernandez, Grupo Yanapai, Peru—use of panels in on-farm testing in highland Peru's crop/livestock project.

101. Women in Farming Systems: A Macro-Micro Analysis in Eastern India

Bahniskha Ghosh

The objective of this study is to examine, in a rice-based farming system in Eastern India, the status, role and strategy of women in the context of family and society through quantitative data, both at the macro and micro levels, that throw light on the share of women in income, employment and work. In specific, the study seeks to estimate and examine the pattern and determinants of employment of the male and the female labour, both at the macro and at household levels. It also explores the participation of male and female members of the household in various types of "work" through allocation of time. The male-female distribution of work load is compared with the distribution of food consumption within the households and the question of gender equity is examined. The share of women in the generation of total household income and expenditure is also measured.

The results suggest that unemployment, reinforced by poverty and illiteracy, seems to have imposed upon women a relatively heavier burden than upon men, and a secular decline in female employment has emerged. It also appears that the total work burden of women is invariably larger than that of men when home production activities are taken into account. This turns out to be valid across locations, communities, economic statuses and seasons. When the work burden is set against food consumption, the male-female differential in family status and strategy becomes more apparent. The female works longer hours, consumes smaller quantities, and sacrifices more during the harder days (lean season). This is also supported by the smaller proportion of consumer expenditure enjoyed by the female within the household. All this results in persistent inequities in the distribution of work and nutrition. Policy interventions to counter this imbalance through changes in the integrated farm-household are explored.

102. Rural Development, Agrarian Reform, and Rural Extension: Impacts on the Female Labor Force in Brazil

Lena Lavinás

This paper intends to discuss the impact of the modernization of agriculture on the female labor force. It will consider specially changes in the different forms of organization of the agriculture activity in Brazil (traditional family farm, modern family farm, extensive and modern farms).

Another important aspect to be considered will be the role of the State, of the rural unions and of women's movements of the contradictions in terms of gender and intra-household issues.

Which are the demands made by rural working women to the State? To what extent do the present regional programs and Agrarian Reform experiments incorporate such demands? Do the rural unions take into consideration the political participation of women in land social movements? What positive aspects are due

- to the struggle of women?  
Finally, some hypotheses concerning the full citizenship of rural women will be presented.
103. **Fully Understanding Women's Role in Agriculture: Their Position in Pulaar Society**  
Tidiane N'Gaide
- When looking at the agricultural development of the Senegalese river basin, more and more women are being involved in all the agricultural activities. The males are going away and much of the decision making and work within households are being transferred to women who sustain their families and help their migrant husbands.
- In many Pulaar areas, women have been always discriminated against access to land. The rare women who have access to land are independent women such as widows, divorced women, or women whose husbands migrated. It is their status that leads them to be economically independent. The structure of the extended family which used to guarantee and preserve the welfare of women and their children is being threatened by combined effects of the evolution of the society, the drought, and the rate of migration in the river basin. As such what should be the new relationship between women and land? Is the changing social structure able to preserve women's rights? Will it be able to take into consideration the welfare of the children? If so, how will this be achieved?
- In recent years, the introduction of new agricultural activities such as irrigation perimeters and village gardens, which provide a useful complement to their family diet as well as a source of income, are changing the new status over land and creating new sets of relations between men and land. As such, what is the role of women in those activities? What is their status? Were they able to have access to land? If so, under what conditions?
- Women will play an important role in the development of the Senegalese river basin by participating more in agricultural production and alleviating the shortage of labor during high peak seasons. This new situation will lead undoubtedly to a new type of farming woman who is conscious of the role she is playing and the necessity of having her economical independence for a greater yield on her participation. This new farming woman will be more interested by individual access to land than the security provided by the extended family.
- Developers and researchers must understand the changing role of women in agriculture that has occurred during the last ten years in order to produce and extend appropriate and viable technologies that will ensure sustainable improvements in the cropping systems throughout the river valley. The paper will discuss the issues of women and development in the Senegal river basin.
104. **The Role of Women in Subsistence Mixed Farming: The Case of Morocco**  
Fatima Nassif
- Based primarily on data collected through structured interviews of a sample of 37 farmers and subsample of eleven farmers' wives in the province of Settat, Morocco, the issue of women's agricultural work in subsistence mixed farming is examined.
- The predominant view of agricultural production in Morocco excludes women and hardly recognizes their contributions. The paper is concerned with the following:
- the identification and assessment of the prevailing male perception of women's work generally and agricultural work in particular especially in rural areas;
  - the identification and analysis of the various contributions of rural women to agricultural production
- with emphasis on their role as suppliers of "unpaid" labor; and
- the methodological question of male/female views of the farming system and its different components and the implications of these views for current and future research, proposed technology recommendations, and agricultural policy.
- One major conclusion of the paper is that the study of the role(s) of women in agriculture presents a challenge for FSR/E in many developing countries. Seldom, have women been targeted to receive their due share in research coverage conceptually and methodologically.
105. **Role of Women In Tribal Community for Economic Development in a Forest Based Mixed Farming System**  
S. Rath, S. Das & A. K. Pattnaik
- Research results presented on the economic role of women in a forest based, rainfed mixed farming system in Phulbani, a tribal district (Orissa State) of India. Descriptions include to what extent the women depend round the year on the nature, in various agricultural operations and in utilizing the forest produce for their household consumption or for sale in local market. Their involvement is 57% in cultivation of rice, 35% in turmeric growing and 39% in livestock rearing while in small income generating activities women's role is more than 60%. This indicates that the farmers development in a tribal community is only possible through Farming System Research approach involving the women participants in the utilization of video as a tool in farmer to farmer education.
106. **Labour Use Patterns in Smallholder Rice Farming Systems - A Case Study**  
Ravi Sangakkara
- A notable change in agriculture took place in Asia with the introduction of the new rice varieties. These varieties respond to greater care in producing their potential yields. Thus labour use in rice farms increased due to greater intensity of cultivation practices. In addition, development of new technology made a greater impact on the sexwise distribution of labour in small farms.
- Increasing population, coupled with the increasing demand for food in Asia saw the opening of new settlement schemes to generate employment and increase food production. The new settlement schemes saw the migration of farmers from traditional rice farming regions. Thus a study was carried out on three rice farming systems in Sri Lanka, namely the traditional settlements, old settlements and the new settlements, to determine the use of labour, especially in terms of different sexes in producing a rice crop over the primary season of cultivation.
- Results show an allocation of different tasks of the traditional rice farming systems to different sexes, and the use of children is minimal in these systems. In the old settlements, which were established in the 1940's, also show the use of females in specific operations of the rice system although there is integration of the sexes and use of children in peak demand periods. In contrast, there is generally no differentiation of sexes in conducting the operations of the rice farms in the new settlement schemes. Except in very difficult tasks such as primary land preparation, females are called upon to assist in all operations. The migratory and imported labour to these regions during peak demand times also do not show sex differentiation in the tasks associated with the rice farming systems. In addition, there is considerable use of family child labour in these new settlement schemes. This indicates the instability of labour use patterns in the new schemes in comparison with old settlement and traditional rice farming systems. Some causal factors for these observations and the sustainability of these trends in the different systems are presented in the context of the rice farming conditions in Sri Lanka.

107. **A Study on Mungbean Storage and Pest Control Practices:  
A Case in Guimba, Nueva Ecija**

Ma. Bettina R. Santos, Bernard Canapi & Virgilio R. Carangal

In lowland rice-based cropping systems, mungbean (*Vigna radiata*) has been identified as an ideal crop before or after rice. However, the adoption of this technology has been constrained by the availability of good planting material. Seed damage during storage by Bruchid weevil has been reported to cause poor viability consequently low yields. Chemicals have been used to control this pest, however, it has some serious drawbacks. Thus, the use of indigenous materials to control this pest has been proposed. A survey was conducted in two villages in Guimba, Nueva Ecija to gain knowledge on indigenous materials currently in use or practices employed and household participation in post harvest operations.

Initial results of the survey indicate that seed storage is mainly a woman's responsibility. Women who do not use any storage control measure reported as much as 100% of seed damage. While those who used indigenous material reported no seed loss. Selected farm women cooperators will test the effectiveness of indigenous materials such as Acacia leaves, salang (Pinus keslya), Madre de cacao (*Gliricidia sepium*), ginger and vegetable oils on controlling mungbean storage pest.

Pest recognition is basic to efficient control. No significant difference in pest recognition was seen between men and women farmers. However, further training on mungbean production, insect familiarization, common insect terminology and control will be conducted to men and women farmers.

108. **Integrating Women's Concerns in Farming Systems Research/  
Extension  
Project in Tribal Area of Bihar, India**

K. P. Singh, Niva Bara, & Valeria Lakra

This paper will present data from a Scheduled Tribal area of Southern Bihar, India, where farming systems research is being carried out by a soil scientist and other agricultural scientists; and extension activities are led by three women Tribal Extension Officers under the program at Birsa Agricultural University, Ranchi. The village used as a case illustration in this paper has shifted from monocropping to 2 to 3 vegetable crops each year, due to scientific management of production factor, i.e. soil fertility, water availability, appropriate seed and cultivation practices. This has been accomplished in a society which has typically avoided interaction with outsiders due to a long history of exploitation. The experience has been replicated in several villages in the area. Unlike other areas in India, the primary cultivators are women, but successful research and extension has brought the men of the village into the production activities also. A village level revolving fund is now being managed by the women of the village to supply inputs for cultivation.

109. **An Impact Assessment of the Application of Gender Analysis  
and FSR/E to a Drought Prone Area in Thailand**

Nongluk Suphanchaimat, Amnieng Viriyasiri,  
& Wilaiwatt Grisapanuti

This paper discusses the initial impact of using a farming systems methodology in a drought prone area in Northeast Thailand. A team of social scientists was included in the on-going crop-livestock development project of the Farming Systems Institute in Ban Don Por Daeng. The team aimed at identifying technology development which would be appropriate to farm conditions. A re-analysis of data from a year of household records, disaggregating by gender, revealed the existence of high seasonal male out-migration and the inappropriateness of proposed

changes in cropping patterns. The team was able to identify significant women's in crop and sericulture enterprises. Under drought stress condition with high male out-migration existing, year round activity, in order to increase family cash income through silk worm rearing. Peanuts and corn have been experimentally intercropped with improved mulberry varieties. The results are (1) increased hectareage of improved mulberry garden, (2) increased number of households in silk rearing, and (3) increased household cash income.

