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Annual Activities Work Plans and Budgets

September 25, 1991–September 24, 1992

TropSoils
The Soil Management Collaborative
Research Support Program

SOIL MANAGEMENT

COLLABORATIVE RESEARCH SUPPORT PROGRAM

TROPSOILS

ANNUAL ACTIVITIES WORK PLANS AND BUDGETS

September 25, 1991 - September 24, 1992

Participating Institutions

Cornell University
University of Hawaii
North Carolina State University
Texas A&M University
USDA-Economic Research Service
USDA-Agriculture Research Service
USDA-Soil Conservation Service

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EXECUTIVE SUMMARY

I. INTRODUCTION

During the 1990-91 fiscal year the AID funded programs in Soil Management Support Services (SMSS) and Technology for Soil Moisture Management were administratively merged with the Soil Management Collaborative Research Support Program (CRSP), recognized internationally as TropSoils. To accomplish this task a new grant was initiated, in phases, starting on July 28, 1991, to terminate on September 24, 1994. The TropSoils 1991-92 Annual Activities, Work Plans and Budgets include the change in operations from block grants to individual projects initiated in FY91 and the block grant activities of these other two (2) AID supported programs in soil and water management.

II. PROCESS OF ALLOCATING PROJECT FUNDS

The change in the TropSoils global plan from agroecological zone concept to focus on natural resource management, sustainable agriculture production and outreach has placed agroecological zones into being the operational strategy. The identification of five (5) major soil management constraints within each of the three (3) thrust of TropSoils' global plan was the criteria on which the 1990 proposal rewrites were approved for the 1990-91 funding year.

Site-based activities with common objectives were then planned to address a global need and researchers were able to participate in planning of cross-cutting projects with specific activity roles to play. The 1990-91 was the final year of specific work plans and budgets for Institutional Prime Sites and Campus Backstopping. These operational costs would be programmed into research plans in this way all prime sites would either be phased out or become an integrated TropSoils Collaborative Research Site with a specified lead institution.

1. Core Funds

The referred to as TropSoils "Core Funds" is the $2,100,000 annual commitment when the grant was extended for the 1989-94 term. This grant has been terminated and a new grant initiated for the 1991-94 period including for TropSoils this same $2,100,000 core funding. It is this funding base that provides sustainability to the TropSoils' collaborative research activities, funds the office of the Management Entity, the communications program and other CRSP operations necessities as mandated by BIFAD. About 74.1% of the core funds are allocated to research, 7.1% for communications, 15.4% for the Office of the Management Entity and 3.4% for other CRSP operations. The funds allocated to communications, Office of the Management Entity and CRSP operations also support TropSoils participation in the CRSP Council activities.

2. Enhancement Funds

During FY91, TropSoils was one of the CRSPs to receive a 20% increase ($420,000) in funding, referenced as enhancement funds, to support collaborative research activities in sustainable agriculture and natural resource management. It is not known if these funds will be continuous or only for one year. For TropSoils these enhancement funds were for the period April 17, 1991--April 16, 1992. Of these enhancement funds, 29.1 % are allocated to natural resource management, 42.0% for sustainable agriculture, 24.6% for outreach activities (workshops, networks and communications) and 4.3% to support CRSP Council and management activities. Where new activities were initiated, new Work Plans and Budgets were completed in April 1991 and are included in this document. Ongoing research activities receiving enhancement funds submitted budget updates in April 1991 to reflect their new FY91 budgets with their remaining enhancement funds included in their FY92 budgets.

3. SMSS and TSMM budgets

The United States Department of Agriculture (USDA) programs in Soil Management Support Services (SMSS) and Technology for Soil Moisture Management (TSMM) were administratively merged with TropSoils during 1991. The SMSS program focus is soil characterization and soil taxonomy is led by the USDA-Soil Conservation Service (SCS). The TSMM program focus has been in the semi-arid agroecological zone led by USDA-Economic Research Services (ERS) and USDA-Agriculture Research Services (ARS). The SMSS and TSMM three (3) year work plans and budgets as included within are supported and administered through block funded reimbursable agreements. The SMSS resources are administered through the USDA-Office for International and Cooperative Development (OICD). The TSMM funds are administered through separate agreements with USDA-ERS and USDA-ARS.

III. ANNUAL ACTIVITIES WORK PLANS AND BUDGETS

The Soil Management CRSP (Cornell, Hawaii, North Carolina State and Texas A&M) includes thirty-three (33) annual work plans and budgets. In addition, the Office of The Management Entity prepares an annual work plan and budget. The primary program focus of these plans were nine (9) in natural resource management, eighteen (18) in sustainable agriculture production and six (6) in outreach. The primary focus of the SMSS and the TSMM/USDA-ERS programs is natural resource management and the TSMM/USDA-ARS is sustainable agriculture production.

IV. FUNDING FOR FISCAL YEAR 1991-92

The 1992 fiscal year (FY92) for the Soil Management CRSP is from September 25, 1991, through September 24, 1992. The Soil Management CRSP requests for funding by individual program

activities and the level of approved funding for 1991-92 is presented in Table 1. Activity requests for $2,335,144 with a core budget of $2,100,000 were adjusted and approved by the Board of Directors at the biannual meeting on September 19, 1991. The program activities supported by enhancement funds were previously approved and included in the allocation totals.

V. HUMAN RESOURCE COMMITMENTS

The estimated human resource commitment, including the activities of SMSS and TSMM, in support of the TropSoils activities are summarized in Table 2. This summary is the compilation of human resources from each of the annual activities work plans and budgets committed to collaboration with the TropSoils program.

VI. TOTAL ESTIMATED RESOURCES

Total estimated resources include AID grant funds, external program support funds (other grants, buy-ins etc.), university matching funds, and a calculated of identified host country institutional support to the TropSoils program. This summary of financial resources for FY92 TropSoils activities is presented by project in Table 3. Only the research programs of the four (4) universities must be matched 25% with non-federal sources. The calculated TropSoils match for FY92 is at the 30.2% level. Including core grant funding of $3,792,392, external funding of $644,400, matching of$524,770 and host country institutions of $430,000 yields estimated total of $5,392,062 in collaborative financial resources for FY92.

Table 1. SOIL MANAGEMENT CRSP--YEAR 11 - 09/25/91--09/24/92 BUDGET WORKSHEET FY 92.

ACTIVITY		REQUEST	RECOMMENDED (ENHANCEMENTS)	TO BE ALLOCATED
NATURAL RESOURCE MANAGEMENT				
TAMU-01	Land Resource Characterization	$ 134,670	$ 0	$ 129,670
TAMU-05	Watershed Management	28,695	0	28,695
CU-03	Green Manures	52,623	0	52,623
CU-05	InterCRSP - Honduras Watershed	24,884	9,756	24,884
CU-06	Cameroon Initiative	15,120	14,634	15,120
NCSU-01	Comparative Agronomics	129,700	8,400	127,070
NCSU-02	Soil Characterization	59,900	11,200	59,900
NCSU-06	Soil Degradation Rejuvenation	24,100	14,500	24,100
UHTX-01	Collaborative Res. with CSAR-Indonesia	53,750	0	53,750
		$ 523,442	$ 58,490	$ 515,812
SUSTAINABLE AGRICULTURE PRODUCTION				
TAMU-02	Soil and Water Management	$ 158,061	$ 0	$ 153,061
TAMU-03	Soil Fertility Management	75,104	0	75,067
TAMU-06	TropSoils/INTSORMIL Collaboration	23,963	0	23,963
TAMU-07	Honduras Watershed Management	7,588	7,588	7,588
TAMU-08	TropSoils-Cameroon Initiative	10,840	10,840	10,840
TAMU-09	InterCRSP-Peanut and INTSORMIL	4,878	4,878	4,878
TAMU-11	TropSoils-ICRISAT-Residue Mgt.	4,878	4,878	4,878
CU-01	Maize and Water Management	67,379	0	57,379
CU-02	Nitrogen Transformation	81,914	7,588	71,914
CU-04	Soil Degradation	115,672	0	102,058
NCSU-03	Sustainable Soil Mgt. Alternatives	110,100	0	110,100
NCSU-04	Agroforestry Systems	120,800	8,400	120,800
NCSU-07	Nutrient Synchrony Supply	18,200	7,600	18,200
UH-02	Collaboration with IRRI	8,672	8,672	8,672
UH-05	Collaboration with IITA	9,214	9,214	9,214
UH-03	Detoxifying Aluminum	44,700	8,672	44,700
UH-07	Base Cation Dynamics	38,200	0	38,200
UH-04	Maize/Legume/*Rhizobium*	43,400	8,672	43,400
		$ 943,563	$ 87,002	$ 904,912
OUTREACH				
NCSU-05	Technical Support to Networks	$ 76,000	$ 6,070	$ 76,000
COM-01	TropSoils Communications Program	152,900	10,840	160,840
PDSS-02	P Decision Support System Workshop	21,995	21,680	21,680
PDSS-01	Phosphorus Decision Support System	97,700	8,672	97,700
UHTX-02	Backstopping and Outreach	67,000	0	63,256
TAMU-10	Semi-Arid Tropics Outreach	59,544	0	59,544
		$ 475,139	$ 47,262	$ 479,020
MANAGEMENT ENTITY				
ME	Office Operations	$ 327,420	$ 9,648	$ 337,068
CRSP	Operations	65,580	0	65,580
		$ 393,000	$ 9,648	$ 402,648
		$2,335,144	$202,402	$2,302,392

Table 2. Human Resource Commitments

Institutional Source	Scientists		Technician	Admin.	Other	Total
	Senior	Junior				
United States	11.25	18.00	2.50	6.50	0.75	39.00
Host	14.80	20.70	12.80	8.50	30.00	86.80
Other	0.85	1.50	0.75	0.50	0.40	4.00
Totals	26.90	40.20	16.05	15.50	31.15	129.80

Table 3. Total estimated financial resouces by source committed to TropSoils 1990-1991.

Project	Funding Source				
	CRSP Core	External	Matching	Host	Total
CU-01	$ 57,379	$ 0	$ 39,726	$ 0	$ 97,105
CU-02	71,914	0	14,229	0	86,143
CU-03	52,623	0	23,727	0	76,350
CU-04	102,058	0	34,178	0	136,236
CU-05	24,884	0	3,722	0	28,606
CU-06	15,120	0	5,822	0	20,942
NCSU-01	127,070	0	32,400	53,200	212,670
NCSU-02	59,900	0	14,200	7,000	81,100
NCSU-03	110,100	0	27,400	53,200	190,700
NCSU-04	120,800	45,000	30,100	53,200	249,100
NCSU-05	76,000	56,400	19,000	150,400	301,800
NCSU-06	24,100	0	6,000	33,500	63,600
NCSU-07	18,200	0	4,300	73,000	95,500
TAMU-01	129,670	0	40,532	0	170,202
TAMU-02	153,061	0	47,361	0	200,422
TAMU-03	75,067	0	22,504	0	97,571
TAMU-05	28,695	237,825	8,598	0	275,118
TAMU-06	23,963	22,175	7,180	0	53,318
TAMU-010	59,544	0	17,841	0	77,385
TAMU-07	7,588	0	7,000	0	14,588
TAMU-08	10,840	0	8,000	0	18,840
TAMU-09	4,878	0	4,000	0	8,878
TAMU-011	4,878	0	4,000	0	8,878
UHTX-01	53,750	0	14,900	7,000	75,650
UHTX-02	63,256	0	14,700	0	77,956
UH-02	8,672	0	3,250	0	11,922
UH-03	44,700	0	9,700	0	54,400
UH-07	38,200	0	5,700	0	43,900
PDSS-01	97,700	0	27,400	0	125,100
UH-04	43,400	0	13,800	0	57,200
UH-05	9,214	0	3,250	0	12,464
PDSS-02	21,680	0	10,250	0	31,930
COM-01	160,840	0	0	0	160,840
ME-Core	337,068	0	0	0	337,068
CRSP Operations	65,580	0	0	0	65,580
SMSS	670,000	96,000	0	0	766,000
TSMM	620,000	187,000	0	0	807,000
ME-Supplement	200,000	0	0	0	200,000
	$3,792,392	$644,400	$524,770	$430,500	$5,392,062

I. NATURAL RESOURCE MANAGEMENT

TAMU-01	Land resources characterization and evaluation in the semiarid tropics.
TAMU-05	Integrated management of small agricultural watershed.
CU-05	Inter-CRSP-Honduras watershed study.
NCSU-01	Comparative agronomic, ecological and socio-economic analysis of humid tropical production systems.
NCSU-02	Soil characterization and interpretation for natural resource management in the humid tropics.
NCSU-06	Processes of soil degradation and rejuvenation under different land use systems.
CU-03	Utilization of green manures within a cropping system.
CU-06	Cameroon initiative.
UHTX-01	Collaborative research program between Center for Soil and Agroclimatic Research (CSAR) and TropSoils project: Soil Management Collaborative Research Support Program.
USDA-SCS	Soil Management Support Services (SMSS).
USDA-ERS	Technology for Soil Moisture Management (TSMM).

Fiscal Year: 09/01/91 - 08/31/92

Project Number: TAMU-01

Title: Land resources characterization and evaluation in the semiarid tropics.

Global Thrust: Natural resource management.

Constraints Addressed:
- Inadequate resource information
- Landscape restrictions

Problem Statement, Objectives and Justification:

Most soil resources in semiarid Africa are highly fragile, droughty and commonly exhibit chemical toxicities and/or nutrient deficiencies. These soil and climatic constraints pose major limitations to agricultural development and, in recent decades, have been amplified by the increased demands for crop and grazing lands. Accelerated soil erosion, declining fertility, soil compaction and crusting and salinization are major processes responsible for landscape degradation and associated declines in productivity which is threatening the sustainability of fragile tropical environments. There is an urgent need to characterize and evaluate land resources in the semiarid tropics to permit the assessment of production constraints associated with various land resource units. Furthermore, research aiming at a better understanding the processes of degradation and rejuvenation is required in order to assess the resiliency of agroecosystems and facilitate the design of management strategies for sustainable production.

The principal goals of this project are (1) to characterize, quantify and evaluate land resources as baseline data for resource management research and technology transfer and (2) characterize land degradation and rejuvenation processes in terms of soil structure, water movement and nutrient cycling under various land use management systems. The project is further divided into four sub-projects which are designed to achieve the following specific objectives:

(1) Establish soil resource conditions for major soils and target research sites in the semiarid tropics.

(2) Conduct baseline land resource studies for small agricultural watersheds which will be utilized by TropSoils for technology development and adaptation.

(3) Assess the causes and extent of crop/soils spatial variability in the Sahel/Sub-Sahel of West Africa.

(4) Assess the role of dust in the nutrient renewal and loss processes common to

semiarid Africa.

(5) Quantify effects of soil structure/porosity status on preferential flow paths of water and solutes under different land use systems.

(6) Characterize processes of surface crust formation and determine controlling factors and susceptibility to crusting under different land use systems.

A knowledge of soil resources is fundamental for the selection of target sites for future research, interpretation of research results and technology transfer. Soil resource inventories and characterization databases serve as the only meaningful basis for linkage among IARCs, NARS, other CRSPs and specific TropSoils target research sites. Furthermore such research is necessary to determine the suitability of various technologies, research innovations and farmer experiences with regard to soil regions of the tropics.

Soil structure related problems found principally in Alfisols and Vertisols of the semiarid tropics pose serious constraints to productivity and threaten the overall sustainability of associated agroecosystems. The loss of soil structure and associated macropores, accompanied by soil consolidation and decreased biological activity, are directly related to degradational processes. The destabilization of structural aggregates results in crusted and sealed surface conditions that decrease infiltration and increase surface runoff, wind and water erosion. Such conditions result in less water recharge to subsoils, decreased root growth and pronounced periods of soil moisture deficits. The consequences of these physical alterations of the soil are reduced growth and vigor of crops which further contribute to structural destabilization. The various mechanisms which contribute to the process of soil degradation are, irrevocably, important aspects applicable to the problems of "desertification" in the Sahel.

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P. Baveye, Cornell University
G. Stutte, University of Maryland
K. Cassel, North Carolina State University
R. Caldwell, University of Hawaii

Research Sites:

Garoua IRA Research Center, Cameroon
Vertisol sites near Maroua, Cameroon
Peanut CRSP Breeding/Trial Plots, Burkina Faso and Niger
IER Research Center, Mali
IMAW Field Site near Hamdellaye Niger

Budget (91-92):

Object	CRSP	External	Matching	Host*	Total
Salaries	26,614.79		27,549.91		54,164.71
Fringe Benefits	7,578.19		9,873.89		17,452.08
Allowances	0.00		0.00		0.00
Consulting	0.00		0.00		0.00
Travel, US	3,575.57		0.00		3,575.57
Travel, INT	10,188.17		0.00		10,188.17
Supplies	3,840.31		897.73		4,738.03
Equipment	2,925.19		0.00		2,925.19
Communications	987.79		364.70		1,352.49
Shipping/Freight	3,644.28		0.00		3,644.28
Publications	2,185.27		0.00		2,185.27
Other direct costs	34,700.00		1,666.41		36,366.41
Indirect costs	38,430.00	0.00	0.00		38,430.53
TOTAL	**134,670.07**	**0.00**	**40,352.64**	**0.00**	**175,022.71**

*Not determined yet.

Human Resource Commitments:

Institution	Full Time equivalents (FTE)					
	Senior Scientist	Junior Scientist	Technician	Admin. Support	Other	Total
US	0.3	1.0	0.1	0.3		1.7
Host*						
Other						
Total	**0.3**	**1.0**	**0.1**	**0.3**		**1.7**

*Not determined yet.

Date Initiated: November 1, 1991

Expected Completion: November 30, 1993

Signatures:

L. P. Wilding 7/5/91

Project Leader Date

7-1-91

Program Coordinator Date

Fiscal Year: 09/01/91 - 08/31/92

Project Number: TAMU-05

Title: Integrated management of small agricultural watersheds.

Global Thrust: Natural resource management.

Constraints Addressed:
- Climatic variability
- Landscape restrictions
- Production-demand pressure
- Inadequate resource information

Problem Statement, Objectives and Justification:

Accelerated rates of land degradation resulting in a gradual destruction of the biological potential of the land and a decrease in its productivity is a growing problem throughout the semiarid tropics. The threat this trend poses to sustainable economic development and ecological stability has highlighted the need to develop innovative strategies for sustainable resource management that are compatible with the environment and with increasing human demands. The growing need for a productive and sustainable agriculture must build upon the risk-reducing and resource-conserving aspects of traditional farming as well as draw upon the advances of modern technology.

The overall goal of this project is to develop and adapt sustainable agricultural watershed management technologies suitable for the semiarid regions of Niger through the integration of improved management technology components of soil conservation and crop production with traditional farming systems. The specific objectives are:

(1) To develop methodologies for integrating baseline information of selected watersheds into a Geographic Information System and delineate/characterize land management units within a wide range of watersheds in the tropics;

(2) To develop and adapt appropriate land management systems for sustained productivity in agricultural watersheds, adapted to social, economic, and cultural conditions within a give land management unit.

(3) To provide technical and logistic support to the USAID/INRAN collaborative project on watershed management in Niger.

Past development efforts have largely focused on promoting productivity improvements in a single sector - specific crops, livestock or forestry - without addressing the contexts in which traditional production systems have developed and without proper consideration of a long-term perspective. While this approach has produced results in the humid and more

fertile areas of the tropics, it has proven inadequate in the semiarid tropics of Africa. This project proposes an integrated approach such that (1) small agricultural watersheds will be the basic units of research, (2) the problems within these watersheds will be addressed with a system-based research approach, (3) traditional farming systems will be evaluated and (4) adaptive research will be planned and conducted with a sustainability perspective.

Principal Investigators and Institutions:

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A.S.R. Juo, TAES, Texas A&M University

Collaborators and Institutions:

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M. Issaka, INRAN, Niger
M. Hassan, INRAN, Niger
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R. van der Beldt, ICRISAT Sahelian Center, Niger
C. Wendt, TAES, Texas A&M University
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L.P. Wilding, TAES, Texas A&M University
L.R. Hossner, TAES, Texas A&M University
F. Smeins, TAES, Texas A&M University

Research Sites: Hamdallaye, Niger

Budget (91-92):

Object	CRSP	External	Matching	Host*	Total
Salaries	14,750.73	66,747.00	5,870.19		87,367.92
Fringe Benefits	4,160.32	18,690.00	2,103.88		24,954.20
Allowances	2,400.00	22,850.00	0.00		25,250.00
Consulting	0.00	17,364.00	0.00		17,364.00
Travel, US	379.43	3,000.00	0.00		3,379.43
Travel, INT	442.67	8,000.00	0.00		8,442.67
Supplies	202.36	11,000.00	191.28		11,393.65
Equipment	126.48	17,000.00	0.00		17,126.48
Communications	189.72	1,800.00	77.71		2,067.43
Shipping/Freight	347.81	6,000.00	0.00		6,347.81
Publications	177.07	1,000.00	0.00		1,177.07
Other direct costs	0.00	25,500.00	355.07		25,855.07
Indirect costs	5,518.19	38,874.00	0.00		44,392.19
TOTAL	**28,694.79**	**237,825.00**	**8,598.13**	**0.00**	**275,117.92**

*Not determined yet.