110. **Role of Women in Rice Seed Management**

International Rice Testing Program

Seed quality has a significant impact on crop production. Yield losses as high as 30% resulting from poor seed vigor were recorded in rice. To realize the full potential of the genetically enhanced modern varieties it is important for the farmers to use high quality seeds that reflect genetic purity as well as health and vigor. Appropriate management practices can ensure such seed quality and most of these operations can be carried out by women. Women can thus play a very productive role in rice seed management and make practical and significant contributions to rice production. The pre- and post-harvest operational care by women, to ensure seed quality, involves activities such as visual examination of seeds for seed health and purity, conducting tests for germination and vigor, seed treatment against insects and diseases, selection and harvest of plants for seed purpose and threshing, drying and storage of seed.

111. **Women's Role in Nepalese Farming Systems:  
A Comparative Study of a Temperate and a Sub-Tropical  
Environment of Nepal**

Jagadish Timsina, Dibya Timsina & N. B. Chhetry

A comparative study on the role of women in decision making processes as well as in actual participation in different agricultural activities was done in Ratnanagar (representing a sub-tropical low altitude environment) and Pumdri Bhumdi (representing a temperate high altitude) villages of Nepal. The study explored that women's involvement and role was quite high in both environments with their contributions much higher in Pumdri Bhumdi as compared to Ratnanagar. Women were involved in all aspects of crop and vegetable production, utilization, and marketing. They were also responsible for livestock production including their sanitation and marketing. In most of the decisions related to crop and animal production activities in both Ratnanagar and Pumdri Bhumdi, women alone, or together with men played important roles. Summary and conclusions, and recommendations and policy implications are also included in paper.

112. **Use of Improved Technology and the Influence of Family-Related  
Factors on Productivity of Some Farms of Tropical Mexico**

Jose L. Zuniga, Sergio Uribe, Rene Camacho

From 1981 to 1987 eight small farm families were studied in San Andres Tuxtla, Veracruz, in the tropical region of Mexico. They were given a series of improved agricultural and livestock methods which would increase the level of productivity of their farms. The families studied revealed certain intrinsic characteristics, of which the following were the most noteworthy:

- a. Alcoholism habits among heads of families
- b. Problems with family integration (instability)
- c. Availability of manpower

Alcoholism was observed in three out of eight heads of families that were studied. Problems of family instability were observed in the same alcoholic group, and also in two other cases. However, it was greater in the alcoholic group. Both problems of

alcoholism and family instability provoked the following: (1) Unfulfillment of the proposed agricultural and livestock practices; (2) Inattention to the productivity process; (3) Deterioration of relationships between fathers and elder sons; (4) Deficient cooperation with work.

As a result, the alcoholic family group reached only 68% of their production potential with corn, and 45% with milk (according to experimental results). On the other hand, the unstable family group obtained only 79% and 81% of production potential with corn and milk respectively. In contrast, a family without either problem reached a production equivalent to 87% of the indicated potential.

The lack of manpower available in families (men 18 to 65 years of age), had negative effects on the level of production of the farms. This was improved when the available potential manpower (family members 12 to 65 years of age) participated actively. However, the improvement was not possible in small and your families.

### *The Role of Information/Communications Systems in FSR/E*

#### 113. FSR/E Communications Assessment: Comparisons Among Five U.S. and Asian Institutions

James H. Bemis

This paper describes conceptual and operational tools used to characterize, measure, and analyze FSR/E communications in five agricultural research and extension institutions in Asia (Sri Lanka, Bangladesh, and Indonesia) and the United States (Arkansas). The perspective is that of a communications scientist/practitioner working for the host institutions on short (20-day) and long-term (20-month) consultancy assignments, from 1985 to 1988. Few traditional agricultural institutions have the staff resources and required allotments of time for such assessment, and only limited conceptual yardsticks or operational devices are available to gauge the newly emerging communications patterns and technologies that have so quickly blurred our previous notions of "research" and "extension" functions. Nowhere is this shifting more apparent than within innovative approaches such as FSR/E, where scientist/farmer teams operate as multi-disciplinary units. Their combined information processes generate streams of both "soft" and "hard" data that often flowing simultaneously and instantaneously in interactions that stretch to and from farmers fields and national-level decision makers. Communications support staffs are among those in special need of creative management and budgetary mechanisms, as well as training and applied research, to integrate the communications forces of research and extension (whether traditional or modern), the private and non-profit sectors, and inter-related government agencies. The concepts and tools described here build upon a common model and methodologies are outlined for systematic communications diagnostics, planning, staffing, facilities development, and training. Institutional communications capabilities are analysed and compared within this common conceptual framework.

#### 114. The Role of Information/Communication of FSR/E in the Philippines

Demetria S. Comelio & Rodolfo S. Cornelio

Communication and information strategies plays a very important role in the development of location-specific and cost effective farming system-technologies for various agro-climatic characteristics and socio-economic conditions. It is that stage of research with more efficient and effective methods in catering to the needs of the small farmers through farming system approach. Considering that the Philippines is an agricultural country

which composes of about 80 percent of Farming industry, it has devoted a total land area in 1985 of 3.2 million hectares (has) to rice production, of which 1.80 million hectares were under irrigated lowland culture, 1.27 million in rainfed lowland and 0.15 million in upland rice.

In all areas of the country from Region I to XII, it is widely implementing the cropping system approach to cover the major rice producing areas. Like other countries of the world, the Filipino farmers aim to increase production by maximizing land utilization through the use of economically feasible crop combinations for a given place and time. The Department of Agriculture (DA) has launched the newest and important activities in its desire to endeavor to provide our farmers farming technologies that will not only increase their productivity, but will maximize the use of their small pieces of land and increase farm income to improve their quality of life through better education, nutrition and living condition. We are also aiming for site-specific recommendations rather than a blanket national recommendation which may not really be appropriate for the specific conditions of the farm concerned. To make more efficient use of resources that are available or can be available and increase the income of small scale farmers.

Training of Technicians, farmers, etc. is one of the main activities in Farming Systems Research and Development. Bringing the technology in farmer's field through demonstration trials, on farm testing and seminars enable the farmers to adopt the technology easily.

Through this process, researchers, extension workers, etc. carefully develop the available technologies through proper communication and scientific information to attain the goals on farming system approaches. The most productive role of the Farming Systems Research and Extension is to help improve the agricultural well-being of the small farm family.

#### 115. Information: A Critical Renewable Resource for Sustainable Agricultural Systems

James W. King & Charles A. Francis

Information could be considered a renewable resource for crop and livestock production systems. This resource is continuously updated and expanded with the introduction of each new idea or crop variety and with each new experience in soil fertility or plant protection. After introducing a new hybrid or weed control strategy, the farmer learns more about their effects as the season progresses. Unlike a bag of fertilizer or bottle of pesticide, information is not "used up" when it is applied. Once present with the farmer and family, information and its variants will be integrated into the total experience base and be available for each succeeding season. Thus information is dynamic and continually expanding, flexible and mobile. It follows the farmer from one field to another, one enterprise to another and even to a new farm if there is a change in ownership or management.

Because of its mobility and potential for reducing production costs, information is a critical component of sustainable agricultural systems. Data and experiences on biological interactions in farming systems can substitute at times for purchased inputs. New research on information processing is leading to more efficient and effective design and development of agricultural messages. There is a critical interface between information and decision making processes. The potentials, promises, and myths surrounding "high-tech" communications must be explored in the farming systems context. Emerging communication concepts are discussed, including "information over-ride," "meaning lag," "distance learning," and "information implosion". New technologies such as telecommunication, desktop publishing, and computer applications are being utilized in a range of settings for learning and training. Farming Systems Research and Extension projects need to make maximum use of the potentials of new communication devices to bring more and

better information to bear on management decisions. Information adds to the ever growing store of internal resources available for reducing production costs and seeking a truly sustainable agriculture. We consider information a key internal resource which has been underexploited to date.

116. **The Potential for Electronic Mail Networks to Extend Farming Systems Research**

Mark Krause, Robert Deuson & Roger Sharp

Farming Systems Research usually suffers from a multitude of time constraints that limit the extent of farming systems analyses and publications. Project timeframes and other professional responsibilities limit the time an interdisciplinary team can work together in the field, then team members most often scatter to different locations. While in the field, the time required to solve logistical and administrative problems, train and supervise data collectors, verify and organize data in an exploitable form, and train local counterparts severely limits the time left for data analysis and reporting results. Analysis is also limited by which analytical techniques team members are familiar with, the capacity of local computers, and usually small reference libraries. Once they have scattered, Farming Systems Research team members usually find few opportunities to meet and discuss additional analyses. As a result, many Farming Systems Research data sets are only superficially exploited and many relevant observations never appear in publications.

An electronic mail network, CGNET, has been used by former members of a farming systems research project to continue collaborative analyses of data collected in Niger. The ability to have computer programming specialist reorganize and summarize data for colleagues in another state and the ability to immediately share manuscript drafts among co-authors have been especially valuable. Computer file compression and preparation of messages with work processors keeps costs moderate. CGNET also allows immediate communication with researchers at the ICRISAT Sahelian Center in Niger who have provided additional current data.

117. **Communicating and Disseminating Project Results: A Model from the Small Ruminant CRSP**

Constance McCorkle, Donald L. Esslinger, & June L. DeWeese

FSR/E and related projects devote enormous energy and sums to research and development (R&D), but typically provide little planning, personnel, or budget for systematically and effectively reporting and disseminating the results of these efforts. Beyond the usual annual or quarterly reports and occasional scholarly articles by project scientists, diffusion and impact are largely left to take care of themselves. Yet communicating and disseminating findings should be a regular, iterative – and critical endpoint – responsibility of all R&D. Shirking this task means that large, expensive projects end up having little impact on either scientific or policy communities or the development public. Worse still, more large, expensive projects may be mounted to address the same problems all over again.

This paper describes a composite plan of publication information diffusion established by the Small Ruminant Collaborative Research Support Program (SR-CRSP) and its Sociology Project. A highlight of the plan is its flexibility in providing a range of communications channels to accommodate varying professional levels of program participants, collaborative efforts across projects and disciplines, and different national languages and target audiences. Practical details of production costs and procedures are also discussed, along with appropriate library and other dissemination networks. The SR-CRSP experience is offered as a useful model for other international R&D projects.

118. **Technology Delivery Systems Development In Sioasio, Sual, Pangasinan: The Case of the Sloping Agricultural Land Technology (SALT)**

Mary Ann Pollisco-Botengan, Timothy Finan, & Roy Roberto Pollisco

The slow transfer of technology from the experiment stations to the farmers' fields has been one of the major factors cited for the minimal impact that agricultural research has made on Philippine agriculture. Technology delivery systems are viaducts of information intended to provide technological knowledge from a research area to a target clientele.

It is a well accepted fact that the adoption of technology in the farm is not as rapid as the generation of technology by research and development institutions. One of the so many technologies developed for subsistence farmers is the Sloping Agricultural Land Technology (SALT). SALT is a diversified farm system. It is a simple, applicable, low-cost and timely method of farming hilly lands (Watson and Laquihon, 1985). SALT is basically a technique of growing crops between contoured rows of ipil-ipil.

This study was conducted from January to December of 1986 in Sioasio, Sual, Pangasinan in the northwestern part of the Philippines. The objectives of the study were: to identify and analyze existing technology delivery systems; to draw up more effective technology transfer mechanisms and make recommendations for the improvement of existing systems; and to test the technology delivery system at the selected representative municipality. The research exercise revolved around the concept of interagency collaboration, hence the research team was comprised of representative from the various research and development agencies conducting extension work in the research site. The team went to the site and identified the technology introduced to the area (SALT), and from there traced the development pathway to the source.

The method of disseminating SALT in the research area was found to be ineffective. The team therefore attempted to improve on this and after a series of modifications and considerations, tested the developed technology delivery system. The modified and tested technology delivery system was observed to be effective in the research site as evidenced by greater participation among farmers. It was concluded that for the technology mechanism for disseminating technology must easily win the confidence and command the respect of the end-users, as well as those others involved with the project.

119. **An Effective Communication is FSR: Research-Extension Linkage**

Mahinda Wijeratne

Linkages between sub-systems play a vital role in the process of knowledge dissemination in Agricultural Knowledge Systems (AKS) perspective. The Farming Systems Research (FSR) and Training and Visit (T&V) System can be regarded as recently developed AKS models which are rapidly gaining ground, especially in developing countries. They make an effort to strengthen the liaisons between sub-systems. Various formal bodies were establishing to fulfill this task. These forums make a platform where 'demand' (utilization) and 'supply' (generation of knowledge) can be met. The formal bodies are expected to perform an effective communication to bring the forces towards each other.

Based on an empirical study carried out in Sri Lanka, this paper explores the formal and actual situations of research - extension linkage in AKS.

120. Planning the Special Bibliography as a Communication Channel:  
The Access to and Transfer of FSR/E Information

Noel D. Young

Lack of relevant information is recognized as a constraint to agricultural production in most of the Third World. Studies have shown that direct personal contacts and networks are seen by researchers to be the most important sources through which pertinent information is gained. This is especially the case for those on the cutting edge of a new multi-disciplinary field. If this is true, then librarians need to promote better direct contact between researchers. The import of this facilitating activity becomes more apparent when one realizes that information transfer through personal contact is too often the most significant mechanism through which such transfer occurs between countries.

The special bibliography is one tool that can help to meet this demand for relevant information. The inclusion of fugitive literature in such a bibliography is crucial. Much of the FSR/E material is non-conventional literature. It most often has a title, usually an author, sometimes a date, and once in a while, a note explaining that "This paper was prepared for such-and-such seminar or meeting." For the researcher, this is always the paper that contains the kernel of creativity, hinting at solutions to problem at hand. Unfortunately, even if an author is noted, the "place of publication" and "publisher" are indicated, following good library cataloging protocol, as s.l. and s.n. respectively.

Bibliographies should be regarded as a means of finding items, rather than as a series of irreproachable library records. Furthering this end, the bibliography must be an instrument of communication, giving users access to relevant information concerning items in the collection. Anything increasing this communication process is good; anything detracting from it is bad. The job of the librarian is "to comprehend the structures of recorded knowledge where they exist, and assist in the structuring process where they do not exist." When this is accomplished successfully, information transfer can take place.

A simple innovation in the elements of the bibliographic record will facilitate this type of networking between researchers, thus making librarians traditional documentation activities more effective. In regard to these problematic papers with nothing but a title, author, and occasional date, I have included (where possible) and institutional affiliation for the author. Inclusion of an author address in the cited record turns the bibliography into a directory, thereby allowing direct communication between researchers.

*Special Topics: Agroforestry*

121. System Description and Project Design in Agroforestry Research:  
A Case Study from Humid Lowland of Cameroon

Bahlru Duguma & Jean Tonye

The International Council for Research in Agroforestry (ICRAF) and the Institute of Agronomic Research (IRA) of Cameroon, funded by the Near East Foundation (NEF) analysed the smallholder land use pattern in the humid lowland of Cameroon in 1986.

The macro level study thus identified three major systems:

- 1) the coffee/food crop/cocoa system found on high fertility nitosols with rainfall of >3000mm.
- 2) the household farming system of plantation workers on infertile xanthic ferrasols in high rainfall zone.
- 3) the cocoa/food crop/coffee system found throughout the Southern plateau, predominantly on low fertility orthic ferrasols with rainfall of 1500 - 2000mm.

Subsequent micro level investigation of the cocoa/food

crop/coffee system, uncovered the following subsystems and associated agroforestry related problems:

- a) fallow based food cropping system: decreasing crop yield due to declining fertility with short fallow.
- b) home garden/smallstock system: underdeveloped and low diversity of crop and problem of free ranging smallstock.
- c) cocoa based cropping system: inadequate and poor quality shade and management.

Based on the above information, the multi disciplinary team from IRA and ICRAF recommended agroforestry technologies such as improved fallow, hedgerow intercropping, mixed cropping and feed bank to address the identified problems and ensure improved and sustainable food production.

As a step towards achieving these objectives, a vigour/phenology trial was set up in 1987, primarily to assess adaptability of MPTS\* to local conditions and screen for suitable traits for use in developing the proposed technologies. Preliminary results from this trial showed that survival and growth rate of all the ten species examined in the study was best when established in pure stand than when intercropped with maize.

The performance of Leucana was the best, followed by Gilircida, Sesbania and Albizia in decreasing order.

122. The Potentials and Practices of Agro-forestry in the Millet and Sorghum Based Cropping Systems in the Semi-Arid Zone of Nigeria: The Case of Acacia albida L.

N. A. Gworgwor

Millet (Pennisetum spp) and sorghum (Sorghum bicolor Moench) are the commonest cereals grown in the Semi-arid zone of Nigeria. They form the basis of the farming system of the area. Their production, however, have been under the traditional farming system with poor soil fertility resulting in declining yield yearly. A brief study within the Maiduguri area of the semi-arid zone shows, however, that farmers under the traditional production system of these crops make use of the leguminous natural growing trees on their field especially Acacia albida L. for better crop growth and obtaining higher yield as the soil nutrient of the land is being improved by the ability of the leguminous tree to fix atmospheric nitrogen and through shading of their leaves at the beginning of the rainy season adds organic matter to the soil for the crop use. Furthermore, this tree serves as a fodder source for their animals during the dry season and as well as a source of firewood. Thus, the agro-forestry practice has been in local practice by the farmers of the semi-arid zone which has abundance of the Acacia albida L. growing naturally, but its proper use and potentials in the farming system is yet to be utilized fully.

In this paper, I intend to discuss the traditional practice of growing millet and sorghum in association with Acacia albida L., the potentials of this tree in the farming system and areas of possible improvements and research are highlighted.

123. The Sondeo Applied to Perennial Crops:  
Results from Fruit Growers with Timber Resources

Steven E. Kraft, Thomas Purcell, & Paul Roth

The literature on rapid surveys or "the sondeo" revolves around its use with farmers producing primarily annual crops. Examples from the literature on the application of the approach to crops of a perennial nature are few. In this paper, we report on the use of the rapid survey technique with farmers producing perennial crops: tree fruit and forests. As in the traditional Sondeo, a multidisciplinary team was used to meet with the farmers and identify their goals, resource limitations, problems, farm enterprises, off-farm activities, etc. As part of this process, it was necessary to find out about the nature of the stands of fruit trees and woodlands. To accomplish this, it was frequently necessary to spend time carrying out a "rapid survey of these" in order to

assess their potential and the manner which the perennials were integrated into the farm operation. A two phase sondeo was developed: first, the team met with the farmer and discussed the nature of the farm operation and how it was merged with the household. Second, the team carried out a second visit in which the tree plantations were inspected as to the age, variety, and management of the fruit trees. Additionally, the woodlands were inspected to determine the different stands and to assess the possibility of managing the woodlands for economic returns with the other on-going farmer activities. In the study area, woodlands are frequently seen not as a resource to be used, but as something filling the space among fields. When this perception was confirmed during the initial contact with the farmers, we decided that team members would have to see the forests to determine what management options might be open to the farmers. This paper reports on how the two phased sondeos were developed, how they were carried out, results obtained from them, and how our experience can be generalized to dealing with perennial crops in other areas.

124. **Farm Forestry in Eastern Ontario, Canada:  
The Role of Marketing and Investment Incentives**

Timothy P. Murphy

The productivity of small parcels of privately-owned forest lands throughout eastern Canada is far below its potential maximum, yet many of these lands have inherent productivity far greater than either the corporate or government owned boreal forests of the Northland. A number of policies, both on national and provincial levels have been implemented in order to assist landowners with various aspects of forest management.

Previous efforts undertaken by the Ontario Government to effectively promote forest management on private non-industrial forest lands (PNIF) and increase the forestry-derived rural incomes in the province have emphasized landowner assistance in the establishment of new softwood plantations on abandoned farmland. While it is not disputed that benefits have accrued by this policy, including soil conservation, aesthetic improvements, and wildlife habitat, these benefits are primarily public in nature and return little economic benefits to the owners of the land. This problem has reduced the overall effectiveness of these policies and reduced potential participation by PNIF landowners.

This case-study seeks to clarify those options that are available to PNIF landowners in the eastern region of Ontario and analyze marketing strategies and policies that promote investment in forest management. The key to economic development is investment. However, without adequate markets and prices for forest products at the farm level, the level of investment into forest management activities will continue to be inadequate. It is my position that a gap exists, both in current policy initiatives and in available information: that of the role that marketing plays in the development of economically-viable forestry on private non-industrial forestlands. Without adequate markets, a self-sustaining source and incentive for forestry investment will not exist. And without adequate access to information about these markets, the forest farmers in Ontario will receive less than the optimum return from their harvests. Lacking this economic incentive to engage in forestry, their lands will not receive adequate investment and management, and the full productive potential of the land will not be achieved.

My hypothesis holds that the continued development of farm forestry in Eastern Ontario will help diversify much of the marginally-productive agricultural lands that are expected to be abandoned during the next few decades if both regional markets and government policies provide sufficient financial incentives to justify the necessary investment. Farmers will need to develop a knowledge about the forest products market so that they can evaluate forest management options on the basis of financial return and integrate this understanding with other non-market considerations.

125. **Agroforestry: A Long Term Strategy for Land Use  
in the Forest Zone of Cameroon**

Jean Tonye & Bahiru Duguma

Soil fertility problems defined by the low level of organic matter and major nutrients, high acidity and low cation exchange capacity are known as major crop production constraints for the forest zone of Cameroon. Moreover, the farmers have low income and therefore, cannot afford high capital cost technologies to improve crop production in the area where the population is increasing rapidly.