Human Resource Commitments:

Institution	Full Time equivalents (FTE)					
	Senior Scientist	Junior Scientist	Technician	Admin. Support	Other	Total
US	0.7	1.0		0.3		2.0
Host	1.5		0.5			2.0
Other						
Total	**2.2**	**1.0**	**0.5**	**0.3**		**4.0**

Date Initiated: November 1, 1991

Expected Completion: November 30, 1993

Signatures:

A. Manu/aj 7-1-91
Project Leader Date

7-1-91
Program Coordinator Date

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: 4/17/91 - 4/16/92

Project Number: CU-05

Title: Inter-CRSP-Honduras Watershed Study

Global Thrust: Natural Resource Management

Constraint(s) addressed: Production-Demand Pressure, Landscape Restrictions, Inadequate Resource Information.

Problem Statement, Objectives and Justification:

The coastal zone of southern Honduras (along the Gulf of Fonseca) consists primarily of coarse-textured soils of alluvial and marine origin. This region is nearly semi-arid and is characterized by two dry seasons, December through April and July through August. Most of the land is used for production of cattle and cash crops. Melons are produced for both the domestic and U.S. market. Subsistence-level hillside agriculture is being conducted in the upland regions of the coastal watersheds.

Some areas adjacent to estuaries have recently come into use for large-scale commercial shrimp production, primarily for export, larvae are captured from the natural breeding grounds in nearby estuaries. The shrimp larvae are subsequently raised in controlled ponds until they have reached optimum size for harvest.

Concerns exist about recent reductions in shrimp larva populations and the long-term survivability of the shrimp industry. It is believed that inland agriculture has caused a deterioration of water quality and shrimp habitat in the estuaries. Both erosion from small-scale farming on the hillsides and heavy use of agrichemicals on lands used for export crops are considered to be contributing to this problem. In addition, the shrimp production practices themselves (over-harvesting of the larvae and intensive pumping of estuarine water) may be responsible for deterioration of natural shrimp habitat.

Hillside farming

Subsistence farming in the hilly regions of the watershed typically includes extensive land use with 3-5 year fallow periods followed by slash and burn. This non-sustainable systems has resulted in extensive soil erosion and dramatic changes in the region's hydrology. Research needs to focus on intensive sustainable management of the land resource base. Soils research can address various aspects related to soil/water conservation, soil fertility and crop production. Water is in limited supply during about six months out of the year. Improved water conservation and reduced erosion during the wet season may be attained by improving the soil physical and chemical status of soils. The use of rotation crops such as bean, cowpea and peanut may provide soil physical and chemical benefits in addition to alternative food sources. Soil and water conservation not only maintains or improves soil productivity, but will also reduce the occurrence of peak hydrologic events and sediment loads in the downstream areas of the watershed, especially in the shrimp-producing estuaries.

Cash crop farming

Melon production is conducted on sandy alluvial soils using modern agronomic practices including the application of chemical fertilizers and pesticides. Melons are produced in the winter, when export to northern latitudes is economical. Concerns exist about the effect of agrichemicals on water quality in the watershed. Of particular concern is the use of insecticides and their effect on shrimp larva populations. Opportunities exist for reduction of agrichemical use through the use of rotation crops (e.g. peanuts, beans) which can provide additional cash income, break pest cycles, provide organic sources of nitrogen, and improve soil physical conditions. Soils research can focus on nitrogen dynamics and soil structural improvement. In addition, solute transport processes can be studied to determine the quantities of chemicals lost to the environment and the pathways along which they reach groundwater.

Shrimp production

The quality of water in the estuary is believed to threaten shrimp larva populations, which are essential for the continuation of the shrimp industry. Increased turbidity from upstream erosion and contamination by insecticides which are used in the production of melons may be some of the causes of this decline. TropSoils research can include analyses of soils and land use in the watershed which can be used to identify potential sources of contamination and estimate the effect of land use practices on water quality in the watershed. The feasibility of alternative management practices and their effects on the watershed in general and the estuary in particular can be evaluated through the use of geographical information systems. A watershed management plan can subsequently be developed which considers land resources, environmental quality and economics.

The TropSoils CRSP can play an integral part in research on each of these three agricultural systems. Moreover, soils research in each of these systems can largely be integrated. The initial stage of this project will focus on selecting and initiating suitable collaborative research in the context of the objectives outlined above.

Principal Investigators and Institutions:

Harold van Es, Cornell University

Collaborators and Institutions:

Tony Juo, TropSoils, (Texas A&M)
Dan Meckenstock, Sorghum/Millet CRSP (Texas A&M)
Silvio Viteri, Escuela Agricola Panamericana, Honduras
Personnel from the LUPE project, Honduras

Research sites:

Rio Sampile watershed, Department of Choluteca in southern Honduras.

CU 05

SOIL MANAGEMENT CRSP
ANNUAL BUDGET

FISCAL YEAR: 4/17/91-09/24/91

BUDGET: $ 7,920

OBJECT	TOTAL FUNDING SOURCE				TOTAL
	CRSP	EXTERNAL	MATCHING	HOST	
Salaries					
GRA (2) Stipend					0
GRA (2) Fees					0
H. van Es (5%)			1,025		1,025
Administrative Support			440		440
Fringe Benefits @ 23.44%	0				
Matching F.B. @ 30.46%			312		312
Allowances					0
Consulting					
Travel					
U.S.					0
International	4,000				4,000
Supplies	1,000				1,000
Equipment					0
Communications	200				
Shipping/Freight					
Publication					
Other Direct Costs					
TOTAL DIRECT COSTS	5,200		1,777		6,977
Indirect Costs					
On-Campus	2,720		930		3,650
Off-Campus					0
TOTAL PROJECT COSTS	7,920		2,707		10,627

INSTITUTION	FULL TIME EQUIVALENTS (FTE)				
	SCIENTIST				
	SENIOR	JUNIOR	TECHNICIAN	ADM. SUPPORT	OTHER
US	0.05			0.02	
Host					
Other					
TOTAL	0.05	0.00		0.02	

DATE INITIATED: APRIL 17, 1991

EXPECTED COMPLETION: SEPTEMBER 24, 1994

SIGNATURES:

Harold M Ivanov 4/30/91 Susan J Rehia 4/30/91

(Project Leader) (Date) (Program Coordinator) (Date)

CU 05

SOIL MANAGEMENT CRSP
ANNUAL BUDGET

FISCAL YEAR: 09/25/91-4/16/92

BUDGET: $10,080

OBJECT	TOTAL FUNDING SOURCE				TOTAL
	CRSP	EXTERNAL	MATCHING	HOST	
Salaries					
GRA (1.5) Stipend					0
GRA (1.5) Fees					0
H. van Es (5%)			1,305		1,305
Administrative Support			560		560
Fringe Benefits @ 23.44%	0				
Matching F.B. @ 30.46%			568		568
Allowances					0
Visiting Scientist					0
Consulting					
Travel					
U.S.					0
International	2,000				2,000
Supplies	2,000				2,000
Equipment					0
Communications	1,000				1,000
Shipping/Freight					
Publication					
Other Direct Costs	1,588				1,588
TOTAL DIRECT COSTS	6,588		2,433		9,021
Indirect Costs					
On-Campus	3,492		1,289		4,781
Off-Campus					0
TOTAL PROJECT COSTS	10,080		3,722		13,802

INSTITUTION	FULL TIME EQUIVALENTS (FTE)				
	SCIENTIST				
	SENIOR	JUNIOR	TECHNICIAN	ADM. SUPPORT	OTHER
US	0.05			0.02	
Host					
Other					
TOTAL	0.05	0.00	0.00	0.02	

DATE INITIATED: APRIL 17, 1991

EXPECTED COMPLETION: SEPTEMBER 24, 1994

SIGNATURES:

Harold Mauntes 4/30/91 Susan J. Ruba 4/30/91

(Project Leader) (Date) (Program Coordinator) (Date)

CU 6

SOIL MANAGEMENT CRSP
ANNUAL BUDGET

FISCAL YEAR: 9/25/91-9/24/92

BUDGET:

OBJECT	TOTAL FUNDING SOURCE				TOTAL
	CRSP	EXTERNAL	MATCHING	HOST	
Salaries					
GRA (0) Stipend					0
GRA (0) Fees					0
H. van Es (??%)					0
Hourly Wages	700				700
					0
Fringe Benefits @ 23.44%	164				
Matching F.B. @ 30.46%					0
Allowances (GRA & PI)					0
Visiting Scientist					0
Consulting					
Travel					
U.S.					0
International	2,000				2,000
Supplies	1,800				1,800
Equipment	11,600				11,600
Equipment Maintenance					0
Telecommunication & copying					0
Analytical Costs					0
Publication					
Labour (off-campus)*					
TOTAL DIRECT COSTS	16,264		0		16,264
Indirect Costs					
On-Campus	8,620				8,620
Off-Campus					0
TOTAL PROJECT COSTS	24,884		0		24,884

INSTITUTION	FULL TIME EQUIVALENTS (FTE)					TOTAL
	SCIENTIST					
	SENIOR	JUNIOR	TECHNICIAN	ADM. SUPPORT	OTHER	
US	0.10	1.50		0.04		1.64
Host	0.05					0.05
Other	0.05					0.05
TOTAL	0.20	1.50		0.04		1.74

DATE INITIATED: SEPTEMBER 25, 1990

EXPECTED COMPLETION: SEPTEMBER 24, 1994

SIGNATURES:

Howard M van Fossen 8/1/91 Susan Rekia 8/1/91

(Project Leader) (Date) (Program Coordinator) (Date)

SPONSOR'S INDIRECT COST SHEET
CU6 - VAN ES
BUDGET JUSTIFICATION - Indirect Cost Detail 31-Jul-91

	Period TROPSOILS 9/25/91-6/30/92	Period TROPSOILS 7/1/92-9/24/92	Period MATCHING 9/25/91-6/30/92	Period MATCHING 7/1/92-9/24/92
TOTAL DIRECT COSTS - ON-CAMPUS	$12,198	$4,066		
TOTAL DIRECT COSTS - OFF-CAMPUS				
TOTAL DIRECT COSTS	$12,198	$4,066	$0	$0
MINUS EXCLUSIONS				
- Graduate Student Exclusion				
- Capital Equipment (Statutory - over $500/2 yr.)				
- Use of Cornell Computing Services				
- Subcontracts over $25,000				
SUBTOTAL EXCLUSIONS (ON-CAMPUS)	$0	$0		
MODIFIED TDC (ON-CAMPUS)	$12,198	$4,066	$0	$0
MODIFIED TDC (OFF-CAMPUS)	$0	$0		
Indirect Cost Rate (ON-CAMPUS)	53.0%	53%	51.5%	53%
Indirect Cost Rate (OFF-CAMPUS)	30.0%	30%		
TOTAL INDIRECT COSTS (ON-CAMPUS)	$6,465	$2,155	$0	$0
TOTAL INDIRECT COSTS (OFF-CAMPUS)	$0	$0		

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: 1991-1992
Project Number: NCSU 1
Title: Comparative Agronomic, Ecological, and Socio-economic Analysis of Humid Tropical Production Systems
Global Thrust: Natural Resource Management

Constraint(s) Addressed: Increasing population pressure in the humid tropics has created a large demand for increased food production on marginal lands. The farmers in such areas do not have access to markets, credit and fertilizers necessary for high-input continuous agriculture. The result is continued and accelerated forest clearing and mismanagement of previously cleared lands. These practices result in local, regional and global environmental problems. Land management options that allow for continued production of the same piece of land for resource-poor farmers are being developed. Little is still known about the environmental impact of such systems of their economic viability. An experiment that compares agronomic, ecological and economic aspects of food production systems in the tropics will aid in making appropriate recommendations according to the socioeconomic status of farmers.

Problem Statement, Objectives and Justification: Sustainable agricultural production and resource management depend on both the maintenance of on-site productivity and minimization of environmental impacts at local, regional, and global scales. These objectives must be attained in accordance with local socioeconomic conditions. In areas of the tropics where markets, infrastructure, and credit are available agricultural production is best maintained by conventional cropping with mechanization, fertilization, and liming. This high-input type of agriculture however, is often associated with environmental damage such as erosion and losses of excess nutrients by leaching and gaseous emissions. Carbon stocks in the vegetation and soil are thought to be lower in these systems, adding more $C0_2$ to the atmosphere and potentially contributing to global warming. In most areas of the humid tropics this type of agriculture is not economically feasible and agricultural production must depend on the efficient use and cycling of nutrients within the system. The comparative sustainability of such systems is not known.

Over the past fifteen years, much of the research at the Yurimaguas Experiment Station in Peru has been devoted to defining and refining production systems for different soil/landscape positions and socioeconomic conditions found throughout the humid tropics. Although it is clear that such systems differ in terms of their biological, chemical, physical, and economic characteristics, differences in underlying processes, sustainability, and environmental impact are not well understood. Past attempts at Yurimaguas and other tropical humid sites comparing specific processes and changes in some of these management systems did not deal rigorously with the problem of the confounding effects of time and spatial variability. For example, some studies indicating changes of 50% in soil

organic matter with changes in land use are often due to differences in the soil texture for the different treatments and are totally independent of treatment effect. Data from these studies are nonetheless used for estimating carbon fluxes from the tropics caused by changes in land-use controlled. Experiments such as the one proposed in this project will provide more reliable estimates for changes in soil carbon.

Sustainability will be determined in part by the maintenance of soil organic matter. Soil organic matter content and its maintenance are generally associated with soil fertility and production.

Sustainability of different systems will also depend on the nutrient budgets of the systems, a system cannot be sustainable for long if nutrient exports (e.g. losses by leaching or crop harvest) are greater than nutrient inputs (via rainfall or fertilizers) to the system. Recycling of nutrients through organic input management (crop residues, litterfall, pruning, root turnover) can help to prolong productivity even in the absence of external nutrient inputs. The different management options will have different nutrient budgets but to date little is known of comparative budgets. Knowledge of these budgets and an understanding of the nutrient cycling of the systems will point out potential limitations to production and allow for modifications in the systems for more efficient management.

This is particularly true for low-input agricultural systems where the majority of nitrogen, and even phosphorus on acid soils comes from soil organic matter. Despite several decades of research there are still no simple measurements for soil organic matter that relate to nutrient availability. The amount and type of organic inputs to the system will, in part, determine the content on soil organic matter as well as the nutrient supplying capacity of the soil organic matter. This experiment provides an excellent design for studying soil organic matter dynamics, contents and subsequent nutrient availabilities because of the broad range in types and amounts of organic inputs among the management systems.

Principal Investigators and Institutions:

C.A. Palm - NCSU

Collaborators and Institutions:

L. Arévalo - INIAA, Yurimaguas, agroforestry components of project
J.C. Alegre - NCSU
A. Salazar - NCSU
A.G. Wollum - NCSU
L.T. Szott - International Development Research Centre
G. Meléndez - INIAA, Yurimaguas, soil mineralization
B. Pashanasi- INIAA, Yurimaguas, soil fauna
P. Lavelle - Ecole Normale Supérieur, Paris, soil fauna
E.T. Elliott- Colorado State University, soil organic matter and aggregation
W.J. Parton - Colorado State University, modelling

Research Sites:

Estación Experimental de Yurimaguas, Yurimaguas, Loreto, Peru

Budget: 9/25/91 - 9/24/92

	Total Funding Source US $1000's				
OBJECT	CRSP	EXTERNAL	MATCHING	HOST	TOTAL
Salaries	46.6	0.0	20.1	24.2	90.9
Fringe Benefits	11.1	0.0	4.8	5.8	21.7
Allowances	6.5	0.0	0.0	0.0	6.5
Consulting	0.0	0.0	0.0	20.0	20.0
Travel, US	1.7	0.0	0.0	0.0	1.7
Travel, Int.	9.7	0.0	0.0	0.0	9.7
Supplies	9.7	0.0	0.0	35.0	44.7
Equipment	5.2	0.0	0.0	14.0	19.2
Communication	0.9	0.0	0.0	3.0	3.9
Shipping/Freight	3.1	0.0	0.0	10.0	13.1
Publication	0.7	0.0	0.0	4.0	4.7
Other Direct Costs	5.7	0.0	0.0	10.0	15.7
Indirect Costs	28.7	0.0	7.5	33.6	69.8
Total	129.7	0.0	32.4	159.6	321.7

	Full Time Equivalents (FTE)					
	Scientist					
Institution	Senior	Junior	Technician	Adm. Support	Other	Total
US	0.33	1.00	0.06	0.46	0.40	2.25
Host	1.33	2.00	1.00	2.00	10.00	16.33
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.66	3.00	1.06	2.46	10.40	18.58

Date Initiated: Oct 1, 1985

Expected Completion: Oct 1, 1993

Signatures:

Cheryl Ann Palm 5 Sept 91 — (Project Leader) Date

(Program Coordinator) — 9-6-91 (Date)

	Full Time Equivalents (FTE)					
	Scientist					
Institution	Senior	Junior	Technician	Adm. Support	Other	Total
US	0.02	0.44	0.00	0.00	0.00	0.46
Host	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.02	0.44	0.00	0.00	0.00	0.46

Date Initiated: Oct 1, 1985

Expected Completion: Oct 1, 1993

Signatures:

5 Sept 91
(Project Leader) Date

(Program Coordinator)

9-6-91
(Date)

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: 1991-1992
Project Number: NCSU 2
Title: Soil Characterization and Interpretation for Natural Resource Management in the Humid Tropics
Global Thrust: Natural Resource Management

Constraint(s) Addressed: This project addresses portions of two major constraints to better management of the world's soil resources. As science develops better genetic varieties with increased nutrient uptake potential what is the absolute mineral nutrient reserve content of major soil types in the tropics? Modern soil characterization procedures do not address this question because they rely on "available" or "exchangeable" types of analysis to determine the characteristics of the soil. The extreme end of leaching potential through well-drained upland soils in perudic soil moisture regimes have seldom been studied. By characterization of perudic soil moisture regime soils in Bolivia, in concert with agronomic research a abetter evaluation of leaching and translocation of plant nutrients will be obtained. A systematic reporting of responses to agronomic practices, as related to quantified soil conditions is possible through the use of the Fertility Capability Classification system. This is an ongoing activity and electronic storage of the data with geographic display potential will be developed to aid in distributing these data to extension workers, researchers, and decision makers.

Problem Statement, Objectives and Justification: The absolute, total quantity of mineral reserve of necessary plant nutrients in major soil types of the tropics is not known. Limited data indicate that absolute zero contents of certain nutrients could be reached in as little as 20 harvests. The total potential content can be determined by selecting soils representative of the major parent material mineral sites around the world and subjecting them to total elemental analysis. The results will help establish where, and in what kind of soil there is potential for improved nutrient uptake by superior genetic root systems and biological extraction enhancement and where such techniques are useless.

Environments of excess rainfall each month of the year are extreme but present in portions of every tropical continent. These areas present problems of nutrient translocation and leaching in the upland soils. This extreme of the humid tropics, the perudic soil moisture regime is an extension of TropSoils research in the Udic soil moisture regime of Yurimaguas, Peru. The targeted area is the Chapare region of Bolivia where ongoing agronomic research can collaborate with the soil characterization studies proposed.

The degree of success of each agronomic management practice depends, in part, on the soil conditions where it is practiced. The systematic recording of results obtained, according to quantitatively defined soil properties provides a tool for use in guiding where, and under what soil conditions extension personnel should recommend specific management practices. The FCC system, developed

in previous TropSoils projects is such an ongoing system. In addition to increasing the information in the system by entering new data from collaborating researchers attempts will be made to enhance the output through the use of GIS technology.

The research goals and objectives are to enhance the scientific understanding of how soil properties interact with plants in the humid tropics. In this project the limits of soils as potential mineral nutrient suppliers will be examined. Also, the characteristics of soil in perudic soil moisture regime will be determined as an extension of on-going work in less humid areas of the humid tropics. Finally a system of matching soil management responses to soil conditions via FCC will be continued and improvements attempted.

Principal Investigator and Institution:

S.W. Buol - NCSU

Collaborators and Institutions:

Hari Eswaran - SMSS
José Salinas - PDAR/Bolivia
T.J. Smyth - NCSU
S. Sokotelo - ZAREP, Zambia
S. Monteith - NCSU

Research Sites:

Raleigh, NC; Chapare, Bolivia; Kasama, Zambia

Budget: 9/25/91 - 9/24/92

	Total Funding Source US $1000's				
OBJECT	CRSP	EXTERNAL	MATCHING	HOST	TOTAL
Salaries	26.8	0.0	8.8	0.0	35.6
Fringe Benefits	6.4	0.0	2.1	0.0	8.5
Allowances	3.0	0.0	0.0	0.0	3.0
Consulting	0.0	0.0	0.0	4.0	4.0
Travel, US	0.6	0.0	0.0	0.0	0.6
Travel, Int.	2.5	0.0	0.0	0.0	2.5
Supplies	1.5	0.0	0.0	0.0	1.5
Equipment	0.0	0.0	0.0	0.0	0.0
Communication	1.3	0.0	0.0	0.0	1.3
Shipping/Freight	0.4	0.0	0.0	0.0	0.4
Publication	0.7	0.0	0.0	0.0	0.7
Other Direct Costs	2.9	0.0	0.0	3.0	5.9
Indirect Costs	13.6	0.0	3.3	0.0	17.1
Total	59.9	0.0	14.2	7.0	81.1

	Full Time Equivalents (FTE)					
	Scientist					
Institution	Senior	Junior	Technician	Adm. Support	Other	Total
US	0.18	2.00	0.08	0.16	0.00	2.42
Host	0.50	2.00	0.00	0.00	3.00	5.50
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.68	4.00	0.08	0.16	3.00	7.92

Date Initiated: Sept. 1990

Expected Completion: Sept. 2000

Signatures:

Stanley W. Boyd — (Project Leader)
6 Sept 1991 — (Date)
[illegible] — (Program Coordinator)
9-6-91 — (Date)

	Full Time Equivalents (FTE)					
	Scientist					
Institution	Senior	Junior	Technician	Adm. Support	Other	Total
US	0.03	0.44	0.00	0.00	0.00	0.47
Host	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.03	0.44	0.00	0.00	0.00	0.47

Date Initiated: Sept. 1990

Expected Completion: Sept. 2000

Signatures:

(Project Leader) 6 Sept. 1991 (Date) (Program Coordinator) 9-6-91 (Date)

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: 1991-1992
Project Number: NCSU 6
Title: Processes of Soil Degradation and Rejuvenation under Different Land Use Systems
Global Thrust: Natural Resource Management

Constraints Addressed: Inefficient use of water resources and high erosion rates are major limitations to sustainable crop production on soils at various locations on hilly landscapes in the humid tropics. Information on the degradation and rejuvenation rates of these soils is needed to provide a judicious choice of management alternatives.