The hedgerow intercropping, successfully tested in areas with similar environment as the Cameroonian forest zone, was introduced in 1984, with a view to ensure sustainability. In a three-year alley cropping experiment with *Leucaena*, maize grain yield has increased from two (without *Leucaena* prunings) to four (with *Leucaena* prunings) tons per hectare. Feedback from farmers showed that 29% of them would readily adopt alley cropping because they can crop the same piece of land year after year while 18% would adopt it because of the high maize yield.

**Special Topics:  
Descriptions of Agricultural Production Systems**

126. **Influences of Population Density on the Size of Traditional Farms  
and on the Intensification of Traditional Agriculture**

Dirk W. Bergen

This paper has two different objectives. In the first place, it shows the existence of a life cycle on the traditional far. This information creates better understanding on how a rising population density can cause a diminution of farm size. It also reveals the necessity of examining farming systems from a dynamic point of view. Secondly, it shows the importance of being able to prove that it is the lack of available agricultural land, rather than economic considerations which makes farmers intensify. Finally, this paper calls for special attention to development possibilities under these conditions.

The results of this analysis originate from a farming system analysis in the Buyenzi natural region of Burundi, in which a special focus was placed on beans and maize. Multidimensional techniques were used for showing the farm's life cycle.

127. **Factors Limiting Farming Systems in Nepal**

B. K. Gyawali & R. P. Chaudhary

Although Nepal is rich in natural resources, they are not properly utilized. Annual rainfall averages 4142 mm, of which approximately 88% falls during the May-to-September monsoon. Wet-season plants, except rice, suffer from an excess of water during the monsoon, and during the October-to-April dry season all plants suffer heat stress. Subsistence farming is predominant in the country, and the economic level of farm families falls below basic needs. Productivity of all crops, livestock, and fodder trees are below the world average for many reasons in Nepal: (a) dependency on agroclimate, (b) a low level of management due to a diversified ecosystem in mid hills and valleys, (c) small holdings composing the majority of farms, (d) poorly coordinated approach due to social obligations, (e) increasing human population, (f) decrease in economic status.

The extremely diversified ecosystem shows a complex farming trend in agroecosystem, which results in a decline of agroforestry, livestock and other agricultural production in spite of the government's major economic thrust towards sustainable agriculture.

128. **Avoiding Risks in Traditional Cropping Systems in Semi-Arid Regions of Mauritania—Opportunities for Research and Development**

Tidiane N'Gaïde & Mark B. Lynham

In the semi-arid regions of the sahel, farmers encounter numerous constraints when they cultivate their lands. The harsh environment with its uncertain rainfall pattern and the many predators makes traditional subsistence agriculture a high risk activity. Over the centuries, the agrarian population has established certain practices to reduce the production risks to each extended family and ensure sufficient annual production to feed the local population. The risks were minimized through the application of a traditional land tenure system, traditional agro-pastoral codes, and traditional social obligations. But these established systems, codes and obligations, since the onset of the prolonged drought, are no longer sufficient to ensure minimum subsistence levels. The rainfall patterns are more irregular and total annual rainfall less; predators have concentrated on the crops and are causing more damage; natural pastures and arable lands are diminishing resources; population migrations and burdening urban pressures reduce the rural labor force and increase demands for agricultural products; conservatism and religious obligations threaten development. All these factors translate into agro-pastoral competition and nomadic-sedentary conflict. Thus the agrarian population have sought other ways to overcome the new production constraints and reduce the immediate risks to food production.

Agricultural policies have been dictated by the urban population which, in the case of Mauritania, have led to the emphasis on irrigated agriculture (specifically rice production) to the detriment of traditional rainfed and flood recession agricultural systems. Yet more and more of the rural population are turning to traditional agriculture as a full time occupation because of the diminished freshwater fishstocks, large livestock losses, and reverses in the rural economy. What implications does the traditional farmers' attitude towards risk aversion have on research and development?

The paper discusses why traditional peasant farmers along the northern bank of the Senegal river and in the semi-arid regions adjacent to the valley are averse to taking risks, how they minimize those risks, and why the extent of diffusion of risk-reducing technologies depends on the severity of environmental conditions and, thus, the threat to the family's basic well being. An attempt is made to answer the question of whether the emphasis on irrigated agriculture in Mauritania will achieve the desired results of food self-sufficiency and stop rural to urban migration. The paper indicates where the present research activities are leading to. And it concludes with the strategies the research and development community should develop in order to assist farmers to overcome their constraints and reduce the risks of severe production set backs, and in the long run achieve the government's food and agricultural policy goals.

129. **Evolution of the Peasant Agriculture in the Eastern Horogue Highlands - Development Prospects**

Georges Risoud

From an historical survey of the functioning of 17 farming systems of two Peasants' Associations in the Kombulche area (Eastern Horogue Highlands), the main evolutionary trends of agriculture in the region as well as underlying socio-economic mechanisms are described.

Farmers' strategies regarding crop and animal management are determined.

From these issues, possible actions of extension and development are considered.

130. **Farming System to Sustain Productivity in China**

Liu Xun-fao

1. **The threatened agricultural resources-**

Owing to the overabundant population and scarcity of cultivated land, it has been estimated that the population will exceed 1.25 billion, and the overall man/land ration comes to 0.07 ha/capita in 2000.

The massive needs for agricultural products to the big population need to maximize the productivity which may be limited by the shortage of resources-cultivated land, water, energy and may deteriorate resources.

2. **Some sustainable approaches of farming system in China-**

**Multiple Cropping:** It's an important way for China to maximize productivity from limited land and make full use of energy, water and supplementary inputs. At present, the cropping index for the whole country has already been up to 151% in 1986 as against 128% in 1949 and roughly 20% of cultivated land are in inter-cropping or relay cropping.

**Green manure rotation:** 4.4 million ha. of green manure of legume is located in southern China in the rice rotation, while alfalfa is quite perspective in north-western China.

**Reduced tillage:** Both in northern and southern China it shows quite useful for saving energy, water, and labor.

*Special Topics:*

*Linkages with Policy Analysis Units in LDC's*

131. **An Economic Analysis of Agricultural Policy In Zaire: The Impact of Food Aid and Subsidized Exports from Developing Countries**

Glenn C. W. Ames & Yampulu Mukendi

In the 1980's, the U.S. and European Community (EC) have increased their use of export subsidies to protect their agriculture from adverse developments in the world economy and to increase their respective shares of the world food trade. Large export subsidies of the developed countries may have a strong negative impact on the agricultural sector of the importing countries by depressing farm prices thus weakening the incentive for farmers to expand production.

The impact of export-subsidies can be analyzed in the Small World Trade Liberalization (STLB) model as a percentage reduction in the trade price of the respective commodity. The long-run impact of the export subsidy is estimated as percentage changes in prices, supply, demand, and net trade for the respective commodities in the "target" country.

An adjusted STLB model generated estimates of projected supply, demand, net trade and prices in the agricultural sector of Zaire which was selected as a proxy for a group of low income recipient countries. As a result of U.S. export subsidies, Zairian wheat and rice imports increased 10 and 129 percent; producer and consumer prices fell 19 and 39 percent for wheat and rice. Domestic supplies declined 6 and 14 percent, respectively. Furthermore, there was a very modest cross-commodity effect with maize and cassava, traditional African foods, where demand fell approximately 1.2 and 3 percent as the result of cheaper grain imports from the U.S. Thus, export subsidies from the developed countries could undermine Zaire's or other low income countries agricultural programs, if cheaper imports are allowed into the country.

132. **How the Commercial Banking System Distributes Agricultural Credit in Mexico: 1976-1984**

Antonio Macias, Ricardo Salvador, Benito Ramirez, Fernando Martinez, & Pedro Martinez

It is suspected that the largest and most advanced producers in developing regions have greater access to agricultural credit, and that this limits the effectiveness of development projects targeted toward small-scale farmers. This study was performed to determine 1) how credit has been allocated historically, in Mexico, in order to 2) assess how this support has affected the adoption and implementation of agricultural practices, and 3) to enable the formulation of recommendations for agricultural development. The problem was to ascertain the patterns of distribution of agricultural credit in Mexico at several levels: national, regional and state. To what type of producer has credit been disbursed? What have been the trends? How has the Commercial Banking System influenced the course of agricultural development in Mexico? To analyze the problem, Mexico was divided into four regions that each represented one of the four predominant forms of agricultural activity in the country: 1) peasant farmers, 2) small-scale producers, 3) medium-scale producers or 4) commercial producers. Data were obtained from governmental annual reports and from the Bank of Mexico. Trends were analyzed by simple regression and analysis of variance. Though the number of beneficiaries of the Commercial Banking System increased six-fold over the period of study; the total amount of credit disbursed, in adjusted monetary units, decreased over the same time period. Even so, the commercial producers alone received as much capital in loans as did the other three groups of producers combined. This distribution of capital seems not to have been based on the area of land cultivated by each sector (5,276,030 ha. by peasants vs. 5,476,234 ha. by commercial producers), nor on the gross agricultural commercial producers), nor on parsimonious distribution among the population involved in agriculture as a primary activity (2,301,240 peasants vs. 735,000 commercial producers). The major criterion determining agricultural lending seems to be the risk assumed by the lending institution. This policy results in a greater proportion of subsidies for modern, high-input technology and limits the adoption of new management techniques by subsistence farmers.

133. **Relevant Features of FSR/E Policy and Practice in South Africa**

W. J. Stilwell & C. J. Van Rooyen

The paper introduces the agricultural development problem within the dualistic nature of the economy in Southern Africa and the current policy and strategies toward promoting development.

The development problem is described within the context of the needs and constraints facing small farmers in developing areas, to secure access to agricultural markets and appropriate entitlements.

Development strategies are briefly proposed arguing the need for comprehensive farmer support systems. FSR/E is identified as an important element of any Farmer Support Programme (FSP).

Development strategies are briefly proposed arguing the need for comprehensive farmer support systems. FSR/E is identified as an important element of any Farmer Support Programme (FSP).

The role of FSR/E in the proposed development strategy is analysed, and it is concluded that FSR/E should have, as its ultimate goal, the promotion of economic, social and structural change induced by technological transformation.

Lessons from four recently implemented FSR/E studies in South Africa are highlighted emphasizing: a) system identification for research into small farmer support systems, rural support

systems and farmer settlement system; b) differences in respect of decision-making responsibilities (group and household), vis-a-vis implementation responsibilities; c) support specifically structured toward women "farmers"; d) position and role of livestock and multiple cropping systems and risk avoidance; and e) the need for development goals to be clearly defined and a milestone approach to be followed when considering the funding of FSR/E projects.

134. **Research-Extension Linkages From Researcher's Viewpoint: The FSDP-EV Experiences**

Ly Tung

1. Common Characteristics of successful agricultural research systems in developing countries.
2. Agricultural research and technology transfer in the Philippines with reference to E.V. region.
3. Reasons for effective research-technology transfer linkage.
4. Opportunities for linkage to happen in E.V.
5. Modus operandi of FSDP-EV with emphasis on institutional and functional linkage.
6. Constraints/Difficulties and Solutions
  - Manpower constraints and solutions
  - Orientational constraints and solutions
  - Organizational/functional constraints and solutions
7. The artificial linkage in FSDP-EV
8. Towards achieving a natural linkage

**Special Topics: Natural Resource Management**

135. **Ten Years of Farming Systems Development in the South-Mali Zone. Results and Constraints.**

Wilfried Berckmoes, Yacouba Kone, and Bert Jager

The South-Mali Zone is an important zone for cotton and grain production. In 1987, it produced almost the total production of cotton in Mali and approximately 30% of the national grain production. Presently, the zone is confronted with a soil depletion problem. The availability of land is not sufficient to continue the old long-term fallow system.

The Fonsefougou component of the Research Division on the Rural Production Systems (DRSPR/VF) at Sikasso has been working in a group of villages since 1977. Initial research undertaken focused on the development of a package of interventions and innovations at the farm level. These past years, there has been an awareness in Mali and among the DRSPR/VF team regarding the need to take into account the problem of depletion of the natural resources and the need for a package of measures and interventions which address farming systems as well as an individual site, a group of sites or a zone.

The proposed paper addresses this problematic situation. During the last ten years, the range of farmer's production constraints have changed considerably. The paper will present a description of production systems and the changes which have taken place based on information provided by about ten farms.

The soil depletion problem, being a base cause of the desertification process in the Sahel Zone, requires an intensification of production by surface unit. On the other hand, the total constraints presently facing farmers, especially constraints of economic nature, do not favor such an intensification. A conflict exists between the national interests (medium and long term) and the farmer's short term interests.

136. Effectively Relating Agricultural Research to Farmers' Needs

Alex Cunard

The wide gap existing between the objectives of agricultural research and satisfying the needs or solving the problems of farmers is generally acknowledged. Production oriented researchers have difficulty in understanding that what they are doing in their experiment stations might be out of context with holistic production conditions in farmers' fields. There has been some improvement in researcher realization of the agronomic complexity of traditional farming systems, although this knowledge has generally not been systematically analyzed so as to render it amenable to problem solving approaches. Agronomists have oriented research towards higher levels of production, which, however, are dependent upon expensive inputs such as fertilizers and pesticides. In subsistence economy agro-ecosystems this often gives rise to "embarrassments of plenty" and farmers recoil from the idea of investing in growing food crops which bring no revenues. A more useful and farmer preferred type of research would be based on low input, sustainable agriculture that is oriented towards satisfying self-sufficiency and domestic consumption needs. Low fossil fuel intensive inputs, biological agents, risk minimizing and production optimizing crop associations, livestock/crop integration, manure and improved fallow use factors that would help to establish a sustainable agriculture. Developing and enhancing the positive characteristics of local varieties, especially those of yield stability, drought tolerance, associability, capacity for long storage and taste would be of more value to farmers in subsistence economies. Varieties with yield potential and fertilizer responsiveness can surely be developed if markets develop. Traditional cultural practices, planting strategies and sowing patterns of crop associations have problems and constraints that can be addressed by OSTs and OFTs. The essential requirement is that each prevailing farming system should be fully described and analyzed into its components, upon which opportunities for interventions will become clear. Examples of such research problems and proposed solutions are given from several countries in the Sahelian zone.

137. FSR and Resource Management for Sustainability

Kamal El-Kheshen

Natural resource mismanagement (NRMM) may lead to adverse effects on implementing FSR models. The paper will examine the economic importance of natural resource management (NRM) in terms of direct costs and the economic performance. As such, these causes will be stratified according to source/origin, medium of transmission and control/alleviation. Finally, an examination of the possible policy measure to combat NRMM, is made and the likely consequences of each option will be examined from a FSR perspective. Sustainability of FSR/E is taken here to imply that the flow of both the economic/financial benefits and the environmental benefits would continue while at the same time maintaining the natural resource stock. The rate of flow in a certain year is defined as greater than or equal to that of the previous year.

137a. Modification of Graded Bunding Systems for Small Farms in Southern India: A Joint Effort Between Scientists and Farmers

N.K. Sanghi, S.N. Sharma, K. Rao

This paper deals with the on-farm experience where scientists and farmers have jointly contributed in modification of conventional soil conservation methods to suit the small holding farms.

In Indian graded bunding system has been recommended

for areas which receive more than 700 mm annual rainfall and possess undulating topography with slopes up to about 5 percent. This system was evolved on the basis of research carried out, for minimizing the soil erosion problem on large holding farms.

At many places in southern India the above system did not receive favorable reaction from the farmers. On the large holding farms, where usually the entire watershed/sub-watershed is owned by the same farmer, the conventional graded bunding system does not create any clash of interest. But under the small farm situation the above bunding system results into wider water ways in someone's field on account of the runoff from the other's fields.

During the course of above study, the problem was solved by evolving a modified bunding system through a joint effort between the researchers and farmers without violating the main principles of soil conservation. The main features of the modified system are as follows:

- Formation of a series of water ways on boundary lines (in between every two holdings) rather than a few centralized water ways at the natural depression.
- Diverting the excess runoff into boundary water ways through a combination of discontinuous bunds and waste-weirs, rather than making long continuous graded bunds which run across different holdings.

138. Strategies for Sustainable Hillside Agriculture in the Red Soils Region of the People's Republic of China

G. Sullivan, J. Sturgeon, J. Nickum, X. Xie, & J. Yao

Hillside agriculture is an important component to overall sustainable farming systems in many densely populated areas of Asia. The important food crop in this region is rice which is grown in the valleys. Improvement in the overall household economy will depend on increased productivity from the combination of cropping, agro-forestry and livestock activities and not solely from rice production. Understanding the linkages between resource allocation for crops/livestock and the utilization of by-products from farm enterprises holds the key to identifying strategies for improving overall agricultural productivity and efficiency.

The authors present a conceptual framework for identifying these linkages between resource availabilities and the design of strategies for sustainable agriculture for a large region of The Peoples' Republic of China. This region derives its name from the reddish yellow and purple soils. A high incidence of soil erosion exists in the region precipitated by the Great Leap Forward in the 1950's when trees were cut from the hillsides for small-scale village enterprises.

Controlling soil erosion and fostering sustainable agriculture in the Red Soils will require a combination of initiatives in research, extension and manpower development. Each of these three areas will focus on production (technology), marketing and policy. Strategies for sustaining agriculture will depend on a combination of these activities which can provide a complete system for agricultural development.

The findings of the study are based on field research conducted by U.S. and Chinese scientists to rapidly assess the conditions in one prefecture in the larger red soils region. A detailed field interview schedule was administered to households. Household and market survey data are combined to design overall strategies for development of this region and provide a methodology for practitioners in farming systems.

### **Special Topics: Research/Extension Linkages**

139. **Improving Coordination of Extension and Research Through the Use of Interdependency Models**

Claude Bennett

There is lack of common understanding of the roles and relationships of extension and research agencies. Conflicting views and expectations concerning these roles and relationships stem from the competing views presented by two categories of conceptual models: research-transfer models and adult education models. Use of a third category of conceptual models, interdependency models, can help overcome the lack of common understanding and conflicting views, thereby improving coordination between extension and research agencies. Research-transfer models identify only the research basis for extension developing extension programs. Adult education models and interdependency models identify both the research and non-research bases for extension programs.

Policy makers seldom use adult education models because they focus on extension, while policy makers need models which focus on relationships among extension, other public sector (especially research) agencies and private organizations. Two questions, then, are as follows. First, do policy makers and legislators tend to view extension's roles and relationships from the perspective of research-transfer models, even though these models omit some of extension's quintessential roles and relationships? Second, should extension administrators invite policy makers, public/private sector coordinating councils and legislators to view extension's roles and relationships from the more inclusive perspective of interdependency models?

140. **Utilization of Linkages in Farmer Problem Identification and Transfer - A Contribution to FSR/E Programmes**

Mangala de Zoysa & Mahinda Wijerathna

Research - Extension - Farmer linkages play a vital role in transferring farmers' problems and needs to experimental stations. Past research and extension traditions mainly dealt with forward flow of knowledge or information. The popular Transfer of Technology (TOT) model made a favorable environment for this top down flow. Fortunately, today, scientists increasingly pay attention to the formulation of development approaches which focus on backward flow as well....farmer problem identification and transfer functions. Some approaches have already made efforts to establish formal and informal forums to strengthen the liaison between research - extension - farmer. The Farming Systems Research and Extension (FSR/E) is also trying to do so. However, it is important to understand the prevailing conditions in prior to make any modification to a system. Based on the finding of an exploratory study carried out in Sri Lanka, this paper explores the facts concerning the existing situations on farmers problem identification and the above mentioned linkages.

141. **Research and Extension: Reliques or End Products? Institutions for Technology Development, Ready for Reformation?**

Bertus Haverkort

Agricultural development depends heavily on the development of technologies which allow agricultural producers to reach their goals more effectively and efficiently.

Agricultural Research and Extension have been considered as essential instruments for technology development for more than hundred years now. These instruments of development intervention as they have emerged in the western societies, have undoubtedly contributed to the agricultural development in the West. From

there, they have been introduced to the South. Many of the present institutions of agricultural research and extension in developing countries have their roots in the colonial era and most activities in these spheres were related to "colonial crops". Food commodity research is rather of recent nature, and adaptations such as FSR and T&V can be considered as efforts to make the instruments more effective in tropical conditions.

Yet, it can be argued that research and extension as it is practiced in developing countries, especially in the rainfed regions, impede, rather than promote the development of the traditional agricultural systems. Local knowledge, farmers' participation, use of local resources and eco-specific adaptations have been pillars in many of the western agricultural research and extension programmes. However, these concepts have consistently been neglected in research and extension programmes in tropical areas. Western concepts have been used in the programmes in the South. Production potentials of rainfed areas have been wrongly assessed, since many resources for production in tropical areas have been undervalued.

The time is ripe for an approach to agricultural technology development where locally available physical and human resources will be used and where sustainability will be inherent.

Environmental and economic arguments lead to more emphasis to this approach, but also field experience leads to evidence that this approach, which implies a real reformation of the present institutional situation, has great perspectives.