Problem Statement, Objectives, and Justification: Many studies have addressed the issue of alley cropping systems to improve the cycling of nutrients. Most studies have shown that dependence on recycled nutrients alone will not lead to a sustainable agricultural system. The competition of the tree for water and nutrients, and the shading due to the trees reduce crop yields by 30% or even greater. Additional nutrients must be applied periodically for sustainable production.

While the hope of alley crop system technology is fading on soils occurring on the "flat" portion of the landscape, there is still some prospect for the system on sloping land, especially if the competition of the alley crop vegetation is reduced. The main purpose for alley cropping on sloping land is to sustain agricultural production over a longer period of time by enhancing soil and water conservation.

The development of an alley cropping system on sloping land begins with the establishment of "hedge" row crops on the contour. This hedge could be trees, shrubs, grasses or legumes as demonstrated by Dennis Garrity in research conducted at IRRI in the Philippines. Terrace formation evolves as soil moves downslope and is deposited near the hedge row. Bench terraces as high as 30 cm have developed over three years on a 20% slope.

There are many significant gaps in knowledge or developed technology in the development and sustainability of the hedge rows, the bench terraces formed, and the water and nutrient relationships in these terraces as time progresses. The specific objectives of this research are:

1. To evaluate the effect of several plants on hedge row terrace formation on acid infertile sloping lands.

2. To evaluate the temporal and spatial changes in the hydrology (infiltration, redistribution, runoff, and soil loss) of the soil under hedge rows.

3. To evaluate the temporal and spatial changes in solute transport under various bench terrace systems.

4. To monitor the temporal and spatial changes in soil physical properties as the terraces develop.

Principal Investigator and Institution:

D. Keith Cassel - NCSU

Collaborators and Institutions:

Dennis Garrity	- International Rice Research Institute
Fahmuddin Agus	- Center for Soils Research, Bogor, Java, Indonesia
Philippe Baveye	- Cornell University
Murray McBride	- Cornell University
Larry Wilding	- Texas A&M

Research Sites:

Claveria, Mindanao, Philippines

Budget: 9/25/91 - 9/24/92

	Total Funding Source US $1000's				
OBJECT	CRSP	EXTERNAL	MATCHING	HOST	TOTAL
Salaries	5.2	0.0	3.7	17.5	26.4
Fringe Benefits	1.2	0.0	0.9	4.2	6.3
Allowances	0.8	0.0	0.0	0.0	0.8
Consulting	1.0	0.0	0.0	0.0	1.0
Travel, US	0.0	0.0	0.0	0.0	0.0
Travel, Int.	5.6	0.0	0.0	0.0	5.6
Supplies	2.7	0.0	0.0	2.0	4.7
Equipment	1.0	0.0	0.0	2.0	3.0
Communication	0.3	0.0	0.0	0.2	0.5
Shipping/Freight	0.1	0.0	0.0	0.0	0.1
Publication	0.0	0.0	0.0	0.0	0.0
Other Direct Costs	0.8	0.0	0.0	1.5	2.3
Indirect Costs	5.3	0.0	1.4	6.1	12.8
Total	24.1	0.0	6.0	33.5	63.5

	Full Time Equivalents (FTE)					
	Scientist					
Institution	Senior	Junior	Technician	Adm. Support	Other	Total
US	0.05	0.00	0.08	0.16	0.00	0.29
Host	0.05	0.00	0.50	0.00	0.55	1.10
Other	0.00	1.00	0.00	0.00	0.00	1.00
Total	0.10	1.00	0.58	0.16	0.55	2.39

Date Initiated: April 17, 1991

Expected Completion: December 1993

Signatures:

Keith Cassel — (Project Leader)

Sept 6, 1991 — (Date)

Todd Swanson — (Program Coordinator)

9-9-91 — (Date)

CU-3, Utilization of Green Manures Within a Cropping System
1991-1992

Global Thrust - Sustainable Agriculture/Outreach/Natural Resource Management

Constraint(s) Addressed:

Nitrogen most often is the nutrient limiting yields of maize and other non-legumes in the tropics . The N must be obtained either as commercial fertilizer or through N fixation by legume. The cost and/or availability of commercial fertilizers often prohibits their use; therefore, legume green manures can play an important role in supplying N. The legume green manure crop must be grown within the cropping system in a manner to fix and supply sufficient N for the following crop(s) without large excesses, but the green manure crop should not replace an economic crop within the system. To develop or determine the adjustments within the system to maximize the use of the legume green manures requires the determination of N requirements and uptake patterns of following crop(s), N fixation characteristics of the legume green manure, N Mineralization rates, N losses from the system to determine the most appropriate time for the legume to be included in the rotation as well as the crop cultural information.

Problem Statement and Justification for the Research

Green manures can provide most if not all of the nitrogen needed for a following non-legume crop. Utilizing the green manures as an N source provides a farm based supply of the nutrient and does not depend upon having cash or commercial fertilizer available. However, establishing a cropping system for managing the green manure to supply sufficient N without excess N and without displacing an economic crop is often difficult. This requires that the system be balanced with respect to N fixation by the legume, rate of N mineralized by the green manure, N use by the crop, and N losses from the system. These factors have not been sufficiently quantified to permit the nitrogen in the green manure system to be managed with the same precision as the use of commercial fertilizer.

The green manure has the potential to produce more nitrogen than can be utilized by the following crop. If the soil does not have some mechanism to retain N, nitrates may be lost to the groundwater. It appears that some of the soils have considerable anion exchange in the subsoil. Under these conditions, one productive legume green manure crop might supply N to more than one following crop.

Principal Investigators and Institutions:
W.S. Reid - Cornell University
D.R. Bouldin - Cornell University
Bernard Triomphe - Cornell University
Pierre Siband - IRAT
Host country PI to be determined.

Collaborators and Institutions:
To be determined during summer of 1991 through site visits

Site locations:
To be determined during summer of 1991.

CU 3

SOIL MANAGEMENT CRSP
ANNUAL BUDGET

FISCAL YEAR: 9/24/91-9/24/92

BUDGET:

OBJECT	TOTAL FUNDING SOURCE				TOTAL
	CRSP	EXTERNAL	MATCHING	HOST	
Salaries					
GRA (1.0) Stipend	12,500				12,500
GRA (1.0) Fees	4,020				4,020
D. Bouldin (15%)			11,975		11,975
Administrative Support	500				
Fringe Benefits @ 23.44%	117				
Matching F.B. @ 30.46%			3,648		3,648
Allowances	7,680				7,680
Visiting Scientist	1,500				1,500
Consulting					
Travel					
U.S.	1,250				1,250
International	3,000				3,000
Supplies	5,000				5,000
Equipment	2,000				2,000
Communications					
Shipping/Freight					
Publication					
Other Direct Costs					
TOTAL DIRECT COSTS	37,567		15,623		53,190
Indirect Costs					
On-Campus	12,805		8,104		20,909
Off-Campus	2,251				
TOTAL PROJECT COSTS	52,623		23,727		74,099

INSTITUTION	FULL TIME EQUIVALENTS (FTE)					TOTAL
	SCIENTIST					
	SENIOR	JUNIOR	TECHNICIAN	ADM. SUPPORT	OTHER	
US	0.15	0.15	0.50	0.04		0.84
Host	0.05					0.05
Other			0.20			0.20
TOTAL	0.20	0.15	0.70	0.04		1.09

DATE INITIATED: SEPTEMBER 25, 1990

EXPECTED COMPLETION: SEPTEMBER 24, 1994

SIGNATURES:

(Project Leader)	(Date)	(Program Coordinator)	(Date)
	8/1/91		8/1/91

SPONSOR'S INDIRECT COST SHEET
CU3 - BOULDIN
BUDGET JUSTIFICATION - Indirect Cost Detail 31-Jul-91

	Period TROPSOILS 9/25/91-6/30/92	Period TROPSOILS 7/1/92-9/24/92	Period MATCHING 9/25/91-6/30/92	Period MATCHING 7/1/92-9/24/92
TOTAL DIRECT COSTS - ON-CAMPUS	$22,550	$7,517	$11,717	$3,906
TOTAL DIRECT COSTS - OFF-CAMPUS	$5,625	$1,875		
TOTAL DIRECT COSTS	$28,175	$9,392	$11,717	$3,906
MINUS EXCLUSIONS				
- Graduate Student Exclusion	$3,015	$1,005		
- Capital Equipment (Statutory - over $500/2 yr.)	$1,500	$500		
- Use of Cornell Computing Services				
- Subcontracts over $25,000				
SUBTOTAL EXCLUSIONS (ON-CAMPUS)	$4,515	$1,505		
MODIFIED TDC (ON-CAMPUS)	$18,035	$6,012	$11,717	$3,906
MODIFIED TDC (OFF-CAMPUS)	$5,625	$1,875		
Indirect Cost Rate (ON-CAMPUS)	53.0%	54%	51.5%	53%
Indirect Cost Rate (OFF-CAMPUS)	30.0%	30%		
TOTAL INDIRECT COSTS (ON-CAMPUS)	$9,559	$3,246	$6,034	$2,070
TOTAL INDIRECT COSTS (OFF-CAMPUS)	$1,688	$563		

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: 4/17/91 - 4/16/92

Project Number: CU-06

Title: Cameroon Initiative

Global Thrust: Natural Resource Management

Constraint(s) addressed: Production-Demand Pressure, Landscape Restrictions

Problem Statement, Objectives and Justification:

This project will focus on the identification and appraisal of land types in terms of their potential to sustain the cropping systems considered most adapted to the region under study. The specific region or regions in Cameroon for study will be selected in conjunction with Cameroon authorities and a more detailed plan of work would be developed at the time of a site visit. However, expected activities involved in the diagnostic process would include:

a. Identification of the physical constraints to satisfactory performance of the selected land utilization types on the major kinds of land resources.

b. Identification of the economic constraints that reduce the sustainability of the cropping systems.

c. Identification of the deterioration of the natural resources suffered under the present set of land-uses.

The next stage of the project will include preparation of recommendations and/or a research agenda directed to formulate soil management practices to alleviate identified constraints.

Principal Investigators and Institutions:

Armand Van Wambeke, Cornell University
Philippe Baveye, Cornell University
David Bouldin, Cornell University

Collaborators and Institutions:

Institute for Agricultural Research (IRA), Cameroon
TropSoils, Texas A&M
Other possible collaborators:
IITA, ORSTOM, CIRAD, and NCRE

Research sites: To be selected.

CU 06

SOIL MANAGEMENT CRSP
ANNUAL BUDGET

FISCAL YEAR: 04/17/91-09/24/91

BUDGET: $11,880

OBJECT	TOTAL FUNDING SOURCE				TOTAL
	CRSP	EXTERNAL	MATCHING	HOST	
Salaries					
GRA (1) Stipend	2,000				2,000
GRA (1) Fees					0
A. Van Wambeke (5%)			1,848		1,848
Administrative Support			440		440
Fringe Benefits @ 23.44%	0				
Matching F.B. @ 30.46%			563		563
Allowances					0
Visiting Scientist					0
Consulting					
Travel					
U.S.					0
International	4,000				4,000
Supplies	1,400				1,400
Equipment					0
Communications	399				399
Shipping/Freight					
Publication					
Other Direct Costs					
TOTAL DIRECT COSTS	7,799		2,851		10,650
Indirect Costs					
On-Campus	4,081		1,491		5,572
Off-Campus					
TOTAL PROJECT COSTS	11,880		4,342		16,222

INSTITUTION	FULL TIME EQUIVALENTS (FTE)				
	SCIENTIST				
	SENIOR	JUNIOR	TECHNICIAN	ADM. SUPPORT	OTHER
US	0.05	1.00		0.02	
Host					
Other					
TOTAL	0.05	1.00		0.02	

DATE INITIATED: APRIL 17, 1991

EXPECTED COMPLETION: SEPTEMBER 24, 1994

SIGNATURES:

		Susan Pelu	5/1/91
(Project Leader)	(Date)	(Program Coordinator)	(Date)

CU 06

SOIL MANAGEMENT CRSP
ANNUAL BUDGET

FISCAL YEAR: 09/25/91-04/16/92

BUDGET: $15,120

OBJECT	TOTAL FUNDING SOURCE				TOTAL
	CRSP	EXTERNAL	MATCHING	HOST	
Salaries					
GRA (1) Stipend	7,000				7,000
GRA (1) Fees	4,050				4,050
A. Van Wambeke (5%)			2,352		2,352
Administrative Support			560		560
					0
Fringe Benefits @ 23.44%	0				
Matching F.B. @ 30.46%			886		886
Allowances (GRA & PI)					0
Visiting Scientist					0
Consulting					
Travel					
U.S.					0
International					0
Supplies	235				235
Equipment					0
Equipment Maintenance					0
Telecommunication & copying					0
Publication					
Other Direct Costs					
TOTAL DIRECT COSTS	11,285		3,798		15,083
Indirect Costs					
On-Campus	3,835		2,013		5,848
Off-Campus					0
TOTAL PROJECT COSTS	15,120		5,811		20,931

INSTITUTION	FULL TIME EQUIVALENTS (FTE)				
	SCIENTIST				
	SENIOR	JUNIOR	TECHNICIAN	ADM. SUPPORT	OTHER
US	0.05	1.00		0.02	
Host					
Other					
TOTAL	0.05	1.00	0.00	0.02	

DATE INITIATED: APRIL 17, 1991

EXPECTED COMPLETION: SEPTEMBER 24, 1994

SIGNATURES:

_____	_____	Susan J. Pike	5/1/91
(Project Leader)	(Date)	(Program Coordinator)	(Date)

Soil Management CRSP
Annual Activities Work Plan and Budget

Fiscal Year: 1991-92

Project Number: UHTX-01

Title: Collaborative Research Program Between Center for Soil and Agroclimate Research (CSAR) and TropSoils Project: Soil Management Collaborative Research Support Program

Global Thrust: Natural resource management, sustainable agricultural production, and outreach

Problem Statement, Objectives and Justification:

Soil acidity and low nutrient availability continue to be major constraints to increasing levels of food productivity in the humid tropics in general and transmigration areas of Indonesia, in particular. Elimination of support for TropSoils sites in overseas locations resulted in the termination of a senior staff position in Indonesia and the direct support for the continuation of any field research activities.

The CSAR/TropSoils research station in Sitiung continues to be maintained with local funding by CSAR. The Sumatra Agricultural Research Institute for Food Crops (SARIF) also has staff and facilities situated in the adjacent Gunung Medan station in Sitiung, West Sumatra. Both could provide an operational base for any planned collaborative activities in the area.

The IRRI Upland Agriculture program now has a resident research agronomist on site in West Sumatra and is a cooperator to the SARIF/WINROCK effort. This reflects the continuing interest and concerns of the government of Indonesia and donor agencies in Sitiung and West Sumatra.

Sites in Sitiung can serve to validate outputs of both the soil acidity and phosphorus decision support systems. Upon validation of these outputs, application of both systems may be possible at a regional or national level. Opportunities to address agricultural and environmental issues in collaborative programs with Indonesian scientists anywhere in the country is also possible.

Principal Investigators and Institutions:

Suryatna Effendi, Director, Center for Soil Research and Agroclimatology, Bogor
I Putu G. Widjaja-Adhi, Center for Soil Research and Agroclimatology, Bogor
Zulkifli Zaini, Director, Sukarami Agricultural Institute for Food Crops, Sukarami
Goro Uehara, Program Coordinator, TropSoils Project, University of Hawaii

Collaborators and Institutions:

Anthony Juo, Program Coordinator, Texas A&M University
Susan Riha, Program Coordinator, Cornell University
Jot Smyth, Program Coordinator, North Carolina State University

Research Sites: Sitiung, West Sumatra, Indonesia

Budget:

	CRSP	Host	Matching	Total
Salaries	25,000	5,000	8,500	38,500
Fringe Benefits	4,000	0	2,400	6,400
Travel (US)	0	0	0	0
Travel (INT)	4,000	0	0	4,000
Supplies	2,000	0	1,000	3,000
Equipment	0	0	0	0
Communications	1,500	0	0	1,500
Shipping/Freight	1,500	0	0	1,500
Other Direct Costs	5,000	2,000	3,000	10,000
Indirect Costs	10,750	0	0	10,750
TOTAL	53,750	7,000	14,900	75,650

Human Resource Commitments:

	Scientist					
Institution	Senior	Junior	Technician	Admin	Other	Total
UH	.2	0	0	0	0	.2
Host	.2	0	0	0	0	.2
Other	.2	0	0	0	0	.2
TOTAL	.6	0	0	0	0	.6

Date Initiated: 1991

Expected Completion: 1994

Signatures:

Goro Uehara 10/14/91
Project Leader Date

Goro Uehara 10/14/91
Program Coordinator Date

WORK PLAN AND BUDGET

SOIL MANAGEMENT SUPPORT SERVICES (SMSS)

GLOBAL THRUST: Natural Resource Management
Outreach

CONSTRAINTS: Inadequate Resource Information
Number and Diversity of Soils
Lack of Local Expertise, Information
Number and Diversity of Users

PROBLEM STATEMENT, OBJECTIVES AND JUSTIFICATION

Problem Statement

Basic soil resource information is not utilized adequately to provide the basis for environmental assessment or monitoring, and for planning appropriate country policies for sustainable land management. Information currently available is fragmentary, of questionable quality, and/or not in a format readily useable by national planners and other clients such as extension workers for assisting farmers in land management.

Objectives

1. To improve the utilization and dissemination of soil resource information necessary to implement land management in the developing countries.

2. To develop a coherent, comprehensive, and interactive data base on soils and climate to serve as inputs for Global Climate Change (GCC) and Sustainable Land Management (SLM) activities, and to improve the reliability, usefulness, and availability of soils data for production systems (IARCs, CRSPs, NARS, IBSRAM).

3. To assist in developing strategies to monitor soil degradation through the use of remote sensing techniques and through land management research, the latter in collaboration with IBSRAM, ICRISAT and other IARCs.

4. To conduct training courses and workshops, and initiate publications to enhance information dissemination for the judicious use of the soil resource.

Justification

An inventory of soil resources is necessary for country, regional, and farm level planning for agriculture. A knowledge of soil resource characteristics is fundamental for optimal selection of sites and research, experimental station setting, interpretation of research results, and technology transfer. Soil resource inventories and characterization databases serve as the only meaningful basis for linkage among IARCS, NARS, Crop and Livestock CRSPs, and the Soils CRSP.

Soil resource information provides the basis for integrating agronomic management, socioeconomic context, and socio political reality into sustainable agricultural systems. This same information on a global basis is completely essential to the prediction of response to interventions for production, of climate change response, and influence of soil degradation. Principles of applications are site-specific and dependent on soil resource information.

There is a need to work more closely with the IARCs, CRSPs, NARS and other regional and international groups to obtain more detailed mapping and soil characterization of their research sites for more effective agrotechnology transfer and to make the resultant information more available globally.

There is a need to provide assistance and training to developing country scientists and planners and their institutions in obtaining and utilizing land and soil resource information for inventories and maps to enable more appropriate policy decisions, and for the design and implementation of development programs.

There is a need to develop greater access and commonality among the various international soils databases developed by institutions in their national and international work. There is a need to obtain more information on the existing soils databases to make the total agronomic information more useful for input into production systems analyses and global change scenarios.

Activity Areas

With the completion of the current project at the end of FY 91, SMSS is in the process of developing new activities in Sustainable Land management and Global Climate change in addition to refining some of its previous activities. Major areas of activity include:

1. Technical assistance to support utilization of soil resource information in policy and planning initiatives (USAID and CDSSs) for integrated economic development, and alternatives associated with global climate change;

2. Worldwide soil database development to backstop modelling (soil, weather, crops, farming systems, water management, erosion and other forms of soil degradation, etc.);

3. Soil and site characterization of important field research sites and tension zones to provide a consistent set of values, with proper classification, to promote and facilitate technology transfer that is soil/land based;

4. Assistance with soil and environmental monitoring techniques and strategies for resource assessment;

5. Information dissemination and training through organized workshops, field tours, training forums, publications, and presentations in other media (GIS, CD Roms, and videos, etc.).

The Soil Conservation Service (SCS) of the United States Department of Agriculture (USDA) will implement the project. Fiscal and general program management and policy guidance is provided by the Office of International Cooperation and Development (OICD) of USDA.