### **Special Topics: Regional, National or Sub-National FSR/E Program Descriptions**

142. **FSR Work for a Commodity Programme**

C.D.S. Bartlett, K. Kassongo, R. Mayala, O. Osiname, & L. Simba

FSR work is being carried out in Zaire within a fairly typical commodity based national agricultural research system consisting of commodity programmes each of which is based at a research station in a region of the country where production of that commodity is important. Sub-programmes for other commodities are also located at each research station. Agronomist/social scientist teams are located within each commodity programme with responsibility for carrying out all agronomy and FSR work within the region.

The commodity programmes lacked essential information from the farm level for the design of their selection trials. This information is required for the identification of suitable controls, non-experimental variable levels and selection criteria. It is being provided by the FSR team by means of specialized exploratory surveys combines with agronomy experiments. Feed-back on the design and results of the trials is being provided by trial extension and on-farm tests.

None of the above work relies on an intensive location-specific FSR programme. Such a programme to identify location-specific extension recommendations for the production of each commodity, together with local research priorities is being developed by each FSR team for the region in which it is located as resources become available to cover the very large, diverse regions involved. It will complement the commodity-specific work now being done, but is not a pre-requisite for this work.

143. **The Orissa Experiment with Farming Systems Research as a Conditioner of Research and Extension Programmes**

S. N. Das, R. N. Mohanty & J. K. McDermott

This paper deals with an experiment, an ambitious experiment, to improve the programme quality of research and extension in Orissa without any important change in programme content or organization. The process of integration and decentrali-

- sation, with the Dean of Research being also the Dean of Extension Education, providing each Regional Research Station with a component of Extension support, developing stronger functional linkage with Directorate of Agriculture, and finally, with greater emphasis on On-farm research with FSR approach; shows encouraging results.
- 144. Information Systems Analysis and Design for Extension Workers**  
Eri Eriyatno
- Comprehensive study on agricultural extension practices in Indonesia sponsored by NAEP - World Bank was completed by 1987. The study found that lack of information exchanges and its networks has produced severe problems for field extension workers. Lots of farmers actual questions on-farm remained unanswered or misguided. The concept of FSR/D should be implemented through improvement of info-linkages between technological resources such as the University and field extension workers.
- Computerized data base on farming system has been initially developed in Bogor Agriculture University. To ensure the effectiveness of information management, several decision support models are considered progressively. The application of expert system is also explored due to many ill-structured problems arising from farmer, i.e. production assessment criteria and socio-economic evaluation.
- 145. Towards Sustainable Agriculture in Papua New Guinea: The Dynamics of Farming Systems**  
R. D. Ghodake, Bruce Isaacson & William Hadfield
- The challenge of agricultural development in Papua New Guinea is to modify existing farming systems, in light of inevitable changes, and to maintain their sustainability. Traditional subsistence farming systems, based on shifting cultivation, remain very much intact. Until recently these systems have been efficient and stable. Food shortages are rare, and hunger virtually unknown throughout the country. There is no need for corrective action at the present time. Since there is no single optimum farming systems that will assure sustainability over time, the objectives in Papua New Guinea have been to establish a means by which farming systems can be appropriately modified over time in order to maintain sustainability. Thus, the dynamics of the farming systems, in light of changing physical, socio-cultural, and economic conditions, must be maintained in a state of equilibrium.
- The national Department of Agriculture and Livestock (DAL) has fully adopted a programme of Farming Systems Research and Extension (FSR/E) to meet the challenges. Research on major export crops has been turned over to the respective industries which have created commodity research institutes. This has cleared the way for DAL research activities to completely focus to smallholder activities not full dealt with by the export crop research institutes. The particular emphasis is on food crop and small livestock production. Research is organized regionally with separate highlands and lowlands FSR/E teams. Since the production of export crops has become an important part of most smallholder farming systems, specific needs will be met through two additional FSR/E teams focusing on coffee and cocoa based farming systems. A specific agro-forestry team has also been established to help assure the future sustainability of smallholder farming systems.
- 146. Supervised Farm Practice Programs in Honduras and Jamaica**  
Jonathan Hubchen & Edward Gassie
- Students who want a career in rural development should appreciate the interrelationships found in a small farm. They should also learn accepted extension methods so they can transfer skills and ideas to farmers. These ideas are best obtained through practical field experience. The educational value is increased if students can develop their management skills. If students are exposed to the decision making process, they will better appreciate involving farmers in this process when they are teachers or extension agents.
- The extension module of the Escuela Agricola Panamericana in El Zamorano, Honduras aims to do this. It has students work in a demonstration farm and involves them in extension activities recommended for poor rural areas. The students, not the instructor should be responsible for planning and execution. Proposals also have been made to change the Jamaican College of Agriculture's field practicum to allow student participation in decision making.
- The authors describe and evaluate both programs based on observation and a literature review. They will list objectives and activities and the evaluations will include limitations, accomplishments, shortcomings and suggestions. These suggestions should help them better provide their students with skills to improve small farming systems and to work with small farmers.
- 147. The Contribution of Pakhribas Agricultural Centre to the Development of Farming Systems in the Hills of Nepal**  
Famesh J. Khadka, David Gibbon
- This paper draws on the experience of Pakhribas Agricultural Centre (PAC) which is situated in the Eastern Region of Nepal. The Centre's accomplishments have been achieved over a 16 year period through a multi-disciplinary and multi-support approach to agricultural development in the Hills.
- Diverse physical, natural and socioeconomic factors have resulted in a great variety of farming systems involving several field and horticultural crops, livestock, forest, rangeland and fodder trees and off-farm activities. PAC has established the necessity to understand the operation of the farm and household system in order to develop appropriate research and extension programmes that take account of the complex interactive nature of farming in this region. The region's farmers face acute difficulties in transport, access to markets and access to the most basic of inputs. As a result, PAC has evolved a structure that contains all the necessary technical disciplinary sections and also includes livestock, tree and crop seed production, extension and training.
- The involvement of farmers in breeding programmes, the utilization of existing small farmer groups, the inclusion of women motivators in the extension programme, the development of informal research and extension methods, and the participation of senior staff in regular interdisciplinary treks (Samuhik Bhraman), have all been incorporated into the programme and substantially improved its efficiency and relevance. The other major issues such as, linkages with other programmes, labour options including migration, ethnic group relevance and the sustainability of the PAC system are also discussed.
- Recent work has led to the formalizing of farming systems research and extension through the establishment of working groups with a specific focus on systems, fodder, soil fertility, regenerative technology and women's development, all of which have a bearing on an overall concern for the sustainability of agricultural systems in the Eastern Hills of Nepal.
- 148. The FSR/E Program in the CEPGL (Economic Community of the Great Lakes Countries)**  
Kasonga Mukandila & Augustin Bizimungu
- The newly formed FSR/E Regional Program in the CEPGL (Economic Community of the Great Lakes Countries) includes Burundi, Rwanda and Zaire. National programs are however developed at different levels. In Rwanda, it is institutionalized and

- directed by the Agricultural Research Institute. In Burundi, the program is being developed although studies on the existing traditional cropping systems are executed within the framework of the socio-economic research. In Zaïre, it is managed by RAV (Agricultural Research and Extension) through the logical efforts in agricultural research and extension.
- The cropping characteristic of the region is mixed-cropping, banana being predominant, and where associations can include up to six crops.
- Through the development of FSR networks according to the CEPGL natural regions, IRAZ tries to assure the coordination of the program by diffusing information and appropriate technologies. However, the success of extension is not evident in the entire region, especially in Zaïre.
- Additionally, IRAZ works actively in the rural areas in collaboration with the National Institutes Researchers in the program entitled "In-Field Research".
- Considering the aspects of agricultural issues brought forth by the farmers, the program is oriented towards the integration of Agriculture and Livestock where the needs in inputs, notably fertilizers and manure, are stressed.
- Given the limited nature of farmable land and human food needs, the program is directed towards research/development of intensive farming and livestock methods with the farmer's support.
- Knowledge of the socio-economic component is being well addressed through surveys undertaken in rural areas.

149. Utilisation de la Methodologie de Recherche sur les Systemes de Production Agricole pour l'Elaboration d'un Plan Directeur du CNRADA

Abou Oumar N'Gam & Mark B. Lynham

L'integration par le CNRADA de la methodologie de recherche sur les systemes de production agricole dans sa strategie globale, a permis avant tout une identification exhaustive des contraintes et des problemes ressentis par les fermiers. Des themes et des priorites de recherche ont pu etre degages a la suite d'un important travail exploratoire qui a touche a la fois les paysans et les organismes de developpement. Cette etape de diagnostic a revlee que le CNRADA a eu des resultats importants qui n'ont pas pu atteindre les paysans, faute de liaisons efficaces entre la recherche et ses utilisateurs.

Ces prospections et d'etudes ont debouche dans un 2eme temps a la formulation d'un plan d'amelioration d'un plan directeur de CNRADA a moyen terme (1988-1991).

Une nouvelle strategie de recherche qui comprend 4 etapes a ete mise en oeuvre: recherche adaptative en station; experimentation multilocale; tests agronomiques et systemes de production; tests de prevulgarisation. Ce plan, en institutionnalisant la methodologie de FSR/E, constitue en outre une base pour un plan directeur national de la recherche qui se situerait dans la perspective du long terme.

Le volet-recherche de nouveau plan d'investissement public (PIP) du gouvernement (1989-1991) a repris les requetes de financement inscrites dans le plan directeur de CNRADA dont l'elaboration a ete faite en fonction du nouvel organigramme de centre, lui-meme concu selon l'approche de FSR/E. Tout ceci constitue une garantie certaine pour la perennite de la demarche dans la recherche agricole Mauritanienne qui est desormais sortie de sa tour d'ivoire.

150. Farming Systems Research - Cameroon Experience

J. A. Poku, E. A. Atayi, & Dermot McHugh

Farming Systems Research in Cameroon began as a result of the creation of the Testing and Liaison Unit (TLU) in 1981. TLU is a component of the National Cereals Research and Extension (NCRE) Project jointly funded by the United States Agency for

International Development (USAID) and the Government of Cameroon. The International Institute of Tropical Agriculture (IITA) headquartered in Ibadan, Nigeria is contracted to provide a team of technical assistants for the project. The original function of TLU was to forge and foster communication linkages between research, extension and farmers, but has evolved into Farming Systems Research (FSR) units over the years. In the process, knowledge and experience have been accumulated that have resulted in some technologies in various stages of development, and strong linkages between research, extension, farmers and parastatal organizations for future research. This evolution clearly indicates the importance of adequately defining project goals and terms of reference during design and implementation stages.