PRINCIPAL INVESTIGATORS:

Principal Investigator:	Dr. Richard S. Affleck USDA/OICD/DR/NRE Room 3213 So. Agr. Bldg. Washington, DC 20520-4300 Tel: 202/245-5915
Project Leader:	Dr. Hari Eswaran, National Leader, World Soil Resources, Soil Conservation Service, USDA Tel: 202/475-5333 Fax: 202/447-4593

COLLABORATORS AND INSTITUTIONS:

Dr. Marc Latham	Director, International Board for Soil Research and Management, Bangkok, Thailand
Dr. Michael Walsh	SACCAR Food Security Program of SADCC, Natural Resources Unit
Dr. Surender Virmani	ICRISAT, India
Dr. Jagtap Singh	IITA, Nigeria
Dr. Upender Singh	IFDC, Muscle Shoals
Dr. Goro Uehara	IBSNAT, Hawaii
Dr. Stanley Buol	North Carolina State University
Dr. Larry Wilding	Texas A&M University

PLANNED ACTIVITIES FOR FY 1992:

1. Workshops/Planning Meetings

SEMAP Planning Meeting

Initial planning meeting to discuss and formulate Soil Environmental Monitoring and Assessment Program (SEMAP). Depending on funding level, this will be a regional or international level.

Argentina Workshop

This workshop, scheduled for April 1992, addresses the subject of soil resources for sustainable agriculture.

West US Workshop

Organized by SCS, the workshop addresses the subject of utilization of soil survey information.

2. Training

A training workshop on "Utilization of GIS for resource data manipulation" is planned for Philippines (planning costs).

In collaboration with IBSRAM and TropSoils, training on detailed grid sampling and soil characterization for SEMAP project.

3. Documentation

The following current activities will yield products for publication in 1992:

1:30,000,000 map and report on Major Soil Regions of the World.

1:5,000,000 map and report on Major Soil Regions of Asia.

1:10,000,000 map and report of "Soil Moisture and Temperature Regimes of the World."

4. New Activities Initiated

1:1,000,000 soil maps: data compiled for Czechoslovakia, Hungary, and Bulgaria. Requires site visits and sampling of benchmark pedons.

Major Land Resource Area (MLRA): data compiled for one or two African countries. Requires site visits and sampling of benchmark pedons.

In collaboration with IBSRAM and TropSoils, utilize their networks for monitoring carbon and other soil properties in their network experiments, for studies on soil degradation in the context of Global Climate Change (SEMAP effort).

Characterization of TropSoils experimental sites including detailed grid sampling as in the IBSRAM sites for monitoring purposes (SEMAP effort).

5. Backstop USAID Mission Projects

This technical assistance is always on request and funds must be available to respond at short notice. Occasionally Missions request characterization of their experimental sites.

6. Staff Participation in International Workshops and Co-Sponsoring Those Workshops that Further the Objectives of SMSS

SMSS has traditionally co-sponsored and helped organize important workshops by providing seed money.

BUDGET (July 26, 1991--September 24, 1994)
($1000)

Object	CRSP	External	Host*	Total
Salaries	350	100		450
Fringe Benefits	49	10		59
Workshops	500	100		600
Soils Analyses	150	50		200
Travel, US	20	5		25
Travel, INT	230	-		230
Supplies	25	10		35
Equipment	15	5		20
Communications	10	5		15
Publications	15	5		20
Indirect Costs	371	-		371
NCSU Overhead[1]	12	-		12
Total	1,747	290		2,037

*To be determined

[1]Represents overhead charges by NCSU of 48 percent on the first $25,000 on the subgrant if this is separate subgrant.

WORK PLAN AND BUDGET

TECHNOLOGY FOR SOIL MOISTURE MANAGEMENT

UNITED STATES DEPARTMENT OF AGRICULTURE--
ECONOMIC RESEARCH SERVICE

PRINCIPAL INVESTIGATOR:

Dr. John C. Day (USDA-ERS)
Senior Economist
USDA/ERS
1301 New York Avenue, NW
Washington, DC 20005

COLLABORATORS AND INSTITUTIONS:

W. R. Butcher	Washington State University, Pullman
R. R. Deuson	Purdue/WINROCK, Ouagadougou, Burkina Faso
A. S. R. Juo	TAMU-TAES
K. Savadorgo	University of Ouagadougou, Burkina Faso
Goro Uehara	University of Hawaii

RESEARCH SITES: Jordan; Hamdallaye, Niger, Mali; Burkina Faso

GLOBAL THRUST: Natural Resource Management

CONSTRAINTS:
Landscape restrictions
Climatic variability
Production-demand pressure
Inadequate resource information

PROBLEM STATEMENT, OBJECTIVES AND JUSTIFICATION

Problem Statement

In the vast majority of cases in developing countries where rainfed agriculture predominates, crop yields are extremely low and generally insufficient to provide nutritional requirements of rural farm families. Animal productivity is also low. Low crop and livestock productivity in turn means that cash income is low and farm families are unable to purchase the food, clothing, medical care, and other necessary goods and services. Standards of living are declining. Moreover, high population growth and reduced productivity has set in motion a trend of increasingly

intensive cultivation leading to serious negative consequences on the environment. The result is growing uncertainty regarding the long run sustainability of these agricultural systems.

Objectives

The overall goal of this project is to identify farm technologies and farm management practices that will improve income, food production and consumption, and the long-term productive capacity of agriculture in the semi-arid and humid tropics.

1. To develop multi-disciplinary analytical methodologies effectively integrating soils, agronomic, agroclimatic, and economic data for accurate assessment of farm production technologies.

2. To assemble baseline and response data suitable for use in the methods and procedures of Item 1.

3. To identify sustainable farm production systems through socio-economic analyses of soil, water and related crop/livestock management technologies.

4. To evaluate economic policies for stimulating adoption and diffusion of improved resource management technologies.

Justification

Evidence indicates that the key to increase and sustainable food and fiber, fuel and shelter materials production in the tropics is improved management of the soil resource base including on-farm water conservation and proper cropping systems for efficient utilization of available precipitation. An extensive scientific data base on the principals of soil and water management exists, but the development of sustainable technologies compatible with local farming systems and economic settings is less advanced. Thus, the potential for lasting productivity gains exists, but realization of this potential has been slow.

There is a need to determine what soil and water resource management practices are technically feasible, economically sound and environmentally safe within different soil, agroclimatic and social systems. Also needed is better understanding of policy measures which can effectively stimulate widespread adoption of beneficial technologies.

This work will focus on the economics of alternative technologies and farm management options for sustainability. The importance of indigenous knowledge of farming systems is to be stressed. In that framework, examination of traditional systems and incremental adjustments based on emerging technologies will be the basic perspective for this program of work.

Farming systems research currently underway in Jordan will continue, as will ongoing effort to develop new programs of work in Burkina Faso and Mali. Special emphasis, however, will be given to socio-economic analyses of resource management in the context of an agricultural watershed in Niger. In this effort, through collaboration with Texas A&M, an integrated program of various upstream land and water management techniques, common-ground grazing practices, and on-farm soil, water, crop and livestock management options will be examined.

Throughout this project collaborative research with TropSoils scientists will be pursued. In FY 1991-92 specific research plans involving Washington State, Purdue, and Texas A&M will be developed. Planning discussions with Cornell, Hawaii and NCSU are also expected to take place.

ESTIMATED BUDGET (1991-1994)

(X $1000)

Object	CRSP	External	Host	Total
Salaries	300	25		325
Fringe Benefits	42	4		46
Cooperative Agreements	764	159		923
Travel, US	15	-		15
Travel, INT	58	-		58
Supplies	4	1		5
Equipment	16	2		18
Communications	4	1		5
Publications	4	-		4
Indirect Costs	193	-		193
Total	1400	192		1593

Date Initiated: July 28, 1991
Expected Completion: September 24, 1994

II. SUSTAINABLE AGRICULTURE PRODUCTION

TAMU-03	Soil fertility management for sustainable agriculture in the semiarid tropics.
TAMU-06	TropSoils/INTSORMIL collaborative research.
TAMU-07	Inter-CRSP-Honduran watershed management.
TAMU-08	TropSoils-Cameroon initiative.
TAMU-09	Peanut and INTSORMIL CRSP.
TAMU-011	ICRISAT collaborative research on crop residue management and agroforestry in semiarid Africa.
NCSU-03	Sustainable soil management alternatives to slash and burn.
UH-03	Detoxifying aluminum and reducing P fixation in variables-charge soils with organic amendments.
UH-07	Base cation dynamics in low base status tropical soils.
NCSU-04	Agroforestry systems for acid soils of the humid tropics.
NCSU-07	Synchrony between soil nutrient availability and plant nutrient uptake.
CU-01	Integrated management of maize under variable rainfall conditions in the tropics.
CU-02	Pathways of nitrogen flow in relation to crop utilization of applied nitrogen.
CU-04	Processes of soil degradation and rejuvenation under different land use systems.
TAMU-02	Soil and water management and conservation for sustainable agriculture in the semiarid tropics.
UH-02	Upland research in collaboration with IRRI.
UH-04	Maize/legume/<u>Rhizobium</u> systems: Interspecific in interactions, nitrogen fixation, and yield responses on acid soils.
UH-05	West Africa collaboration with IITA.
USDA-ARS	Technology for Soil Moisture Management (TSMM).

Fiscal Year: 09/01/91 - 08/31/92

Project Number: TAMU-03

Title: Soil fertility management for sustainable agriculture in the semiarid tropics.

Global Thrust: Sustainable agriculture

Constraints Addressed:
- Nutrient deficiencies and losses
- Soil acidity

Problem Statement, Objectives and Justification:

The stabilization of agricultural production in the semiarid tropics requires careful evaluation of alternative strategies to maintain and improve soil fertility. A major constraint to sustainable food production in the Sahel region of Africa is the rainfall regime, however, soil fertility and chemistry are additional contributing factors to low and variable yields. In some cases, soil chemical and physical constraints are the limiting factors which results in the reduced ability of crops and native rangeland species to efficiently use the limited rainfall received. The major soil fertility constraints include low N and P availability, low pH, Al toxicity and low organic matter levels.

The overall goal of this project is to develop sustainable, low-input management strategies which improve and/or maintain soil fertility to permit an increase in total yields and reduce year to year and within-farm variability. The project is further divided into three sub-projects which are designed to achieve the following specific objectives:

(1) To develop and evaluate low-input soil management practices to overcome short-distance spatial variability in crop development.

(2) To enhance water use efficiency of crops with applied plant nutrients and soil amendments under semiarid conditions.

(3) To characterize biotic and abiotic processes affecting the transformation of organic matter in selected agroecosystems in the semiarid tropics.

High and sometimes toxic levels of Al due to low soil pH have been reported to be responsible for spatial variability with respect to crop growth. However, there are other factors which contribute to the observed variability such as nutrient deficiencies and toxic levels of Mn brought on by a low pH, termite mounds and previous village sites. Low-input soil management practices are needed to overcome this problem under the conditions of Sahelian farmers. A combination of resistant cultivars, locally-available corrective amendments and low rates of fertilization seems to be an appropriate strategy.

Organic matter is another key component controlling soil fertility. The soils in the region are predominantly sandy, low in soil organic matter and of low native fertility. In many cases, soil organic matter can be major contributor to the total cation exchange capacity of the soil and the loss of this component results in a reduced ability of the soil to retain and supply nutrients. Soil productivity can be maintained through the maintenance of soil organic matter via addition as manure, green manure and/or crop residues. Although the maintenance of adequate levels of soil organic matter has been recognized to play a key role in sustaining crop yield for these soils, the kinetics of decomposition of added organic matter in the semiarid tropics are not well understood.

Principal Investigators and Institutions:

L.R. Hossner, TAES, Texas A&M University
A.S.R. Juo, TAES, Texas A&M University

Collaborators and Institutions:

M. Traore, IER, Mali
Z. Kouyate, IER, Mali
O. Niandou, IER, Cinzana, Mali
M. Doumbia, IER, Mali
K. Grahammer, Texas A&M University
L.P. Wilding, TAES, Texas A&M University
A. Onken, TAES, Texas A&M University
A. Manu, TAES, Texas A&M University
R.W. Weaver, Texas A&M University
R. Yost, University of Hawaii
J.M. Duxbury, Cornell University
D.R. Bouldin, Cornell University

Research Sites:

Hamdallaye, Niger
Cinzana, Mali

Budget (91-92):

Object	CRSP	External	Matching	Host	Total
Salaries	23,820.75		15,364.35	2,000.00	41,185.10
Fringe Benefits	7,939.98		5,506.58		13,446.56
Allowances	0.00		0.00		0.00
Consulting	0.00		0.00		0.00
Travel, US	2,877.06		0.00		2,877.06
Travel, INT	1,023.24		0.00		1,023.24
Supplies	7,967.77		500.66	1,000.00	9,468.42
Equipment	3,792.35		0.00		3,792.35
Communications	1,938.53		203.39		2,141.92
Shipping/Freight	1,803.97		0.00		1,803.97
Publications	2,409.30		0.00		2,409.30
Other direct costs	0.00		929.34		929.34
Indirect costs	21,531.37		0.00		21,531.37
TOTAL	**75,104.32**	**0.00**	**22,504.32**	**3,000.00**	**100,608.64**

Human Resource Commitments:

Institution	Full Time equivalents (FTE)					
	Senior Scientist	Junior Scientist	Techni-cian	Admin. Support	Other	Total
US	0.3	0.5	0.1	0.3		1.2
Host		0.5	3.0			3.5
Other						
Total	**0.3**	**1.0**	**3.1**	**0.3**		**4.7**

Date Initiated: November 1, 1990

Expected Completion: November 30, 1993

Signatures:

L. R. Hosmer 7-8-91
Project Leader Date

7-1-91
Program Coordinator Date

Fiscal Year: 09/01/91 - 08/31/92

Project Number: TAMU-06

Title: TropSoils/INTSORMIL collaborative research.

Global Thrust: Sustainable Agriculture

Constraints Addressed:
- Nutrient deficiencies and losses
- Soil acidity
- Water stress

Problem Statement, Objectives and Justification:

The two most important factors affecting agricultural productivity in the Sudano-Sahelian Zone of Africa is the improvement of soil fertility and better management of rainfall. The solution to the agronomic problems in the region not only lies in the utilization of appropriate soil management technologies but also the development of crops which possess the ability to survive under less favorable environments. Increasing the stability and sustainability of crop production while simultaneously increasing yields will therefore require an integrated research effort by soil scientists and plant breeders.

The overall goal of this project is to provide soil management expertise in support of INTSORMIL plant breeding and agronomy programs. Specific objectives include the following:

(1) Develop analytical procedures for determining chemical and physical properties of Sahelian soils and diagnostic techniques to use in predicting crop response and need for fertilizer or corrective amendments.

(2) Quantify the interactions between sorghum genotypes, available water levels and chemical properties (fertility and toxicity) for Sahelian soils.

(3) Identify and define sorghum genotypes with varying levels of tolerance to drought and chemical stress of Sahelian soils and determine how each trait is inherited.

(4) Breed multiple stress tolerant sorghums for use in Sahelian Africa that meet selected grain quality and yield standards.

(5) Using multiple stress tolerant sorghums, develop best management practices that are economically feasible, promote sustainability and enhance natural resource management.

Genotype, soil moisture and soil chemical properties interact to affect crop yield along with the efficient use of water and nutrients. This interaction must be quantified in order to have sufficient knowledge for development of appropriate agronomic solutions to insure stability and sustainability of sorghum production in Sahelian Africa. TropSoils and INTSORMIL have been collaborating with IER (Mali) and ICRISAT since their inception in the country. Research conducted under this collaborative arrangement and others has clearly shown the potential synergistic effects of interactions between soil fertility, available water and sorghum genotypes. It has also shown a number of important responses of sorghum to drought, soil fertility and levels of input to be under separate genetic control. Thus, there is a great potential for exploitation of available germplasm resources for development of multiple stress tolerant sorghums to take advantage of synergistic interactions for a wide range of climatic and input conditions. This project is designed to take advantage of that potential.

Principal Investigators and Institutions:

A.B. Onken, TAES, Texas A&M University
A.S.R. Juo, TAES, Texas A&M University

Collaborators and Institutions:

A. Toure, IER, Mali
M. Doumbia, IER, Mali
M. Traore, IER, Mali
O. Niangado, IER, Mali
G.C. Peterson, TAES, Texas A&M University
D.T. Resenow, TAES, Texas A&M University
L.W. Rooney, TAES, Texas A&M University

Research Sites: Cinzana, Mali.

Budget (91-92):

Object	CRSP	External	Matching	Host*	Total
Salaries	5,241.23	3,907.00	4,902.30		14,050.54
Fringe Benefits	1,493.27	1,093.00	1,756.99		4,343.26
Allowances	0.00	0.00	0.00		0.00
Consulting	0.00	0.00	0.00		0.00
Travel, US	333.56	500.00	0.00		833.56
Travel, INT	389.15	4,000.00	0.00		4,389.15
Supplies	3,177.90	3,500.00	159.74		6,837.64
Equipment	7,111.19	0.00	0.00		7,111.19
Communications	366.78	200.00	64.90		631.68
Shipping/Freight	605.76	300.00	0.00		905.76
Publications	155.66	500.00	0.00		655.66
Other direct costs	1,500.00	4,000.00	296.52		5,796.52
Indirect costs	3,589.04	4,175.00	0.00		7,764.04
TOTAL	**23,963.54**	**22,175.00**	**7,180.45**	**0.00**	**53,318.99**

*Not determined yet.

Human Resource Commitments:

Institution	Full Time equivalents (FTE)					
	Senior Scientist	Junior Scientist	Techni-cian	Admin. Support	Other	Total
US	0.1			0.2		0.3
Host						
Other*						
Total	**0.1**			**0.2**		**0.3**

*Not determined yet.

Date Initiated: November 1, 1991

Expected Completion: November 30, 1992

Signatures:

Art Onken/gdt 7-1-91
Project Leader Date

7-1-91
Program Coordinator Date

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES, WORK PLAN AND BUDGET

Fiscal Year: 04/17/91 - 04/16/92

Project Number: TAMU-07

Title: INTERCRSP - Honduran Watershed Management.

Global Thrust: Sustainable agriculture.

Constraints:

- Accelerated soil erosion
- Nutrient deficiencies
- Water stress
- Diminishing land resource base

Problem Statement:

Subsistence farming in the hilly regions of southern Honduras has resulted in extensive soil erosion problems, soil fertility depletion and dramatic changes in the hydrologic response of the region's watersheds. The Land Use Productivity Enhancement (LUPE) Project implemented by the Ministry of Natural resources of the Honduran Government and funded by USAID was initiated in order to address these concerns. Although LUPE was initially designed as an impact-oriented extension project, applied research is also becoming an important concern. Soils research is needed to address the various aspects related to soil and water conservation, soil fertility and crop production in the region.

Objectives:

The overall goal of this project is to provide soil management expertise in support of INTSORMIL programs and the LUPE Project in Honduras. Research pertaining to intensive sustainable management of agricultural production methods and management in agricultural watersheds will be addressed. As a result of this research, methodologies and indicators useful for assessing impacts of proposed land modifications under the LUPE project will be developed. The specific objective relating to current collaborations is to assess the effect of terracing on agronomic production and soil physical characteristics in contrast to traditional cropping systems.

Justification:

TropSoils/TAMU can play an integral part in research relating to the sustainable management of the land resource base with emphasis in increasing productivity and reducing off-site impacts. Research which allows the assessment of land management strategies currently being implemented in the region is required to evaluate project effectiveness. Additionally, the generation of baseline data regarding the effects of alternative soil management practices on agronomic and soil related factors is vital towards formulating and evaluating solutions to the current agricultural problems in the region.

Principle Investigators and Institutions:

A.S.R. Juo, Texas A&M University
Marc Thompson, Texas A&M University

Collaborators and Institutions:

Dan H. Meckenstock, INTSORMIL/Honduras
Francisco Gomez, Escuela Agricola Panamericana
David Leonard, USAID/Honduras, Land Use Productivity Enhancement (LUPE) Project

Research Sites: On-farm sites in southern Honduras within the LUPE Project.

Budget:

Object	CRSP	Matching	Total[1]
Salaries	8,340.00	4,250.00	12,590.00
Fringe benefits	1,450.21	750.00	2,200.21
Allowances	0.00	0.00	0.00
Shipping of soil & plant samples and analysis	0.00	1,000.00	1,000.00
Travel, (Int.)	0.00	1,000.00	1,000.00
Indirect Costs	4,209.79	0.00	4,209.79
Total	14,000.00	7,000.00	21,000.00

[1] Collaborators of host country institutions will provide field supplies, local travel expenses.

Human Resource Commitments:

	Full Time Equivalents			
Institution	Junior Scientist	Senior Scientist	Technician	Admin. Support
U.S.	1			
Host		0.25	0.50	
Other				

Date Initiated: May 1, 1991

Expected Completion:

The project is initially designed for one year with expected completion on May 1, 1992. A joint 3 to 5 year TropSoils/LUPE/INTSORMIL collaborative program in Honduras, however, is being planned.

Signatures:

[signature]	4/24/91	[signature]	4/24/91
Project Leader	Date	Program Coordinator	Date

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES, WORK PLAN AND BUDGET

Fiscal Year: 04/17/91 - 04/16/92

Project Number: TAMU-08

Title: TropSoils-Cameroon Initiative.

Global Thrust: Sustainable agriculture.

Constraints:

- soil acidity
- nutrient deficiencies
- physical degradation
- resource base limitations

Problem Statement:

Local cropping practices throughout Cameroon are inefficient in regard to production potential and the degradation of the land resource base. Soils research is required to address the various nutrient management and physical degradation problems as related to cultural practices in the region to serve as a basis in developing alternative management strategies which address the cropping constraints in the region.

Objectives:

Following the Memorandum of Agreement signed between TropSoils CRSP and the Government of the Republic of Cameroon, Texas A&M and Cornell will initiate collaborative research with the Institute de la Recherche Agronomique (IRA) of the Government of Cameroon. The overall goal of the initiative is to develop and adapt improved soil management technology focusing on sustainable agriculture production and enhanced natural resource management. Short term objectives include (1) the development of appropriate field and laboratory methodologies quantify selected physical parameters and (2) the selection of target research sites in northern Cameroon.

Justification:

Improved nutrient management and prevention of soil physical degradation are important strategies in regard to sustainable agricultural production in Cameroon. TropSoils/TAMU can play an integral part in research relating to the sustainable management of the land resource base with emphasis in increasing productivity. The generation of baseline data regarding the effects of alternative soil management strategies on agronomic production is vital towards formulating and evaluating solutions to the current agricultural problems in the region.

Principle Investigators and Institutions:

A.S.R. Juo, Texas A&M University
Jacob Ayuk-Takem, IRA
Clement Coulumbe, Texas A&M University

Collaborators and Institutions:

Larry Wilding, Texas A&M University
Julius Takow, IRA

Research Sites: Selected sites in northern Cameroon.

Budget:

Object	CRSP	Matching	Total[1]
Salaries	7,489.00	5,500.00	12,989.00
Fringe benefits	2,097.00	1540.00	3,637.00
Allowances	0.00	0.00	0.00
Supplies	400.00	0.00	400.00
Equipment	0.00	960.00	960.00
Travel, (Int.)	4,000.00	0.00	4,000.00
Indirect Costs	6,014.00	0.00	6,014.00
Total	20,000.00	8,000.00	28,000.00

[1] Collaborators of host country institution (IRA) will provide field supplies, labor, land and office space.

Human Resource Commitments:

	Full Time Equivalents			
Institution	Junior Scientist	Senior Scientist	Technician	Admin. Support
U.S.	1	0.2		0.2
Host	1	1	1	
Other				

Date Initiated: 04/17/91

Expected Completion: Continuing project contingent on funding availability.

Signatures:

Project Leader	Date	Program Coordinator	Date
	4-24-91		4-24-91

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES, WORK PLAN AND BUDGET

Fiscal Year: 04/17/91 - 04/16/92

Project Number: TAMU-09

Title: INTERCRSP - Peanut and INTSORMIL CRSP.

Global Thrust: Sustainable agriculture.

Constraints:

- Soil acidity and aluminum toxicity
- Nutrient deficiencies and losses

Problem Statement:

Southwest Burkina Faso possesses some of the most favorable agricultural conditions in the country primarily due to the relatively high annual rainfall rates. The soils however are quite acidic and aluminum toxicity is therefore a potential limiting factor for crop production. Notwithstanding, relatively good peanut yields as compared to much of the Sahele should be possible through soil amendments which reduce effects of soil acidity. Characterization of the soils at the test sites, however, will be required to aid interpretations regarding appropriate soil management strategies throughout the region.

Objectives:

The objective of this proposed collaborative Peanut CRSP/TropSoils research is to determine the response of local and acid tolerant genotypes to soil amendments with regard to production potential. The characterization of soils at the peanut test sites will be carried out to permit the applicability of results to other areas within the Sahelian region to be ascertained as well as an appraisal of feasible management practices for employment in the region.

Justification:

The southwest region of Burkina Faso has the potential to make a substantial contribution to peanut production in the country. However, the relationships between soil acidity, nutrient availability and soil amendment interventions must be better understood in order to determine best management practices and increase production potential. Finally, in order to extend the results obtained from test sites to other areas, the characterization of chemical and physical soil factors is necessary.

Principle Investigators and Institutions:

Philippe Sankara, Peanut CRSP, ISP
O.D. Smith, Texas A&M University
A.S.R. Juo, Texas A&M University

Collaborators and Institutions:

A.M. Schubert, Texas A&M University
Lloyd Hossner, Texas A&M University
Larry Wilding, Texas A&M University

Research Sites: Maradi, Niger and Bengou, Niger

Budget:

Object	CRSP	Matching	Total[1]
Salaries	0.00	3,125.00	3,125.00
Fringe benefits	0.00	875.00	875.00
Allowances	0.00	0.00	0.00
Supplies & local labor	5,500.00	0.00	5,500.00
Shipping/freight costs	2,000.00	0.00	2,000.00
Travel, (Int.)	0.00	0.00	0.00
Indirect Costs	1,500.00	0.00	1,500.00
Total	9,000.00	4,000.00	13,000.00

Human Resource Commitments:

	Full Time Equivalents			
Institution	Junior Scientist	Senior Scientist	Technician	Admin. Support
U.S.	0.1	0.2		
Host	0.2	0.2		
Other				

Date Initiated: 04/17/91

Expected Completion: Ongoing project contingent upon funding availability.

Signatures:

Project Leader	Date	Program Coordinator	Date
4-24-91		4-24-91	

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES, WORK PLAN AND BUDGET

Fiscal Year: 04/17/91 - 04/16/92

Project Number: TAMU-011

Title: TropSoils - ICRISAT collaborative research on crop residue management and agroforestry in semiarid Africa.

Global Thrust: Sustainable agriculture.

Constraints:

- Soil moisture limitations
- Soils with low nutrient status
- Seasonal nutrient dynamics

Problem Statement:

The use of residues in cropping systems has the potential to enhance agronomic production and stability in the semi-arid tropics through the conservation of soil moisture and cycling of plant nutrients. The degree to which agroforestry and crop residue practices are effective in this respect depends in part upon the influence of soil properties upon the movement of nutrients and the availability of water. Soil research is therefore needed to address the various constraints relating to the development of viable cropping systems.

Objectives:

Collaborative research involving crop residue management and agroforestry systems will be initiated with ICRISAT and IFDC at the ICRISAT Sahelian Center in Niamey. Initial activities will focus on (1) the study of the growth variability of *Acacia albida* as influenced by soil properties and (2) the effect of crop residue applications on the soil moisture status and nutrient dynamics.

Justification:

The development of biologically-based low input soil management technologies is vital to the sustainability of agricultural production in semiarid Africa.

Principle Investigators and Institutions:

A. Manu, Texas A&M University
A.S.R. Juo, Texas A&M University

Collaborators and Institutions:

R. Vanderveldt, ICRISAT
A. Bationo, IFDC, Niamey

Research Sites: ICRISAT Sahelian Center, Sadore, Niger.

Budget:

Object	CRSP	Matching	Total[1]
Salaries	0.00	3,125.00	3,125.00
Fringe benefits	0.00	875.00	875.00
Allowances	0.00	0.00	0.00
Supplies & local labor	5,500.00	0.00	5,500.00
Shipping/freight costs	2,000.00	0.00	2,000.00
Travel, (Int.)	0.00	0.00	0.00
Indirect Costs	1,500.00	0.00	1,500.00
Total	9,000.00	4,000.00	13,000.00

Human Resource Commitments:

	Full Time Equivalents			
Institution	Junior Scientist	Senior Scientist	Technician	Admin. Support
U.S.	0.1	0.2		
Host	0.2	0.2		
Other				

Date Initiated: 04/17/91

Expected Completion: Ongoing project contingent upon funding availability.

Signatures:

Project Leader	Date	Program Coordinator	Date
	4-24-91		4-24-91

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: 1991-1992
Project Number: NCSU 3
Title: Sustainable Soil Management Alternatives to Slash and Burn
Global Thrust: Sustainable Agricultural Production

Constraint(s) Addressed: Soil acidity, nutrient deficiency and losses, soil physical limitations and water stress

Problem Statement, Objectives and Justification: Tropical deforestation is proceeding ar the rate of 14 million hectares per year or 2.1% annually. The losses in biodiversity, deterioration of the natural resource base and increased global warming necessitate alternatives to shifting cultivation which is responsible for about 80% of tropical deforestation. The most practical way to mitigate deforestation is to provide sustainable agricultural alternatives to slash and burn. Systematic research by Tropsoils has resulted in the development and testing of several potentially sustainable alternatives involving: annual crops rotations, low-input cropping and legume based pastures.

The management options are highly promising, but practices that ensure their sustainability need to be developed further. Sustainability can be defined as a low coefficient of variability in adequate levels of production per year through a period of years, without significant off-site effects such as leaching losses to stream waters, sediment loading, or excessive greenhouse gas emissions. Four main factors have been identified as constraints to sustainability across the five management options:

Low nutrient-use efficiency. The problem is to synchronize plant growth demand with nutrient release rates, to utilize acid-tolerant germplasm, to promote recycling techniques such as crop residue return, root turnover, green manures and managed fallows in order to minimize purchased input use. We are seeking innovative, yet simple, ways to make the most efficient use of nutrients that need to be added as ash, lime, inorganic and organic inputs.

Weed encroachment. A major factor responsible for the agronomic or economic collapse of most management options is weed population shifts to increasingly aggressive and tenacious species that outcompete crops. Many of the weeds can be controlled by readily available commercial herbicides, but subsequent generations can only be controlled by prohibitively costly herbicides. We propose to focus on management alternatives that can reduce weed encroachment without resorting to high-cost herbicides. Examples of such management practices include green manures in continuous cropping systems, managed fallows in low-input systems, and shifting from pastures to crop production in grazed systems.

Minimizing soil and nutrient losses. All management options appear to be soil-conserving. The extent of actual runoff and erosion losses varies among them but has not been quantified. Little is known about how to maximize soil-water use during the critical drought periods common to the humid tropics as well as how to eliminate excess moisture during periods of highest rainfall. We have found that even primary forests are losing nutrients from their watersheds. Although nutrient pollution is not yet a major concern in the humid tropics, we must assure that the recommended management options are soil-water- and nutrient-conserving. Research on conservation tillage for continuous cropping, effects of grazing on soil physical properties, and watershed hydrology is proposed to quantify the soil- and water-loss processes and devise practical means of attenuating them.

Lack of information about greenhouse gas emission. There is no data on the atmospheric loading of $C0_2$, CH_4 and $N0_2$ from these promising crop and pasture management systems. Indeed, their sustainability may be open to question if such emissions are higher than those under undisturbed rainforests. We propose to provide estimates of these parameters within this five year period.

Research Goals and Objectives are:

1. To determine the factors responsible for sustainable production in the principal crop and pasture-based soil-management options for the humid tropics.

2. To determine the lower threshold values below which the aforementioned management options are environmentally or economically impractical.

Principal Investigator and Institution:

J.C. Alegre - NCSU

Collaborators and Institutions:

D. Lara - INIAA
W. Guillén - INIAA
M. Gálvez - INIAA
J. Benavides - INIAA
T.J. Smyth - NCSU
J. Salinas - PDAR, Bolivia
C. Castilla - NCSU
P. Luna - NCSU

Research Sites:

Yurimaguas, Peru

Budget: 9/25/91 - 9/24/92

	Total Funding Source US $1000's				
OBJECT	CRSP	EXTERNAL	MATCHING	HOST	TOTAL
Salaries	45.9	0.0	17.0	24.2	87.1
Fringe Benefits	11.0	0.0	4.1	5.8	20.8
Allowances	5.5	0.0	0.0	0.0	5.5
Consulting	0.0	0.0	0.0	20.0	20.0
Travel, US	1.6	0.0	0.0	0.0	1.6
Travel, Int.	1.7	0.0	0.0	0.0	1.7
Supplies	5.9	0.0	0.0	35.0	40.9
Equipment	3.1	0.0	0.0	14.0	17.1
Communication	0.9	0.0	0.0	3.0	3.9
Shipping/Freight	1.3	0.0	0.0	10.0	11.3
Publication	0.7	0.0	0.0	4.0	4.7
Other Direct Costs	7.8	0.0	0.0	10.0	17.8
Indirect Costs	24.7	0.0	6.3	33.6	64.6
Total	110.1	0.0	27.4	159.6	297.0

	Full Time Equivalents (FTE)					
	Scientist					
Institution	Senior	Junior	Technician	Adm. Support	Other	Total
US	0.68	2.00	0.06	0.45	0.00	3.19
Host	0.50	4.00	1.00	2.00	10.00	17.50
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.18	6.00	1.06	2.45	10.00	20.69

Date Initiated: Sept 1, 1972

Expected Completion: Sept. 2000

Signatures:

Julio C. Alegre 9/6/91
(Project Leader) (Date)

9-12-91
(Program Coordinator) (Date)

Soil Management CRSP
Annual Activities Work Plan and Budget

Fiscal Year: 1991-92

Project Number: UH-03

Title: Detoxifying Aluminum and Reducing P Fixation in Variable-charge Soils With Organic Amendments

Global Thrust: Low-input sustainable agriculture

Problem Statement and Justification:

Soil acidity and mineral deficiencies can easily be corrected by lime and fertilizers. Lime and fertilizers, however, are not options always available to resource-poor, subsistence farmers. Before the advent of modern agriculture, organic matter was the principal soil amendment and source of plant nutrients. For many farmers, this is still the case and will likely remain so for some time to come. In recent years, concerns about environmental pollution, global climate change and declining energy resources have compelled agricultural researchers to reconsider organic residues as alternatives to processed fertilizers and amendments. In doing so, researchers have identified and prioritized several areas deserving immediate attention. These include: a) identifying mechanisms for maintaining organic matter in the highly weathered, variable-charge soils of the tropics, b) characterizing the organic matter pools that affect variable charge in soils, c) defining the role of organic matter as a regulator of soil acidity and aluminum/manganese phytotoxicity in variable-charge soils, d) quantifying changes in variable-charge properties brought about by soil disturbances, and e) developing management strategies consistent with specific properties of variable-charge soils.

Owing to such recommendations, many, if not hundreds of organic matter experiments will be conducted in the name of sustainable agriculture. Many of these projects will undoubtedly demonstrate the beneficial effect of soil organic matter on farm performance. It is also likely that the beneficial effects will vary greatly with the soil and the nature of the organic material.

Farming with organic matter, however, has disadvantages and costs. Valuable space must be allocated to produce organic matter, the harvesting method and crop management often require strict adherence to rules and procedures, and considerable time and effort must be invested in harvesting, spreading, and soil incorporation. The cost and drudgery of organic farming render large variances in agronomic performance of organically amended soils unacceptable to resource-poor farmers. We must seek to reduce the variance by understanding its source.

Most benefits of organic matter come from nitrogen. However, organic matter and its decomposition products also play important roles as an aluminum detoxifying agent. In some low manganese

soils, organically chelated manganese makes this element more accessible to plants, but in manganesian soils the same mechanism can increase the phytotoxicity of the element. Organic acids also serve to block positive charge on variable-charge surfaces thereby lowering the affinity of these surfaces to adsorb and fix phosphate.

In this proposed research we wish to identify and measure the parameters in the amended soils and their organic amendment sources which govern variances in aluminum detoxification and reduction in P-fixation.

We intend to also study the interactions between components of organic matter and inorganic soil constituents in situations where the biochemistry of the organic material and its decomposition products, and the surface charge characteristics of the soil constituents are adequately known. More specifically, we wish to understand soil-organic matter interactions in variable-charge soils so that management strategies can be tailored to fit specific soils on the basis of the characteristics and taxonomy of the soil and the source plant.

Objectives:

1. Develop rules to estimate optimum "liming" rates of common organic materials when applied to variable change soils of different soil acidities.
2. Determine the residual effectiveness of organic materials, and identify processes responsible for aluminum detoxification.
3. Quantify the enhancement effects of selected organic acids and organic materials on P availability in low-P soils.

Principal Investigators and Institutions:

N. V. Hue, University of Hawaii, Honolulu, Hawaii
I. Amien, Center for Soil Research and Agroclimatology, Bogor, Indonesia
L. Arya, University of Hawaii, Sitiung, Indonesia

Collaborators and Institutions:

Agus Sofyan, Center for Soil and Climate Research, Sitiung, Indonesia
Tasman Naim, Sukarami Agricultural Research Institute for Food Crops, Sitiung, Indonesia
Russell Yost, University of Hawaii, Honolulu
Rollin Jones, University of Hawaii, Honolulu

Research Sites: Sitiung, Indonesia

Budget:

	CRSP	Matching	Total
Salaries	22,000	6,700	28,700
Fringe Benefits	1,000	2,000	3,000
Travel (US)	3,000	0	3,000
Travel (INT)	0	0	0
Supplies	2,000	0	2,000
Equipment	4,500	0	4,500
Communications	0	0	0
Shipping/Freight	0	0	0
Other Direct Costs	0	1,000	1,000
Indirect Costs	12,200	0	12,200
TOTAL	44,700	9,700	54,400

Human Resource Commitments:

Institution	Scientist Senior	Scientist Junior	Technician	Admin	Other	Total
UH	0	0	0	0	1.0	1.00
Other	.10	0	0	0	0	.10
TOTAL	.10	0	0	0	1.0	1.10

Date Initiated: 1991

Expected Completion: 1994

Signatures:

Gozo Uehara/for N.V. Hue 10/14/91
Project Leader — Date

Gozo Uehara 10/14/91
Program Coordinator — Date

Soil Management CRSP
Annual Activities Work Plan and Budget

Fiscal Year: 1991-92

Project Number: UH-07

Title: Base Cation Dynamics in Low Base Status Tropical Soils

Global Thrust: Sustainable agriculture

Problem Statement, Objectives and Justification:

The Indonesian government is alleviating the immense population pressure on the Island of Java and seeking to more fully utilize the extensive uplands of the 'Outer Islands' through the Transmigration Program. To achieve both of these objectives the upland soils of the Outer Islands must be managed with a strategy to provide sustained food production. As indicated in previous TropSoils/Indonesia Technical reports, soils in the upland areas are infertile and acid. Soils of the Sitiung region of West Sumatra are representative of these soils and are similarly of low fertility and high acidity.

These data indicate that soil pH's of 5.0 or less are not uncommon, base status is often less than 2 cmol/kg, and aluminum saturation is often as high as 72%. Growth and productivity of many common crops is restricted by these adverse conditions.

The transmigrant farmers, often arriving on site with little cash reserve must rapidly learn to grow crops on the infertile and acid upland soils, which contrast with the fertile, high base status paddy soils of Java. These people thus often have limited cash to purchase fertilizer and lime. Small quantities of fertilizer and lime are provided by the government. The farmers, however, are soon left to their own devices to sustain themselves and their families. Lime and fertilizers are thus important in insuring food production but at the same time farmers cannot exhaust their meager cash reserves.

As indicated in the Soil Survey of the Irrigation Project Area -- Sitiung - S. Jujuhan, West Sumatera, potential evapotranspiration exceeds monthly rainfall 9 months of the year -- in some months by as much as 150 mm. With this quantity of water moving through the soil profile we anticipate substantial leaching of nutrients. Given the meager quantities of nutrient cations initially present in many of these soils, assessing and identifying mechanisms of nutrient cation loss with the intent of reducing leaching is important.

A first step in identifying pathways of cation loss and their quantification is to describe the soil-plant system conceptually. To this end a conceptual model was constructed and values typical of soils and crops in Sitiung were substituted into the model.

Subsoils of the Sitiung region have a low Ph with high Al content. One important method of reducing the toxic effects of excess Al on root structure and function is the addition of lime.

Understanding of mechanisms controlling Ca retention and movement are needed.

The low initial content of nutrient cations suggests that K+ will also be needed for sustained crop production. The combination of a udic moisture regime and the well-drained characteristics of soils in Sitiung may lead to loss of K by leaching.

The meager cash reserves of the transmigrant farmers require that fertilizer applications must be designed as efficiently as possible.

Mechanisms and pathways of nutrient cation retention and movement must be better understood to provide the knowledgebase and algorithms for decision aids to be subsequently developed for cation management. Specifically, we need to understand and predict cation movement, be it detrimental in the case of K leaching or beneficial in the case of calcium movement to reduce toxic effects of subsoil aluminum. The understanding and prediction of these mechanisms and pathways will eventually

Objectives:

1. Determine the amount of K leached under various field conditions: (residue removal, cropping pattern, and alley cropping)
2. Identify the major mechanisms controlling K loss and/or retention in the soil that will drive new decision aids describing base cation dynamics in low base status tropical soils.