The future of on-farm research within the Institute of Agronomic Research (IRA) will hinge upon strong Governmental support in implementing farming systems activities in Cameroon.

151. NARP as a Modified FSR Approach in India

K. V. Raman & T. Balaguru

The National Agricultural Research Project (NARP) implemented in India from 1979 with World Bank assistance, emphasises conducting need-based, location-specific, problem-solving and production-oriented research by a multidisciplinary team through extensive on-farm activities with the active participation of farmers and extension agencies. The Country is divided into 126 agro-climatic zones and specific farming situations have been identified. Regional research capabilities in these zones are strengthened physically and technically by having multidisciplinary groups to develop technologies consistent with farmers' indigenous technical knowledge, resources, constraints and needs by providing for both informal and structured interaction and feedback between farmers, extension agencies and researchers. Extensive on-farm trials before dissemination of technology for wider adoption is built into the system. The project, as designed and implemented, thus seeks to fulfil many of the requirements of FSR.

Case Studies undertaken by the National Academy of Agricultural Research Management on the working of NARP as well as its impact at specific locations indicate a significant and desirable shift in the research paradigm. Clientele group needs influencing effectively multidisciplinary problem-solving research efforts and on-farm activities have gained momentum. Implementation problems like interdisciplinary conflict, less enthusiasm for on-farm activities by scientists and inadequacy in the performance appraisal system are common; these are the experiences in FSR also. Despite these, the impact of the project in promoting relevant research is quite appreciable.

Since increased production demands have subjected the biosphere to severe stress, future agricultural research and development programmes should have concern for ensuring ecological sustainability of agriculture and the economic viability of the production process. Equities in the rural sector which will include socio-economic and gender-related issues, labour availability and utilisation will assume greater importance. Farming Systems Research approach modified suitably to fit into National Agricultural Research Systems will be required to provide a thrust to the above issues focussing attention on resource-poor farmers.

152. A Critical Appraisal of the Agricultural Extension Services in Malawi

T. S. Sahota, U. Sabel-Koschella, E. Penot, F. Mwaiyego, I. Khalu-Deen, & X. Hao

Malawi, a land-locked country, bordering Tanzania to the Northeast, Mozambique to the East, South and Southwest, and Zambia to the West, is located between 33-36 degrees E. longitude and 9-17 degrees S. latitude. Due to the lack of profitable mineral

resources, the country depend heavily on the export of cash crops. Therefore, agricultural research and extension services had been biased towards cash crops. The services were extended to the farmers through individual contacts in the sixties and group contacts in the seventies. Since 1981, the Block Extension System (BES), a modified Training and Visit System, is operating through the eight Agricultural Development Divisions (ADDs) to transfer technology to the small holders. The BES has been promoting blanket recommendations with little reference to local farmers' conditions. Consequently, the adoption of recommendations is low (around 25%). Need based messages, e.g. those in relation to cassava mealy bug, were, however, well accepted and helped to improve the farmer-extension-research linkages. Despite the fact that women played a major role in the production of food crops, only 7.5 percent of the Field Assistants are female. The country has, otherwise, a sound institutional framework for providing extension services to the small holders. There is a need to develop acceptable technological packages for subsistence crops, to make extension advice relevant to the farming system in each area and to ensure that this advice is technically sound and financially attractive to the farmers. This could be achieved through the Adaptive On-Farm Research Teams (ARTS) which are operating in 5 ADDs. There is a need to train the extension staff on mass communication techniques and orient them towards farming system concepts. It is recommended that (i) the ARTS should be implemented in all the ADDs and the researchers should plan their programmes in close cooperation with the ARTs and (ii) to extend the technological messages to women farmers, more females should be recruited, trained and posted as Field Assistants.

153. **Multidisciplinary Farming Systems Research in Practice:  
The Experience of Lumle Agricultural Centre, Nepal**

Bhuwon Ratna Sthapit

Lumle Agricultural Centre (LAC), situated in the mid western hills of Nepal, consists of agronomy, horticulture, livestock, fodder pasture/forestry, extension, socioeconomics and training sections. The Centre was established in 1968 by the British Government. By 1975 the Centre had developed into a research station identifying farming technologies for all farmers in the 25 panchayats of Kaski, Myagdi and Parbat Districts. Despite some success in the dissemination of new technologies it was clear that a multidisciplinary approach was needed to respond to the complex problems of hill farming. These problems result from the extreme agro-ecological and socioeconomic differences found in the hills, namely: altitudes ranging from 500m to 3000m in a few kilometres; annual rainfall varying from 2000mm to 5000mm; access to market centres ranging from nil for some settlements to easy access for others; and a mix of Indo-Aryan peoples and Tibeto-Burmese peoples with differing customs and languages. In addition, many of the topics encountered by LAC researchers do not fall within conventional disciplinary boundaries. Soil conservation and fodder collection, for example, have both agronomical and sociological implications. In 1983 LAC turned to the Farming Systems Research approach and pioneered its adoption in Nepal.

This paper describes how the FSR programme has been developed at LAC. Many researchers talk about the necessity for multidisciplinary FSR, but few research centres have demonstrated its successful use in practice. Faced with the difficulties of extrapolating research results from trials to farmers, given the complexity and diversity of the region, LAC developed a number of research methodologies within the FSR/multidisciplinary framework which are proving to be successful in the field. The *Samuhik Bhraman* (combined trek) which is used to identify and appraise research priorities in the field is described. Research 'Thrusts', initiated to bring together the different disciplines to tackle specific hill farming problems, are discussed. The case of the successful 'Soil Fertility Thrust' is used as an illustration of this approach. In conclusion, the contribution of LAC's research to sustainable hill

agriculture is assessed and the wider implications LAC's multidisciplinary FSR approach for hill farming in general are outlined.

154. **The State of Art on FSR/E in France (1950-1988)**

Bertrand Vissac

The failures in the implementation of techniques by farmers and their consequences on agricultural and rural development have been advertised by some agronomists, ecologists and human scientists over the last 20-30 years in France. This has given rise to a growing flow of research at field level, then at farm level and more recently at the level of regional agricultural lands where they are considered as integrated sets of complex and man oriented systems. The purpose of this research field is the management of agricultural activity in its rural and social context taking into account the evolution of the socio-economic and cultural background.

The document presents the institutional roots of research groups, the development of concepts and methods by interdisciplinary research units, the issues and situations to which they are applied in France and the extensions outside France for the purpose of generalization. It chiefly concerns the contribution of the S.A.D. Research Department of I.N.R.A. (Département de Recherches sur les Systèmes Agraires et le Développement). However, it also gives also some indications on other French Institutions working in this field in developing countries.

More recently, the research has aimed at systemic modelling where subjects (pilots) and their projects are included in the representation with the organized objects. It follows the progress of information and communication sciences in the line recently promoted by H. A. Simon in the U.S.A. and J. L. Le Moigne and E. Morin in France.

155. **Research Utilization in the Central Visayas, Philippines:  
A Model Process for FSR/E**

May Segura Ybanez & Pamela C. Edo Sullano

To facilitate the conduct of Farming Systems Research in the Central Visayas characterized as resource-based and farmer-managed, the Central Visayas Regional Project-I through its Research Component have established an inter-agency and multi-disciplinary body called the Central Visayas Consortium for Integrated Regional Research and Development (CIRRD).

Under its umbrella two major sections have been created: Research Operations and Research Utilization. While the former directly deals in the implementation/conduct of FSR in various parts of the region, the latter is tasked to carry the FSR process momentum to its ultimate goal of utilization and application of knowledge and technology through effective technology transfer and dissemination of research results at all levels of clientele.

The Research Utilization Section (RUS) encompasses four sub-units: 1) scientific literature service, 2) technology packaging, 3) applied communication, and 4) training and manpower development. It serves to complement generation of technologies by facilitating technology transfer through an appropriate information management system. In general, the RUS functions to store, process, retrieve and disseminate relevant information on FSR and the related fields using electronic data processing, printed technology guides, development/applied communication media and personnel/clientele training.

All sub-units have inter-agency and multi-disciplinary task force to plan, program and implement research utilization strategies with a back-up general secretariat within the consortium to provide the continuum.

Currently, the SLS unit is being developed into a regional repository of global, national and regional information/data of various ecological zonal concerns of a watershed: forestry, hillylands and coastal areas. The Technopack unit prepares and

publishes unified and location-specific recommendations into one reference for technical personnel (reference called the technoguide). From these recommendations, translations are made by the applied communication unit to produce simpler and more understandable extension materials for the farming/fishing communities.

156. **Identification of Results of Farming Systems  
Research and Extension Activities**

Timothy Frankenberger

The purpose of this study was to review, analyze and document the results of a number of farming systems research and extension projects which have been implemented worldwide. This USAID-funded study was implemented through a cooperative agreement with the University of Arizona acting as the lead institution to the FSR/E Network Steering Committee. The analyses has focused on the factors that affect the sustainability of FSR/E within national agricultural research and extension systems. Key topics that were assessed included a countries ability to meet recurrent costs of FSR/E programs, organizational structure, training, networking, program content and linkages with commodity research programs and faculties of agriculture. The study has gathered data from four field case studies (Botswana, Guatemala, Costa Rica and Indonesia) as well as secondary sources from over twenty countries. Summary information will be presented from the case studies as well as the synthesis report.