Principal Investigators and Institutions:

Tom Dierolf, University of Hawaii
Russell Yost, University of Hawaii
Lalit Arya, University of Hawaii
I Putu Gedger Widjaja-Adhi, Centre for Soils and Agroclimate Research, Bogor, Indonesia
James Fownes, University of Hawaii

Collaborators and Institutions:

Agus Sofyan, Centre for Soils Research, Bogor, Indonesia

Research Sites: Sitiung, Indonesia

Budget:

	CRSP	Matching	Total
Salaries	22,000	3,500	25,500
Fringe Benefits	1,000	1,200	2,200
Travel (US)	0	0	0
Travel (INT)	1,500	0	1,500
Supplies	2,000	0	2,000
Equipment	0	0	0
Communications	500	0	500
Shipping/Freight	0	0	0
Other Direct Costs	1,200	1,000	2,200
Indirect Costs	10,000	0	10,000
TOTAL	38,200	5,700	43,900

Human Resource Commitments:

	Scientist					
Institution	Senior	Junior	Technician	Admin	Other	Total
UH	0	.50	0	0	0	.50
Other	.20	0	0	0	0	.20
TOTAL	.20	.50	0	0	0	.70

Date Initiated: 1991

Expected Completion: 1994

Signatures:

Russell Yost — Project Leader — Oct. 14, 1991 — Date

Gary Alexander — Program Coordinator — 10/14/91 — Date

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: 1991-1992
Project Number: NCSU 4
Title: Agroforestry Systems for Acid Soils of the Humid Tropics
Global Thrust: Sustainable Agricultural Production

Constraint(s) Addressed: Soil acidity and rapid nutrient depletion following forest clearing are major limitations to sustained production in the humid tropics. Resource limited farmers are unable to buy necessary inputs therefore low-cost land management alternatives are necessary to provide sustained food production on marginal lands.

Problem Statement, Objectives and Justification: Shifting cultivation is no longer a sustainable farming system in many areas of the humid tropics due to decreased fallow periods caused by increased population pressure or land tenure systems. Many of these areas do not have sufficient infrastructure or access to markets, precluding continuous cultivation as an economically viable alternative. Under the traditional system land is in production one year for every five years in unproductive fallow. The low-input system provides two to three years of profitable cropping but then declines in productivity occur due to decreasing fertility and increasing weed problems; then the system has to be abandoned to some other land use. Agroforestry offers a variety of land-use options ranging in degrees of management inputs.

Agroforestry provides an economically viable alternative to shifting cultivation that is ecologically compatible with the humid tropical ecosystem. Production is sustained over time on a given unit of land thus reducing the need to clear new forest every year. Agroforestry is a particularly attractive alternative because it incorporates features of traditional farming practices and is therefore more readily adopted, and it can be adapted to a range of socio-economic and landscape conditions.

Current agroforestry research problems relate to the sustainability of various food tree crop systems. Three main constraints to continue production are: nutrient depletion, weed encroachment and soil losses. Although there is little question about the possibility of trees recycling nutrients from base-rich subsoils the fundamental question is how much recycling does occur in Oxisols and Ultisol, and how much organic or inorganic inputs need to be added to compensate for crop extraction. Weeds are a problem in agroforestry as they are in most other cropping systems however shade and mulches provided by the trees may effectively control weeds. Throughout the humid tropics farmers are encroaching on fragile slope lands, the result being excessive soil and nutrient losses. Several features associated with agroforestry, can aid in stabilizing these slopes and lead to sustained production.

The general hypothesis and goal addressed by agroforestry is that when trees are included in a system sustainability can be maintained with fewer fertilizer

and herbicide inputs than systems without trees because trees provide continuous nutrient cycling and they protect the soil surface from intense rains and extreme temperature fluctuations. There are various types of agroforestry systems and each one approaches sustainability from different economic and agronomic aspects. We are proposing a multi-system approach to agroforestry research. The specific objectives of the research are:

1. To develop a technological package for the establishment and management of peach palm plantations for both fruit and heart of palm production, and to adapt the technology to other native fruit species.

2. To adapt alleycropping to acid, infertile soils and to sloping lands.

3. To measure and understand nutrient requirements and cycling in alleycropping and other agroforestry systems in order to manage organic and inorganic inputs more efficiently.

4. To shorten the fallow period by use of leguminous species that restore nutrients and suppress weeds faster than the natural forest fallow and to do so with economically valuable species.

Principal Investigator and Institution:

C.B. Davey - NCSU

Collaborators and Institutions:

L.T. Szott - IDRC, CATIE
L. Arévalo - INIAA, Yurimaguas, Peru
J.M. Pérez - INIAA, Yurimaguas, Peru, Peach palm cultivation
C.A. Palm - NCSU
A. Salazar - NCSU
B. Pashanasi - INIAA, Yurimaguas, Peru, Native fruit tree selection
M. Arcos - INIAA, Yurimaguas, Peru, Peach palm extension
J. Sánchez - INIAA, Yurimaguas, Peru, Alley cropping
A. Ricsi - INIAA, Yurimaguas, Peru, Legume tree selection
E. Fernandes - NCSU
P. Ruíz - NCSU

Research Sites:

Yurimaguas, Peru

Budget: 9/25/91 - 9/24/91

	Total Funding Source US $1000's				
OBJECT	CRSP	EXTERNAL	MATCHING	HOST	TOTAL
Salaries	37.2	20.0	18.7	24.2	100.1
Fringe Benefits	8.9	0.0	4.5	5.8	19.2
Allowances	4.1	0.0	0.0	0.0	4.1
Consulting	2.0	0.0	0.0	20.0	22.0
Travel, US	1.6	0.0	0.0	0.0	1.6
Travel, Int.	9.7	10.0	0.0	0.0	19.7
Supplies	8.4	15.0	0.0	35.0	58.4
Equipment	7.2	0.0	0.0	14.0	21.2
Communication	0.9	0.0	0.0	3.0	3.9
Shipping/Freight	2.9	0.0	0.0	10.0	12.9
Publication	0.7	0.0	0.0	4.0	4.7
Other Direct Costs	11.0	0.0	0.0	10.0	21.0
Indirect Costs	26.2	0.0	7.0	33.6	66.8
Total	120.8	45.0	30.1	159.6	355.5

	Full Time Equivalents (FTE)					
	Scientist					
Institution	Senior	Junior	Technician	Adm. Support	Other	Total
US	0.71	1.00	0.06	0.45	0.33	2.55
Host	0.50	2.00	1.00	2.00	10.00	15.50
Other	0.25	0.00	0.00	0.00	0.00	0.25
Total	1.46	3.00	1.06	2.45	10.33	18.30

Date Initiated: Sept. 1981

Expected Completion: Sept. 2000

Signatures:

(Project Leader) 9/13/91 (Date) (Program Coordinator) 9-13-91 (Date)

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: 1991-1992
Project Number: NCSU 7
Title: Synchrony Between Soil Nutrient Availability and Plant Nutrient Uptake
Global Thrust: Sustainable Agriculture

Constraint(s) Addressed: Nutrient Deficiencies and Losses

Problem Statement, Objectives, and Justification: Application of knowledge about biological and ecological processes to the management of agriculture and land use in the tropics may provide an efficient and cost-effective alternative to shifting agriculture. Sustainability of low-input systems is based on nutrient conservation and efficient management of nutrients. An international group, Tropical Soil Biology and Fertility Program (TSBF) was formed with the objective of understanding biological processes in tropical soils and their role in contributing to soil fertility. The goal of TSBF is to provide a means for the maintenance of soil fertility by influencing these biological processes through management practices. One of the major themes of TSBF is the management of organic additions and how the quality of these additions affects patterns of nutrient availability. The prediction is that by knowing the nutrient release patterns from the organic additions one can alter the timing, quantity or placement of the additions to synchronized nutrient availability to crop demand. This, so-called SYNCHRONY hypothesis is particularly relevant to agricultural systems in the tropics based on leguminous mulches and green manures. Legumes provide an economical source of nitrogen however, the efficiency of nitrogen use might be improved by selecting plant materials that decompose and release nitrogen in synchrony with plant demand. Leguminous plant material generally has a high % N concentration and low C/N ratio and should be expected to decompose and release N quickly. Recent studies, however, have shown that N release rates of legumes are quite variable and are influenced by the polyphenolic and lignin content of the leaves. Leaves low in polyphenolic or lignin content release nitrogen rapidly while those with a high polyphenolic content show a rapid initial release followed by a slow release, or even net accumulation. It is proposed that the polyphenolics bind to nitrogen forming resistant complexes, making the nitrogen unavailable. The release patterns of other nutrients, except for potassium, are also affected by the quality of the pant material. These are important factors to consider when selecting legumes as a nitrogen source in agricultural systems and agroforestry systems. Legumes low in polyphenolics will provide a rapid flush of nitrogen mineralization and may therefore be a good choice for use with annual crops that require large amounts of nitrogen for short periods of time. Nitrogen release by legumes higher in polyphenolic or lignin content will be slower and over a longer time period and may be the better choice for tree-production systems. The objectives of this project are: 1) to determine to the effects of organic additions of deficiency N release patterns on N dynamics and budgets and 2) to determine the

effects on crop yields.

Principal Investigator and Institution:

C.A. Palm - NCSU

Collaborators and Institutions:

M.G. Wagger - NCSU
M.J. Swift - IITA, Nigeria, TSBF, Kenya
K. Glasener - NCSU, Raleigh
P. Woomer - TSBF, Nairobi, Kenya

Research Sites

A site will be selected in the humid tropics at IITA, Cameroon or in conjunction with ICRAF in Kenya at the Maseno Agroforestry Research Station.

Budget: 9/25/91 - 9/24/92

	Total Funding Source US $1000's				
OBJECT	CRSP	EXTERNAL	MATCHING	HOST	TOTAL
Salaries	10.0	0.0	2.7	16.1	28.8
Fringe Benefits	2.4	0.0	0.6	3.8	6.8
Allowances	0.0	0.0	0.0	7.5	7.5
Consulting	0.0	0.0	0.0	2.1	2.1
Travel, US	0.1	0.0	0.0	3.2	3.3
Travel, Int.	0.0	0.0	0.0	4.3	4.3
Supplies	0.3	0.0	0.0	5.4	5.7
Equipment	1.1	0.0	0.0	5.4	6.5
Communications	0.3	0.0	0.0	0.2	0.5
Shipping/Freight	0.0	0.0	0.0	5.4	5.4
Publication	0.0	0.0	0.0	0.0	0.0
Other Direct Costs	0.1	0.0	0.0	7.3	7.4
Indirect Costs	4.0	0.0	1.0	12.3	17.3
Total	18.2	0.0	4.3	73.0	95.6

	Full Time Equivalents (FTE)					
	Scientist					
Institution	Senior	Junior	Technician	Adm. Support	Other	Total
US	0.05	1.00	0.08	0.16	0.00	1.29
Host	2.00	1.00	1.00	0.50	0.00	4.50
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.05	2.00	1.08	0.66	0.00	5.79

Date Initiated: April 17, 1991

Expected Completion: December 1993

Signatures:

(Project Leader) 5 Sep 91 (Date) (Program Coordinator) 9-6-91 (Date)

CU-1, Integrated Management of Maize Under
Variable Rainfall Conditions in the Tropics
1991-1992

Global Thrust: Natural Resource Management/Sustainable Agriculture/Outreach

Constraint(s) Addressed:

This project addresses several constraints that have been identified in the TropSoils Extension Proposal, 1989-1994. These include "Climatic Variability" under Natural Resource Management, "Water Stress" under Sustainable Agriculture and "Site-Specificity of Management Practices" under Outreach.

Problem Statement, Objectives and Justification:

The response of crops to varying timing and levels of rainfall is the result of a complex series of interactions between the crop and its above- and below-ground environment. This is particularly true of maize, a plant whose yield potential can be unalterably effected by very short term environmental changes at discrete times in its life cycle. Maize has among the highest yield potential and broadest agroecological range of all crops grown in the tropics. Given this and the generally high desire of small farmers in the many areas of the tropics to grow maize, research aimed at acquiring knowledge necessary to improve the growth and yield of maize under the range of soil,climate and cropping systems faced by many tropical farmers appears relevant.

Currently, this project is focusing on the uptake of stored soil water of maize in comparison to millet and sorghum. Factors influencing water uptake patterns will be identified and discussed. The implications of this research for modeling water uptake of cereal crops in tropical regions will be articulated. The next phase of this research will involve initiating plans to explore more directly the implications for management.

Principal Investigators and Institutions:

Susan J. Riha, Dept. of Soil, Crop and Atmospheric Sciences, Cornell University

Collaborators and Institutions:

Beverly McIntyre, Cornell University
Dr. David Flower, ICRISAT, Kano, Nigeria substation
Dr. Peter Crawford, IITA, Kano, Nigeria substation

Research Sites:

Kano, Nigeria

CU 1

SOIL MANAGEMENT CRSP
ANNUAL BUDGET

FISCAL YEAR: 9/25/91-9/24/92

BUDGET:

OBJECT	TOTAL FUNDING SOURCE CRSP	EXTERNAL	MATCHING	HOST	TOTAL
Salaries					
GRA (1.5) Stipend	18,750				18,750
GRA (1.5) Fees	6,030				6,030
S.Riha (35%)			20,050		20,050
Administrative Support	500				
Fringe Benefits @ 23.44%	117				
Matching F.B. @ 30.46%			6,107		6,107
Allowances					0
Consulting					
Travel					
U.S.	1,250				1,250
International	8,000				8,000
Supplies	5,000				5,000
Equipment	1,500				1,500
Communications	1,500				
Shipping/Freight					
Publication	4,000				
Other Direct Costs					
TOTAL DIRECT COSTS	46,647		26,157		72,804
Indirect Costs					
On-Campus	20,732		13,569		34,301
Off-Campus					0
TOTAL PROJECT COSTS	67,379		39,726		107,105

INSTITUTION	FULL TIME EQUIVALENTS (FTE)					TOTAL
	SCIENTIST					
	SENIOR	JUNIOR	TECHNICIAN	ADM. SUPPORT	OTHER	
US	0.40	2.00		0.04		2.44
Host	0.05		0.05			0.10
Other	0.10			0.02		0.12
TOTAL	0.55	2.00	0.05	0.06		2.66

DATE INITIATED: SEPTEMBER 25, 1990

EXPECTED COMPLETION: SEPTEMBER 24, 1994

SIGNATURES:

(Project Leader)	(Date)	(Program Coordinator)	(Date)
[illegible]	8/1/91	[illegible]	8/1/91

SPONSOR'S INDIRECT COST SHEET
CU1 - RIHA
BUDGET JUSTIFICATION - Indirect Cost Detail 31-Jul-91

	Period TROPSOILS 9/25/91-6/30/92	Period TROPSOILS 7/1/92-9/24/92	Period MATCHING 9/25/91-6/30/92	Period MATCHING 7/1/92-9/24/92
TOTAL DIRECT COSTS - ON-CAMPUS	$34,985	$11,662	$19,618	$6,539
TOTAL DIRECT COSTS - OFF-CAMPUS				
TOTAL DIRECT COSTS	$34,985	$11,662	$19,618	$6,539
MINUS EXCLUSIONS				
- Graduate Student Exclusion	$4,523	$1,508		
- Capital Equipment (Statutory - over $500/2 yr.)	$1,125	$375		
- Use of Cornell Computing Services				
- Subcontracts over $25,000				
SUBTOTAL EXCLUSIONS (ON-CAMPUS)	$5,648	$1,883		
MODIFIED TDC (ON-CAMPUS)	$29,338	$9,779	$19,618	$6,539
MODIFIED TDC (OFF-CAMPUS)	$0	$0		
Indirect Cost Rate (ON-CAMPUS)	53.0%	53%	51.5%	53%
Indirect Cost Rate (OFF-CAMPUS)	30.0%	30%		
TOTAL INDIRECT COSTS (ON-CAMPUS)	$15,549	$5,183	$10,103	$3,466
TOTAL INDIRECT COSTS (OFF-CAMPUS)	$0	$0		

CU-2, Pathways of Nitrogen Flow in Relation to Crop Utilization of Applied Nitrogen
1991-1992

Global Thrust: Sustainable Agriculture.

Constraint(s) Addressed:

This project addresses several constraints that have been identified in the new TropSoils proposal. Under the Sustainable Agriculture category this project addresses the identified constraint of "Nutrient Deficiencies and Losses." The development of sustainable agricultural systems requires efficient management of soil nutrient pools and of applied nutrients. Soil infertility and inefficient and improper managment of nutrients are major obstacles to the development and maintenance of productive agricultural systems. Nitrogen is generally identified as the nutrient most limiting to agricultural production and is applied to agricultural systems worldwide in both organic and inorganic forms. Nitrogen is also a nutrient that is readily lost from agricultural systems through a variety of pathways resulting in nitrogen pollution of groundwater reservoirs, surface water supplies, and the atmosphere. A better understanding of N-transformations and N-cycling in the soil-plant system is needed if agricultural systems are to maintain their productivity, and if losses of N to other systems are to be minimized.

This project also addresses issues identified under the constraints of "Land-Clearing Pressure" and "Production-Demand Pressure." Population-growth in the tropics has resulted in substantial increases in the demand for agricultural products. These factors combined with low soil fertility and poor soil management have resulted in a shortening of fallow periods and an increase in the rate of land clearing. Conservation of natural areas will only be possible if productivity of existing agriculture lands can be maximized. Effective management of soil nutrients is essential if this is to be achieved.

Problem Statement, Objectives and Justification:

Efficient management of soil nutrient pools is especially critical for tropical soils which are often low or deficient in plant nutrients and where the application of chemical fertilizers is not always possible. Better nutrient management could extend the number of cropping cycles on cleared land which would help to slow the rate at which additional land is being cleared. Nitrogen is generally considered to be the nutrient most limiting to agricultural production, and is the nutrient most easily lost from soils. The efficiency of crop recovery of applied fertilizer N is only in the range of 30 to 50% and 60% is the best usually achieved in research plots. Added N that is not incorporated by crop plants contributes to problems of N loss from agricultural fields to groundwater reservoirs via leaching processes, and to surface waters via runoff. In some situations substantial amounts of N can also be lost to the atmosphere through denitrification. The low N efficiency of agricultural systems contributes to nitrogen pollution problems and represents economic losses to farmers who must replace the lost nitrogen each year to maintain crop yields.

The tremendous amount of research carried out on fertilizer management practices and N-loss processes has improved fertilizer N use to the present level, but it is unlikely that additional work in these areas will lead to further gains in either crop N-use efficiency or to enhanced N recycling. A more thorough understanding of the timing and control of nitrogen transformation processes which are mediated by plants and populations of soil organisms is needed to achieve further progress in these areas.

The question of what is limiting N-use efficiency is not easy to answer as there may be several contributing factors: crop plants may be limited in their ability to take up all of the available nitrogen in the soil, or the plants may take up N during one stage of growth and then lose it during maturation or senescence. There is evidence that plants lose nitrogen in gaseous forms over the course of a growing season (Wetselaar and Farquhar, 1980; Harper et al. 1987) and plants may return N to the soil system through roots. Competition between plants and soil microbial populations has also been suggested as an important mechanism involved in determining N uptake by plants (Broadbent and Tyler 1962, Marion et al. 1982, Schimel et al. 1989).

There have been few studies of the seasonal dynamics of soil microbial populations. The studies that have been done indicate that soil microbial populations expand in the early part of the growing season and decline during plant senescence or following harvest (Lynch and Panting 1980, Granatstein et al. 1987, Sarathchandra et al. 1988). Presumably this pattern is regulated by the input of carbon to the soil by the plant

during growth. Lynch and Panting (1980) found that microbial biomass C increased by 300 kg C/ha in the top 5 cm of soil during the growth of a winter wheat crop in England. If it is assumed that this increase occurred throughout soil depth of 20 cm and that the C:N ratio (by weight) of the microbial biomass is 8:1, the amount of N immobilized by the expanding microbial biomass would be 150 kg N/ha. This simple calculation suggests that the amount of N immobilized may be high. A study done by Ross et al. (1981) in a tussock grassland showed a similar seasonal pattern of microbial biomass increase and decline with plant growth and senescence. Jackson et al. (1989) determined that soil microbes took up about 5 times more NH_4^+ and 2 times more NO_3^- than did plants during both the growing season and the period of plant senescence in an annual grassland system in California. These results were based on short term incubations using ^{15}N tracers. This type of measurement has not been made in an agricultural system or in other ecosystems and therefore the degree to which this type of partitioning pattern may be representative of a general pattern of N flow to plants and microbes is unknown. The factors which determine the degree of partitioning of N (in total and in its different forms) between soil microbes and plants are not well understood. All of the above mentioned studies suggest that there may be significant amounts of N immobilized during periods of plant growth. It is the ultimate fate of this immobilized N which will determine the extent to which N will be retained in the system or lost from it.

All of the research that has been previously described has been done on temperate systems. The benefits to increasing N-use efficiency of crops and promoting tighter N cycling in agricultural systems may be even more critical in tropical areas where the use of inorganic fertilizers is much less common (and less possible) than in temperate agricultural systems. In many tropical areas the use of green manures is being suggested as an alternative to inorganic fertilizer inputs. While we might be able to offer some advice on achieving improvements in the efficient use of inorganic N fertilizers, we still have not gained sufficient knowledge of N cycling in green manure-based cropping systems to confidently offer meaningful recommendations to promote efficient management of N from these sources. A better understanding of patterns of N cycling, N transformations, soil microbial activity, and partitioning of N in the soil-plant-soil microbe system is needed to improve N management in tropical systems.

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Principal Investigators and Institutions:

Dr. John M. Duxbury, Dept. of Soil, Crop and Atmospheric Sciences, Cornell University
Ing. Freddy Sancho, Centro de Investigaciones Agronómicas, Universidad de Costa Rica.

Collaborators and Institutions:

Jean Fruci, Cornell University
Ing. Floria Bertch, Centro de Investigaciones Agronómicas, Universidad de Costa Rica.
Ing. Augusto Rojas, Universidad de Costa Rica.

Site location:

Costa Rica
Canas, Guanacaste

CU2

SOIL MANAGEMENT CRSP
ANNUAL BUDGET

FISCAL YEAR: 9/25/91-9/24/92

BUDGET:

OBJECT	TOTAL FUNDING SOURCE				TOTAL
	CRSP	EXTERNAL	MATCHING	HOST	
Salaries					
GRA (2) Stipend	25,000				25,000
GRA (2) Fees	8,040				8,040
J. Duxbury (10%)			6,181		6,181
Administrative Support	500		1,000		
Fringe Benefits @ 23.44%	117				
Matching F.B. @ 30.46%			2,187		2,187
Allowances	5,000				5,000
Visiting Scientist	3,500				3,500
Consulting					
Travel-local Costa Rica	600				
U.S.	1,250				1,250
International	4,500				4,500
Supplies	6,000				6,000
Equipment	3,500				3,500
Communications	100				
Shipping/Freight					
Publication					
Other Direct Costs					
TOTAL DIRECT COSTS	58,107		9,369		67,476
Indirect Costs					
On-Campus	21,496		4,860		26,356
Off-Campus	2,311				2,311
TOTAL PROJECT COSTS	81,914		14,229		96,143

INSTITUTION	FULL TIME EQUIVALENTS (FTE)					TOTAL
	SCIENTIST					
	SENIOR	JUNIOR	TECHNICIAN	ADM. SUPPORT	OTHER	
US	0.10	1.50		0.04		1.64
Host	0.05					
Other	0.05					
TOTAL	0.20	1.50		0.04		1.64

DATE INITIATED: SEPTEMBER 25, 1990

EXPECTED COMPLETION: SEPTEMBER 24, 1994

SIGNATURES:

J M. Duxbury 8/1/91 Susan Ritter 8/1/91

(Project Leader) (Date) (Program Coordinator) (Date)

SPONSOR'S INDIRECT COST SHEET
CU2 - DUXBURY
BUDGET JUSTIFICATION - Indirect Cost Detail 01-Aug-91

	Period TROPSOILS 9/25/91-6/30/92	Period TROPSOILS 7/1/92-9/24/92	Period MATCHING 9/25/91-6/30/92	Period MATCHING 7/1/92-9/24/92
TOTAL DIRECT COSTS - ON-CAMPUS	$37,805	$12,602	$7,027	$2,342
TOTAL DIRECT COSTS - OFF-CAMPUS	$5,775	$1,925		
TOTAL DIRECT COSTS	$43,580	$14,527	$7,027	$2,342
MINUS EXCLUSIONS				
- Graduate Student Exclusion	$6,030	$2,010		
- Capital Equipment (Statutory - over $500/2 yr.)	$1,500	$500		
- Use of Cornell Computing Services				
- Subcontracts over $25,000				
SUBTOTAL EXCLUSIONS (ON-CAMPUS)	$7,530	$2,510		
MODIFIED TDC (ON-CAMPUS)	$30,275	$10,092	$7,027	$2,342
MODIFIED TDC (OFF-CAMPUS)	$5,775	$1,925		
Indirect Cost Rate (ON-CAMPUS)	53.0%	54%	51.5%	53%
Indirect Cost Rate (OFF-CAMPUS)	30.0%	30%		
TOTAL INDIRECT COSTS (ON-CAMPUS)	$16,046	$5,450	$3,619	$1,241
TOTAL INDIRECT COSTS (OFF-CAMPUS)	$1,733	$578		

CU-4, Processes of soil degradation and rejuvenation under different land use systems
1991-1992

Global thrust: Natural resources management/Sustainable agriculture/Outreach

Constraints addressed and Problem Identification:

Constraints:

Primary:
a. Inadequate resource information
b. Landscape restrictions

Secondary:
a. Soil physical limitations
b. Nutrient deficiencies and losses
c. Number and diversity of soils
d. Water stress
e. Number and diversity of users

Problem Identification:

Many soils of the tropics, particularly the Oxisols and the oxic subgroups of the Alfisols and Ultisols, possess a very stable micropedal structure. In general, this type of structure confers excellent physical characteristics to these fine-textured soils, making them suitable for mechanized agriculture. Nevertheless, these soils suffer from a number of limitations such as nutrient deficiencies, toxicities and heavy losses of fertilizers by leaching, which makes these soils less productive than they could in principle be. In addition, continuous cropping of these soils for long periods can result in the alteration of both their physical and chemical properties. These changes may promote clay dispersion, causing destruction of the microaggregates and reducing air and water movement through the soil.

Other common soils of the tropics, the Vertisols and non-oxic subgroups of the Alfisols and Ultisols, often possess physical limitations, making them susceptible to erosion and subject to surface cementation upon drying.

The problems mentioned above present a serious constraint to agricultural development in the tropics. Unfortunately, the factors which determine the water and solute transport patterns in tropical soils, and the mechanisms controlling the physical stability of aggregates in these soils are not understood. Consequently, soil management practices required to prevent structural degradation or enhance structural integrity so far have not been developed, even though they are urgently needed in various parts of the world.

Problem Statement and Justification for the Research:

In recent decades, increased demands for crop and grazing lands have threatened the sustainability of fragile tropical agroecosystems. In Africa, for example, land degradation has reached such a scale that desertification has affected more than 35% of the area north of the Equator. Drought, soil erosion, infertility or declining fertility, soil compaction and crusting, salinization and deforestation are among the major processes responsible for landscape degradation. There is an urgent need to develop sustainable agriculture and resource management systems that meet changing human needs while enhancing the natural resource base in the tropics. Research aiming at a better understanding of the balance between soil degradation and rejuvenation processes, between soil resistance to

deterioration and resilience, is fundamental for the design of management strategies conducive to sustainable production in currently threatened agroecosystems.

Many soils of the tropic, particularly the Oxisols and Oxic subgroups of the Alfisols and Ultisols, possess a well-developed micropedal (or micro-aggregate) structure. In general, this type of structure confers excellent physical characteristics to these fine-textured soils that make them suitable for mechanized agriculture. Indeed, because they behave like coarse-textured soils, they usually are extremely well drained. However, they are also generally characterized by very heavy losses of fertilizers by leaching, sometimes at a rate up to 60% or more, a feature which presents a very serious constraint to agricultural productivity and a potential threat to groundwater quality. Because there is currently no known procedure to alleviate these important fertilizer losses, these well-aggregated soils are not used as intensively or efficiently as they could potentially be, resulting in an increased production pressure on less stable soils. In addition, recent studies by Tropsoils scientists in the Cerrado region in Brazil have shown that continuous cropping of these well-aggregated soils for long periods of time can result in the alteration of both their physical and chemical properties. These changes may promote clay dispersion, causing destruction of the microaggregates, reducing air and water movement through the soil and, eventually, hindering root penetration.

Another group of soils of the tropics, consisting of the swelling/shrinking Vertisols and the non-oxic subgroups of the Alfisols and Ultisols, are inherently metastable systems where structure-related problems constitute a serious constraint to soil and crop management and threaten system sustainability. The loss of soil structure and associated macropores, accompanied by soil consolidation and decreased biological activity are directly related to degradational processes. Destabilization of structural aggregates results in crusted and sealed surface conditions that decrease infiltration and increase surface runoff, wind and water erosion. Furthermore, such conditions result in less water recharge to subsoils, decreased root growth and greater periods of soil moisture deficit for plant growth. Fragile, barren surfaces are likewise subject to elevated soil temperatures, increased evaporation and decreased seedling germination, vigor and growth.

These various problems could be and, in some cases, have been alleviated by adopting appropriate management practices. Because of the increasing production pressure to which these soils are being subjected, it is important that new strategies be developed to prevent further degradation and to allow the rejuvenation of degraded agroecosystems. This is the objective targeted by the present cross-cutting project. To achieve it will require a much deeper understanding than is currently available of the dynamics of tropical soils under different land use systems .

<u>Principal Investigators and Institutions:</u>

Philippe Baveye Department of Soil, Crop and Atmospheric Sciences, Bradfield Hall, Cornell University, Ithaca, NY 14853.

Murray McBride Department of Soil, Crop and Atmospheric Sciences, Bradfield Hall, Cornell University, Ithaca, NY 14853.

Collaborators and Institutions:

Soklou Worou, Institut National des Sols (I.N.S.), Lomé, Togo
Ricardo Radulovich, Dept. of Agricultural Engineering, University of Costa Rica, San José, Costa Rica.

Research sites:

Lomé, Togo.
Sarapiquí, Costa Rica.

CU 4

SOIL MANAGEMENT CRSP
ANNUAL BUDGET

FISCAL YEAR: 9/25/91-9/24/92

BUDGET:

OBJECT	TOTAL FUNDING SOURCE CRSP	EXTERNAL	MATCHING	HOST	TOTAL
Salaries					
GRA (2) Stipend	25,000				25,000
GRA (2) Fees	8,040				8,040
P. Baveye (20%)			9,821		9,821
M. McBride (10%)			6,276		6,276
Administrative Support	500		1,000		1,500
Fringe Benefits @ 23.44%	117				
Matching F.B. @ 30.46%			5,204		5,204
Allowances (GRA & PI)	7,500				7,500
Visiting Scientist	4,084				4,084
Consulting					
Travel					
U.S.	750				750
International	8,250				8,250
Supplies	5,000				5,000
Equipment	17,500				17,500
Equipment Maintenance	5,000				5,000
Telecommunication & copying	1,000				1,000
Analytical Costs	2,000				2,000
Publication					
Labour (off-campus)*	750				
TOTAL DIRECT COSTS	85,491		22,302		107,793
Indirect Costs					
On-Campus	27,930		11,876		39,806
Off-Campus	2,251				2,251
TOTAL PROJECT COSTS	115,672		34,178		149,850

INSTITUTION	FULL TIME EQUIVALENTS (FTE) SCIENTIST SENIOR	JUNIOR	TECHNICIAN	ADM. SUPPORT	OTHER	TOTAL
US	0.10	1.50		0.04		1.64
Host	0.05					0.05
Other	0.05					0.05
TOTAL	0.20	1.50		0.04		1.74

DATE INITIATED: SEPTEMBER 25, 1990

EXPECTED COMPLETION: SEPTEMBER 24. 1994

SIGNATURES:

Thomas M Bide Aug 1/91 [illegible] 8/1/91

(Project Leader) (Date) (Program Coordinator) (Date)

SPONSOR'S INDIRECT COST SHEET
CU4 - BAVEYE AND MCBRIDE
BUDGET JUSTIFICATION - Indirect Cost Detail 31-Jul-91

	Period TROPSOILS 9/25/91-6/30/92	Period TROPSOILS 7/1/92-9/24/92	Period MATCHING 9/25/91-6/30/92	Period MATCHING 7/1/92-9/24/92
TOTAL DIRECT COSTS - ON-CAMPUS	$58,493	$19,498	$16,727	$5,576
TOTAL DIRECT COSTS - OFF-CAMPUS	$5,625	$1,875		
TOTAL DIRECT COSTS	$64,118	$21,373	$16,727	$5,576
MINUS EXCLUSIONS				
- Graduate Student Exclusion	$6,030	$2,010		
- Capital Equipment (Statutory - over $500/2 yr.)	$13,125	$4,375		
- Use of Cornell Computing Services				
- Subcontracts over $25,000				
SUBTOTAL EXCLUSIONS (ON-CAMPUS)	$19,155	$6,385		
MODIFIED TDC (ON-CAMPUS)	$39,338	$13,113	$16,727	$5,576
MODIFIED TDC (OFF-CAMPUS)	$5,625	$1,875		
Indirect Cost Rate (ON-CAMPUS)	53.0%	54%	53.0%	54%
Indirect Cost Rate (OFF-CAMPUS)	30.0%	30%		
TOTAL INDIRECT COSTS (ON-CAMPUS)	$20,849	$7,081	$8,865	$3,011
TOTAL INDIRECT COSTS (OFF-CAMPUS)	$1,688	$563		

Fiscal Year: 09/01/91 - 08/31/92

Project Number: TAMU-02

Title: Soil and water management and conservation for sustainable agriculture in the semiarid tropics.

Global Thrust: Sustainable Agriculture

Constraints Addressed:
- Water stress
- Nutrient deficiencies and losses
- Soil physical limitations
- Topographic limitations

Problem Statement, Objectives and Justification:

Inefficient and incomplete use of rainfall is a major factor which limits crop production and contributes to land degradation in the semiarid tropics. Additionally, the deterioration of soil physical properties imposed by improper management may result in low infiltration rates, excessive runoff and accelerated soil erosion. The rectification of these problems must involve both the (1) reduction of runoff and soil erosion and (2) the amelioration of physical and chemical soil constraints to allow improved crop growth.

The overall goal of this project is to develop soil and water management practices for sustainable food, fodder and fiber production under semi-arid conditions. The project is further divided into three sub-projects which are designed to achieve the following specific objectives:

(1) Assessment of the magnitude and effect of nutrient, soil and water losses under selected improved and traditional management systems.

(2) Assessment of the interactive effects of water and nutrients on crop growth and integrate them into a model capable of simulating the hydrodynamics and crop performance under different Sahelian conditions.

(3) Assessment of the long-term effects of crop residue, green manure and tillage on crop yields and soil productivity.

Recurrent drought and poor soil resources are the two primary causes for the low productivity of the Sahel. Rainfall in the region, which is highly variable in yearly amount and distribution, commonly occurs in intense storms causing severe runoff and erosion. Soils in the region possess low native fertilities and low water holding capacities. These edaphic and climatic constraints are magnified when combined with soil physical deterioration resulting from land degradation. If rainfall, soil moisture and runoff are managed well,

plant growth can be maximized which in turn facilitates stability and sustainability of the agroecosystem. Basic studies attempting to characterize the agroecosystem, integrating the various physical parameters that operate and regulate the soil-plant-atmosphere continuum, are needed for the development of site specific soil and water management systems to increase productivity.

Principal Investigators and Institutions:

C.W. Wendt, TAES, Texas A&M University
A.S.R. Juo, TAES, Texas A&M University

Collaborators and Institutions:

M. Ouattara, INRAN, Niger
M. Gandah, INRAN, Niger
Z. Kouyate, Institut d'Economie Rurale (IER), Mali
A. Sow, IER, Mali
M. Doumbia, IER, Mali
M. Prashad, NAAR Project
C. Zaongo, Texas A&M University
R. Schwartz, Texas A&M University
M. Thompson, Texas A&M University
L.R. Hossner, TAES, Texas A&M University
R. Lascano, TAES, Texas A&M University
K. Cassel, North Carolina State University
G. Uehara, University of Hawaii
S. El-Swaify, University of Hawaii
P. Unger, Agricultural Research Service (ARS), U.S.D.A., Bushland, TX
B.A. Stewart, ARS, U.S.D.A., Bushland, TX

Research Sites:

IER Research Center, Kariko, Mali
Maradi, Niger
Bushland, Texas

Budget (91-92):

Object	CRSP	External	Matching	Host*	Total
Salaries	45,152.37		32,335.22		77,487.59
Fringe Benefits	12,036.34		11,588.94		23,625.28
Allowances	10,400.00		0.00		10,400.00
Consulting	0.00		0.00		0.00
Travel, US	3,920.90		0.00		3,920.90
Travel, INT	9,241.06		0.00		9,241.06
Supplies	12,524.48		1,053.66		13,578.14
Equipment	7,940.30		0.00		7,940.30
Communications	2,660.45		428.05		3,088.50
Shipping/Freight	3,760.83		0.00		3,760.83
Publications	2,696.42		0.00		2,696.42
Other direct costs	7,000.00		1,955.86		8,955.86
Indirect costs	40,728.54		0.00		40,728.54
TOTAL	**158,061.69**	**0.00**	**47,361.73**	**0.00**	**205,423.42**

*Not determined yet.

Human Resource Commitments:

Institution	Full Time equivalents (FTE)					
	Senior Scientist	Junior Scientist	Techni-cian	Admin. Support	Other	Total
US	0.4	1.0	0.4	0.3		2.1
Host		0.8				0.8
Other						
Total	**0.4**	**1.8**	**0.4**	**0.3**		**2.9**

Date Initiated: November 1, 1990

Expected Completion: November 30, 1993

Signatures:

C. Wendt/gf 7-1-91
Project Leader Date

7-1-91
Program Coordinator Date

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: Apr 17, 1991 - Sep 24, 1991/
Sep 25, 1991 - Apr 16, 1992

Project Number: UH-02

Title: Upland Research in Collaboration with IRRI

Constraints Addressed:
Lack of collaborative research activities with International Agricultural Research Centers.

Problem Statement, Objectives, and Justification:

The reduction in fiscal resources available to TropSoils has resulted in the ceasation of site maintenance for overseas research sites. An opportunity to explore potential collaborative research activities with IRRI scientists involved in the their upland research program in the humid tropics is possible with the availability of funds under this initiative. Previous contact with IRRI scientists in Sukarami and Sitiung provide a basis for complementing resources for a common research goals to improve soil management of upland areas.

The objective of this new initiative is to explore research topics of common interest for collaboration between TropSoils and IRRI scientists in upland regions.

To carry out this task, funds for this initiative will be used primarily for travel related expenses. In the first six months, travel to Los Banos and possibly to Mindanao is planned to establish a collaborative program. In the second, there will be a follow up trip to Los Banos and one to Indonesia to explore initiatives with AARD, Winrock, and IRRI in the Sitiung area.

Principal Investigators and Institution
Goro Uehara, University of Hawaii
Russell Yost, University of Hawaii

Collaborators and Institution:
Dennis Garrity, IRRI/Los Banos
Cesear Mamaril, IRRI/Bogor

Research Sites:
Bukidnon, Philippines; Sitiung/Sukarami, Indonesia

Budget:

	CRSP	Matching	Host	Total
Salaries	0/0	1625/3250	0	1625/3250
Travel	5080/6100	0/0	0	5080/6100
Indirect Costs	1960/2860	0/0	0	1960/2860
TOTAL	7040/8960	1625/3250	0	8665/12210

Human Resources Commitments:

Institution	Scientist Senior	Scientist Junior	Technician	Admin	Other	Total
UH	.10	0	0	.02	0	.12
Host	.10	0	0	0	0	.10
TOTAL	.20	0	0	.02	0	.22

Date Initiated: April 16, 1991

Expected Completion: April 15, 1992

Signatures:

G. Ulehan 4/30/91

Russell Yost 4/30/91

Project Leader Date

Gors Ulehan 4/30/91

Program Coordinator Date

Soil Management CRSP
Annual Activities Work Plan and Budget

Fiscal Year: 1991-92

Project Number: UH-04

Title: Maize/legume/*Rhizobium* systems: Interspecific in Interactions, Nitrogen Fixation, and Yield Responses on Acid Soils.

Global Thrust: Sustainable Agriculture, Natural-Resource Management, and Outreach

Problem Statement, Objectives and Justification:

The Transmigration Project at Sitiung, Indonesia exemplifies the process of agricultural development in many parts of the humid tropics. Population pressures are forcing the establishment of permanent agriculture on highly-acid upland soils. Because of socioeconomic constraints, farmers must manage these soils with a minimum of purchased inputs. Dependence on subsidized fertilizers and lime may compromise the sustainability of crop production; on-farm resources must therefore be utilized, whenever possible, to overcome the problems of soil acidity and nutrient deficiencies. While rainfall is relatively abundant and soil physical conditions are good, soil acidity can limit root system development and lead to drought stress. As appropriate technology becomes available for alleviating soil acidity, the factors limiting crop yields are expected to shift. Nitrogen deficiency, for example, may become a more serious problem.

While much significant research has been performed with relevance to Sitiung, our ability to deliver the information to farmers, extension agents, and policy makers is still limited. Because of interactions among factors, generalities about specific resource constraints often break down when applied to individual farms. Unless a comprehensive, integrated research framework is developed, we will be unable to deliver site-specific management recommendations in a timely manner and we will continue to pass up difficult, but essential, research problems due to expedience.

This project is designed to typify the integrated framework needed to solve complex soil-management problems. Attention is given, from the outset, to the link between detailed process-level science and the generation and delivery of management recommendations. Advanced information technology, contained in recent simulation models (including a supercomputer-based system), will be used to guide experimentation and integrate the results. Expertise from another major US AID project, NifTAL, at the University of Hawaii, will be utilized, illustrating the kind of coordinated effort possible (and ultimately necessary) within US AID's global outreach program.

Multiple cropping is a proven means of increasing farm production in the tropics. The complexity of these systems, and

their dependence on site-specific conditions, presents a challenge to soil scientists and agronomists. Resources are not available to use field trials for screening all the management options at each site of interest.

Simulation models are a fast and effective means of screening management packages *if* valid models and input data are available. Weaknesses exist in current models, especially for interspecific interactions on acid soils, but additional work should enable us to identify the best available models. Such models can provide a framework for process-level research and should aid in site-specific problem solving.

Objectives include:

1. Quantify processes that are central to understanding and modeling maize / legume / *Rhizobium* systems, especially interspecific interactions: (a) biological nitrogen fixation, (b) resource competition (for soil moisture, soil nutrients, and solar radiation), and (c) root system interactions (influencing rooting depth and pattern).

2. Evaluate maize / legume multiple cropping systems and identify a) the levels of lime and fertilizer substitution to be expected by either rotating or intercropping, and b) optimum cropping patterns (i.e. sequences to use for double or triple cropping).

3. Compare contrasting agroecosystem models for their ability to simulate and screen multiple cropping systems on acid soils. Train researchers and implementers in the capabilities and requirements of the models.