157. **Possible Future Directions of  
Farming Systems Research and Extension**

**A Concept Paper**

Timothy Frankenberger

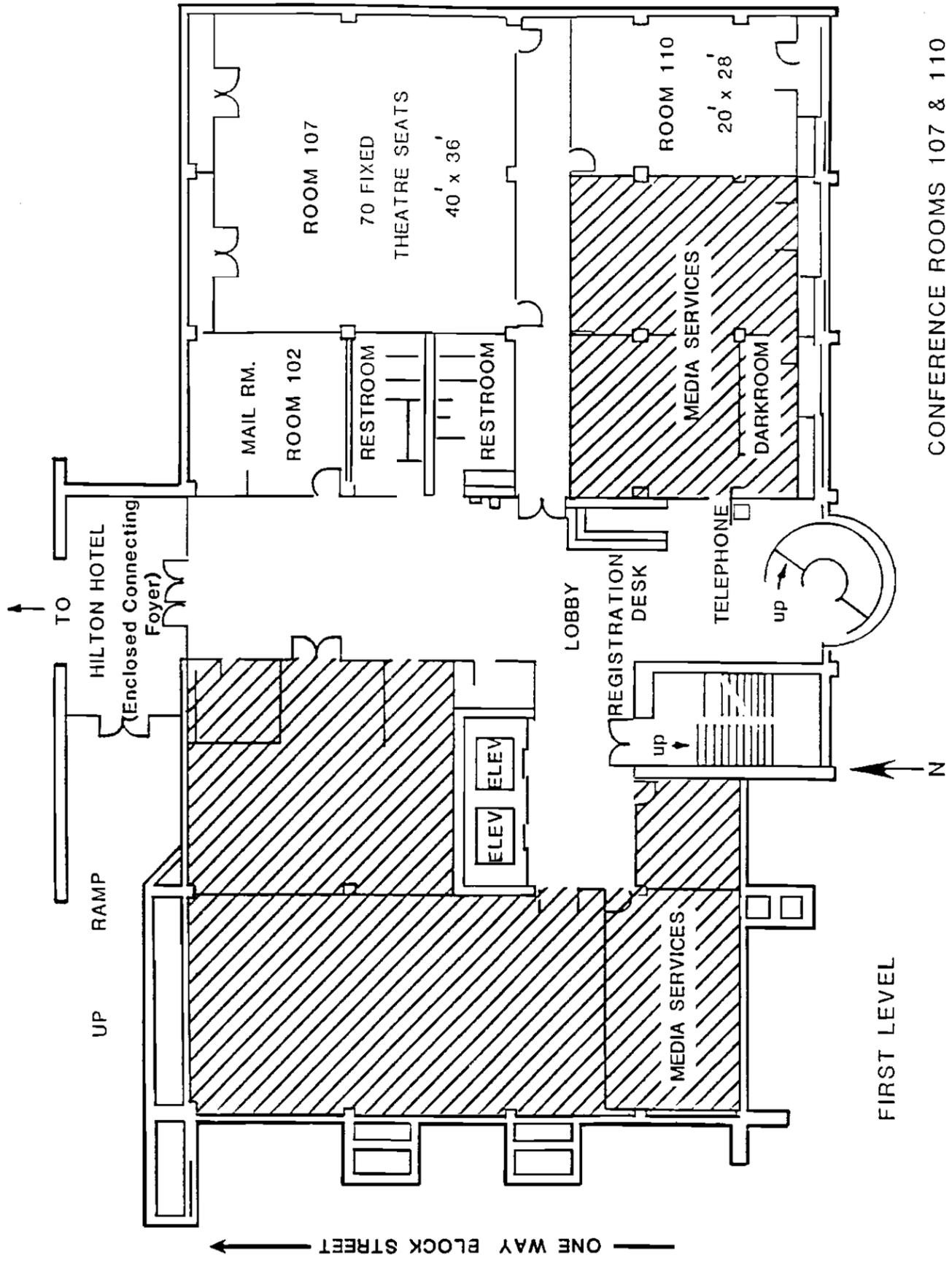
The purpose of this document is to stimulate discussion regarding the future directions and focus of efforts by AID and other donors to support work in farming systems research and development. The report contains a brief analyses of the historical reasons why the farming systems approach came about, and discusses possible options that AID could use to channel future support. Representatives of the farming systems research steering committee, members from AID and several FSR/E practitioners will discuss this paper and elaborate further on the issues it presents. The aim of this discussion is to ensure that the ideas and concerns of the various interest groups are taken into account in future AID supported efforts.

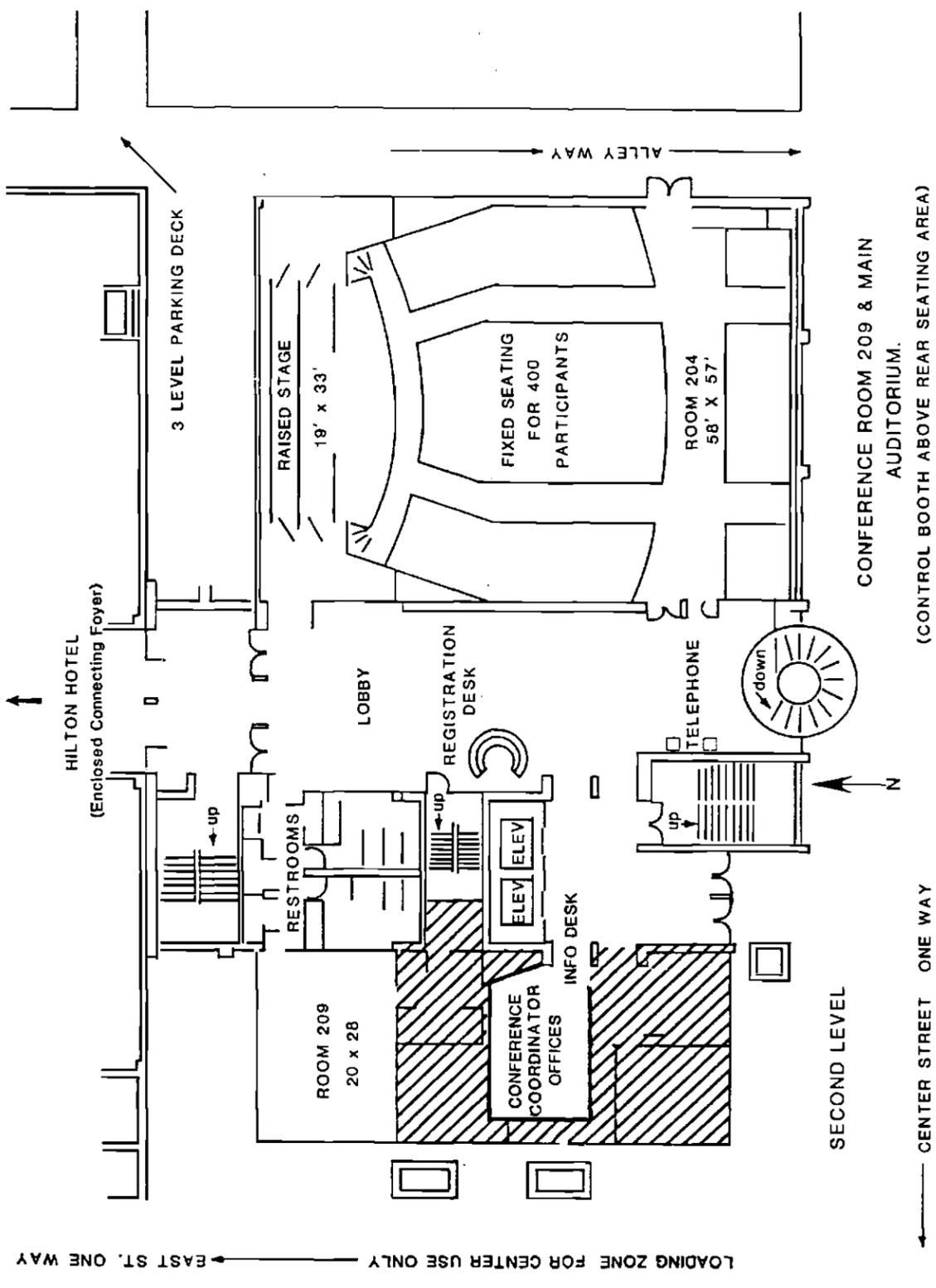
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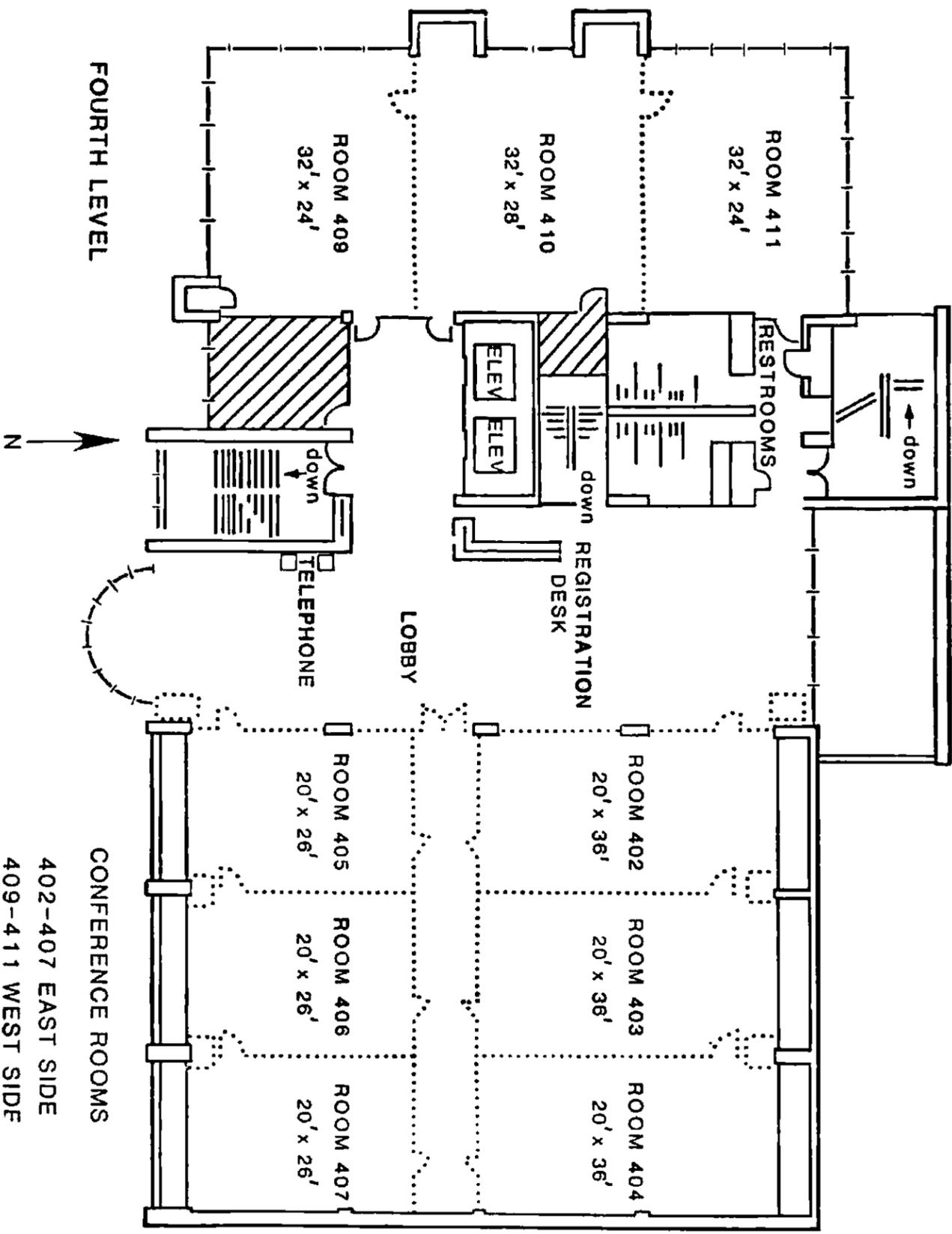
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