Principal Investigators and Institutions:

Robert Caldwell, University of Hawaii
Paul Singleton, NifTAL Project, University of Hawaii

Collaborators and Institutions:

Basil Acock, USDA/ARS, Beltsville, Maryland
Abdul Ghani, Sukarami Agricultural Research Institute for Food Crops, Sukarami, Indonesia
Robert Grant, University of Alberta, Edmonton, Alberta, Canada
C. Allen Jones, Texas Agricultural Experiment Station, Temple, Texas
James W. Jones, University of Florida
Susan Miyasaka, University of Hawaii
Tasman Naim, Sukarami Agricultural Research Institute for Food Crops, Balittan/Sitiung, Indonesia
Agus Sofyan, Center for Soil Research, Bogor, Indonesia
I P.G. Widjaja-Adhi, Center for Soil and Agroclimate Research, Bogor, Indonesia

Research Sites: Sitiung, Indonesia

Budget:

	CRSP	Matching	Total
Salaries	22,000	10,000	32,000
Fringe Benefits	1,000	2,800	3,800
Travel (US)	1,800	0	1,800
Travel (INT)	3,300	0	3,300
Supplies	2,000	0	2,000
Equipment	0	0	0
Communications	0	0	0
Shipping/Freight	500	0	500
Other Direct Costs	1,000	1,000	2,000
Indirect Costs	11,800	0	11,800
TOTAL	43,400	13,800	57,200

Human Resource Commitments:

	Scientist					
Institution	Senior	Junior	Technician	Admin	Other	Total
UH	0	0	0	0	1.0	1.00
Other	.10	0	0	0	0	.10
TOTAL	.10	0	0	0	1.0	1.10

Date Initiated: 1991

Expected Completion: 1994

Signatures:

Robert M. Caldwell 10/14/91
Project Leader Date

Gene Nelson 10/14/91
Program Coordinator Date

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: Apr 17, 1991 - Sep 24, 1991/
Sep 25, 1991 - Apr 16, 1992

Project Number: UH-05

Title: West Africa Collaboration with IITA

Constraints Addressed:
Lack of collaborative research activities with International Agricultural Research Centers.

Problem Statement, Objectives, and Justification:

The reduction in fiscal resources available to TropSoils has resulted in the ceasation of site maintenance for overseas research sites. An opportunity to explore potential collaborative research activities with IITA scientists involved in systems research on soil acidity and plant nutrients (N, P, and K) in the West Africa. If appropriate, a collaborative initiative involving the Institut du Researche Agronomique (IRA) in the United Republic of Cameroon will be explored. Previous contact with IITA and IRA scientists in Nigeria and Cameroon provides a basis for complementing resources for a common research goals to improve soil management of humid and semi-arid zones.

The objective of this new initiative is to explore research topics of common interest for collaboration among TropSoils, IITA and IRA scientists in West Africa.

To carry out this task, funds for this initiative will be used primarily for travel related expenses. In the first six months, travel to Ibadan, Nigeria and Yaounde, Cameroon is planned to develop ties for a collaborative program. In the second, there will either be a follow up trip to West Africa or to provide partial travel support for ex-patriot IITA scientists to visit with TropSoils scientist in the U.S. to futher explore research initiatives in the region.

Principal Investigators and Institution
Goro Uehara, University of Hawaii
Russell Yost, University of Hawaii

Collaborators and Institution:
Gavin Gillman, IITA
Joseph Ayuk-Takem, IRA/Yaounde

Research Sites:
Barombi Kang, Bamenda, N'kolbison, Cameroon.

Budget:

	CRSP	Matching	Host	Total
Salaries	0/0	1625/3250	0	1625/3250
Travel	5200/6610	0/0	0	5200/6610
Indirect Costs	2280/2810	0/0	0	2280/2810
TOTAL	7480/9420	1625/3250	0	9105/12670

Human Resources Commitments:

Institution	Scientist Senior	Scientist Junior	Technician	Admin	Other	Total
UH	.10	0	0	.02	0	.12
Host	.10	0	0	0	0	.10
TOTAL	.20	0	0	.02	0	.22

Date Initiated: April 16, 1991

Expected Completion: April 15, 1992

Signatures:

G. Uehara 4/30/91

Russell Yost 4/30/91

Project Leader Date

Goro Uehara 4/30/91

Program Coordinator Date

WORK PLAN AND BUDGET

TECHNOLOGY FOR SOIL MOISTURE MANAGEMENT

UNITED STATES DEPARTMENT OF AGRICULTURE--
AGRICULTURE RESEARCH SERVICE

PRINCIPAL INVESTIGATOR:

Dr. James F. Parr
Soil Scientist
USDA/ARS
National program Staff
Beltsville, MD 20705

COLLABORATORS AND INSTITUTIONS:

C. Pairintra	Asia-Pacific Natural Agriculture Network (APNAN) Bangkok, Thailand
A. S. R. Juo	TAMU-TAES
M. L. Kyomo	Southern African Center for Cooperation in Agricultural Research (SACCAR)
J. H. Thomas	USDA-OICD, Far Eastern Regional Research Office (FERRO)
Susan Riha	Cornell University
W. R. Butcher	Washington State University, Pullman

RESEARCH SITES: Thailand, Malaysia, India, Niger, Sri Lanka, Mali, Cameroon, Philippines, Botswana

GLOBAL THRUST: Sustainable Agriculture Production and Outreach

CONSTRAINTS: Soil physical limitations
Water stress
Nutrient deficiencies and losses
Information knowledge gap

PROBLEM STATEMENT, OBJECTIVES AND JUSTIFICATION

Problem Statement

Dryland agriculture is a rainfed crop production system in which a major limiting factor is water. In addition to erratic and limited rainfall, many dryland areas of developing countries also have severe soil quality problems. These include low water-

holding capacity; soil crusting and compacting; low water infiltration rates and excessive nutrient runoff losses; excessive soil erosion by wind and water; coarse-textured and shallow-depth soils; and low soil organic matter levels. Intensive cultivation of these marginal soils has led to an alarming decline in soil productivity.

One key to increasing the productivity of soils in the arid and semiarid regions is through the proper and regular additions of organic amendments, primarily crop residues. Yet in most cases such materials are not available because of competitive uses as forage, fuel, fiber and building materials. The agronomic and economic value of crop residues in the drylands of developing countries, in most cases, has not been determined. Consequently, there is little incentive to explore possible trade-offs that would allow some residue return to cropland.

Objectives

The overall goals of TSMM are to increase the productivity and long-term sustainability of rainfed/dryland agricultural systems in developing countries while maintaining or enhancing the natural resource base, specifically the soil and water resources, and to improve output and income in crop and livestock production systems.

1. To assist in the assessment of soil, water and crop/livestock management systems under dryland or rainfed conditions;

2. To develop effective strategies and approaches for increasing dryland and rainfed agricultural productivity through research and technology transfer;

3. To strengthen the capability of developing country scientists and institutions for conducting research that would lead to more effective and efficient management systems for dryland and rainfed agriculture.

Justification

For more than 50 years, U.S. scientists and particularly the ARS have conducted research throughout the U.S. Great Plains to deal with the extreme soil and agroclimatic problems and constraints to the development of sustainable dryland farming systems. Many of these same problems must now be dealt with by national scientists in the arid and semiarid regions. The most successful "international efforts" to develop effective soil, water and crop management systems in these regions has been through the establishment of scientist-to-scientist linkages. Agency-to-agency initiatives alone are seldom successful in developing meaningful and relevant research projects and, therefore, the

need to focus more on individual scientists and linkages with other scientists.

In our linkages with scientists in the semiarid regions, we need to establish a better understanding of dryland resources, the production potentials of those resources, and the scientific and socioeconomic systems within which they operate. In achieving these goals, the basic approach of this project will involve the following:

1. Compile data bases or compendia of research data and information in countries of a particular region that is relevant to dryland or rainfed agriculture. The best and most logical approach in agricultural development initiatives is to determine what has already been done, where it was done and under what conditions. Results obtained, conclusions drawn and whether or not the technology was transferred to the farmer, and if so, was it adopted. Failure to compile such information usually leads to a costly duplication of effort.

2. Conduct workshops to assess and discuss the database findings and to establish research needs and priorities. A data base establishes what has been done, but at the same time it identifies knowledge and information gaps that must be dealt with. The workshop also helps to identify key scientists to be involved in future research activities.

3. Develop regional research networks in which scientists are linked by common research projects, objectives and methodology. Ideally, these projects should be conducted in both developing and developed countries with scientist-to-scientist linkages. This can greatly enhance mutual understanding and transfer of results and technologies to the farmer.

4. Conduct on-farm research using whole-farm analysis (agronomic and socio-economic parameters) and model watersheds which should provide a more realistic and meaningful development or more sustainable farming systems in accordance with specific agroclimatic conditions and the individual farmer's interests, goals and capabilities. This approach would also enhance the conservation of the natural resource base. The Integrated Management of Agricultural Watersheds (IMAW) program now in its initial planning stages by TropSoils in Niger offers an excellent opportunity to evaluate the effectiveness (both short-term and long-term impacts) to using a watershed development approach involving whole-farm and village analysis methods.

Ideally, this stepwise method of assessing knowledge, identifying problems, and mobilizing available resources for developing

acceptable solutions will serve as a model for other countries within each region.

ESTIMATED BUDGET (1991-1994)

(X $1000)

Object	CRSP	External	Host	Total
Salaries	420	25		445
Fringe Benefits	65	10		75
Cooperative Agreements	100	70		170
Workshops	50	200		250
Travel, US	40	-		40
Travel, INT	50	50		100
Supplies	10	5		15
Equipment	20	5		25
Training	10	25		35
Publications	40	-		40
Indirect Costs	115	-		115
Total	920	370		1,320

Date Initiated: July 28, 1991
Expected Completion: September 24, 1994

III. OUTREACH

NCSU-05	Technical support for research networks in the humid tropics.
TAMU-10	Outreach activities in the semiarid tropics.
COM-01	TropSoils communications and outreach support.
PDSS-01	Phosphorus Decision Support System.
PDSS-02	TropSoils Workshop on the diagnosis of P deficiency and the prediction of P soil test calibration.
UHTX-02	Backstopping and outreach.

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: 1991-1992
Project Number: NCSU 5
Title: Technical Support for Research Networks in the Humid Tropics.
Global Thrust: Outreach

Constraint(s) Addressed: Many key components of soil management options can now be transferred to national institutions for validation and extrapolation across the humid tropics. National institution involvement is important for several reasons:

1. Available resources limit the extent to which TropSoils alone can systematically validate developed technology.

2. If developed technology is to be used, information must be disseminated and local soil management expertise must be acquired.

3. Feedback form its eventual users will enhance TropSoils' ability to develop agronomically and economically sound soil management practices through refinements or modifications of ongoing research.

Attempts to perform such technology transfer require a minimum level of on-site expertise in collaborating national institutions, and an organizational framework conducive to and supportive of systematic evaluations of results. Research networks are an effective means for both tapping local personnel and providing useful training to scientists in collaborating countries.

Problem Statement, Objectives and Justification: Current results and future investigations in soil management research for the humid tropics have been organized into a series of land-use options consistent with various landscape positions, soil constraints, socio-economic conditions, and ecological concerns which prevail in this ecosystem. Each land-use germplasm, crop management, and soil-plant-animal relationships. The basic soil physical, chemical, and biological management practices for land-use in continuous cropping, low input cropping, legume-based pastures, agroforestry, and paddy rice have been developed through research in the Amazon of Brazil and Peru, as well as in Indonesia. Despite the need for additional information and refinement, many of the management components are ready to be transferred to national institutions for validation and adoption to local conditions. Collaborative efforts with national institutions in systematic validation and adaptation of existing technologies would advance TropSoils' original goal of "developing and adapting improved soil management technologies..... for developing countries in the tropics" and provide a feedback mechanism for additional refinement and modification of ongoing research.

Effective technology transferral requires the existence or development of a

minimum level of soil management expertise at each site and a mechanism for ensuring essential technical support. Training and technical support programs should also provide enough flexibility to streamline activities to the particular needs, interests, and conditions presented at each validation site.

This project provides a bridge between CRSP-sponsored research and its utilization by national research institutions and addresses the constraints identified by TropSoils for the global thrust on outreach. Soil management networks and workshops 1) provide the training and institutional linkages for extrapolation; 2) expand the information base to a greater number of soils, environments, and socioeconomic conditions; 3) provide technical backstopping to strengthen local projects and foster adoption of new technologies; and 4) improve the quality and relevance of TropSoils research through continued testing and feedback from national institute scientists in developing countries.

The goal of this project is to foster transferral of TropSoils knowledge on acid soil management to national research institutions participating in existing research networks in humid tropical regions. Specific objectives are:

1. To strengthen capabilities of personnel at network collaborating national research institutions to conduct, interpret and report user-oriented research.

2. To systematically validate and extrapolate available soil management technologies to regions beyond the TropSoils primary research sites.

Principal Invectigator and Institution:

T.J. Smyth - NCSU

Collaborators and Institutions:

A. North Carolina State University
G.S. Miner
J.C. Alegre
S.W. Buol
M.G. Cook
C.A. Palm
F. Smith

B. Research Networks
RISTROP
TSBF
CIMMYT/Central American & Caribbean Strategic Agronomic Trials
IBSRAM/AFRICALAND

Research sites:

10 countries in LAC region, 7 in Africa.

Budget: 9/25/91 - 9/24/92

	Total Funding Source US $1000's				
OBJECT	CRSP	EXTERNAL	MATCHING	HOST	TOTAL
Salaries	35.7	11.1	11.8	55.0	113.6
Fringe Benefits	8.5	2.7	2.8	13.1	27.1
Allowances	0.0	0.0	0.0	6.0	6.0
Consulting	0.0	0.0	0.0	2.0	2.0
Travel, US	0.7	0.0	0.0	0.0	0.7
Travel, Int.	5.7	13.0	0.0	8.0	26.7
Supplies	1.5	8.0	0.0	7.0	16.5
Equipment	1.2	0.0	0.0	6.0	7.2
Communication	2.0	4.0	0.0	5.0	11.0
Shipping/Freight	0.4	0.0	0.0	10.0	10.4
Publication	1.0	0.0	0.0	2.0	3.0
Other Direct Costs	2.0	6.0	0.0	3.0	11.0
Indirect Costs	17.3	11.6	4.4	33.3	66.6
Total	76.0	56.4	19.0	150.4	301.8

	Full Time Equivalents (FTE)					
	Scientist					
Institution	Senior	Junior	Technician	Adm. Support	Other	Total
US	0.50	0.00	0.08	0.16	0.00	0.74
Host	6.00	9.00	3.00	2.00	0.00	20.00
Other	0.00	0.00	0.50	0.00	0.00	0.50
Total	6.50	9.00	3.58	2.16	0.00	21.24

Date Initiated: Sept. 1987

Expected Completion: Sept. 1997

Signatures:

(Project Leader) 9-5-91 (Date) (Program Coordinator) 9-5-91 (Date)

Fiscal Year: 09/01/91 - 08/31/92

Project Number: TAMU-10

Title: Outreach activities in the semiarid tropics.

Global Thrust: Outreach

Constraints Addressed:
- Site-specificity of management practices
- Lack of local expertise and communication channels
- Gap between new information and useable knowledge
- Number and diversity of potential users

Problem Statement, Objectives and Justification:

Considerable amounts of knowledge and information have been generated throughout the time period TropSoils has been present in West Africa. The vast majority of communication channels utilized by TropSoils to circulate research results and information is through biannual technical reports and scientific journals. In order to disseminate promising semiarid soil management technologies to the organizations and agencies involved in agricultural extension and support, research results must be distributed in a practical and highly visible form.

The overall goal of this project is to synthesize and translate TropSoils-SAT research results into user-oriented products and disseminate these products to national users through networking, training and workshops. The specific objectives include the following:

(1) Design an implementation plan and strengthen or establish contacts with potential collaborators from West African countries and regional and international agencies, organizations and institutions.

(2) Synthesize and translate some of the more promising technologies into user-oriented products.

(3) Participate in selected agricultural and natural resources management networks currently operating in the semiarid regions. This will include the participation in the West African Fertilizer Management and Evaluation Network (WAFMEN) which is under the auspices of IFDC.

(4) Aggressively seek external funding for short-term training and workshops with particular emphasis on soil infertility and water management.

Achieving TropSoils' sustainable agriculture and natural resource management goals requires the validation and extrapolation of user-oriented technologies. To address this

issue, TropSoils has included outreach as one of its three global thrusts. An important step forward was the establishment of a program-wide communication project. Although it is not feasible for TropSoils to engage in site specific adaptation and validation of soil management technologies in the semiarid tropics, there are a number of research networks in the semiarid tropics of Africa and Latin America where TropSoils has the potential to establish or strengthen linkages and collaboration. National cooperators in Africa and elsewhere have expressed their concern for the lack of expertise in tropical soil management among their scientists. Moreover, the excellent degree and non-degree training facilities and infra-structure established at the international agricultural research centers in the semiarid tropics regions remain relatively under-utilized by TropSoils and its national collaborators.

Principal Investigators and Institutions:

A. Manu, TAES, Texas A&M University
A.S.R. Juo, TAES, Texas A&M University

Collaborators and Institutions:

M. Ouattara, INRAN, Niger
Z. Kouyate, IER, Mali
J. Takow, IRA, Cameroon
R. Schwartz, Texas A&M University
N. Caudle, TropSoils Communications, North Carolina State University
T.J. Smyth, North Carolina State University
R. Yost, University of Hawaii

Research Sites: Various countries in the semiarid tropics of West Africa.

Budget (91-92):

Object	CRSP	External	Matching	Host*	Total
Salaries	29,120.42		12,181.15		41,301.57
Fringe Benefits	8,951.83		4,365.72		13,317.55
Allowances	1,350.00		0.00		1,350.00
Consulting	0.00		0.00		0.00
Travel, US	787.35		0.00		787.35
Travel, INT	3,918.58		0.00		3,918.58
Supplies	1,219.92		396.93		1,616.85
Equipment	262.45		0.00		262.45
Communications	793.68		161.25		954.93
Shipping/Freight	721.74		0.00		721.74
Publications	967.43		0.00		967.43
Other direct costs	0.00		736.80		736.80
Indirect costs	11,450.73				11,450.73
TOTAL	**59,544.13**	**0.00**	**17,841.85**	**0.00**	**77,385.98**

*Not determined yet.

Human Resource Commitments:

Institution	Full Time equivalents (FTE)					
	Senior Scientist	Junior Scientist	Techni-cian	Admin. Support	Other	Total
US	0.3			0.3		0.6
Host			0.5			0.5
Other						
Total	**0.3**		**0.5**			**1.1**

Date Initiated: November 1, 1990

Expected Completion: November 30, 1993

Signatures:

A. Manu/ajy 7-1-91
Project Leader Date

7-1-91
Program Coordinator Date

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: 1991-92

Project Number: COM. 01

Title: TropSoils Communications and Outreach Support

Global Thrusts: Outreach

Constraints Addressed:

Number & Diversity of Users of Soil Management Technology
Lack of Local Expertise and Soil Management Information
Soil Management Information Knowledge Gaps
Lack of Communication Skills

Problem Statement:

Soils and their associated water resources are two natural resource endowments upon which civilizations have depended for the production of their food, fiber, fuel, shelter materials and other basic human needs. Nations that have been poor stuarts of their soil and water resources have eventually climaxed with non-sustainable agriculture production systems and the resulting degradation in productivity of their natural resource base to below the capacity to provide their basic human needs. This long-term degradation of the soil and water resources can be the products of inadequate policies and resource misuse whereby long-term sustainability was sacrificed for the purpose of short-term gains. This can result from a number causes, such as: 1) lack of sufficient soil and water management technology; 2) diversity in users of this technology; 3) failure to translate research technology and communicate as useable knowledge; and 4) lack of local expertise to successfully generate, adapt and adjust an adequate base of soil and water resources management technologies. A major goal of the communications project is to support the processes whereby research technologies can be transformed into useable knowledge for diverse user groups that must put these technologies into use.

Principal Roles and Anticipated Activities:

The principal roles for the project in communications are: 1) provide communication leadership to the outreach thrust identified in the Soil Management CRSP global plan; 2) coordinate with the CRSP principal investigators the production of soil management communication products that enables technology adoption by diverse user groups in developing countries; 3) provide the communications support in the production of technical progress reports and research bulletins on sustainable agriculture and natural resource management for use by educators

and peer scientists; 4) preparation of news releases, newsletters, fact sheets, and research briefs for the purpose of keeping informed principal donors, public officials, special interest groups and institutional administrators on progress of the CRSP research and outreach activities; 5) provide the necessary editorial and communications support to the office of the Management Entity to facilitate meeting grant reporting requirements and public educational demands placed upon the office; 6) provide assistance to the office of the Management Entity in preparation of grant proposal and buy-in documents; and 7) take leadership role in maintaining updated mailing list and handling of mailings of products of the CRSP communications products.

The Anticipated Activities for the fiscal year of 1991-92 are: 1) completion of the 1988-89 TropSoils Technical Report and distribution; 2) initiation and possible completion of the report highlighting the first ten years of TropSoils; 3) completion of the publication GROUNDWORKS 2; 4) publication and distribution of two newsletters; 5) provide donor with monthly paragraph on CRSP progress and other significant happenings and other timely news items; 6) completion of two or three TropSoils technical bulletins; 7) complete a round of campus, USDA and NifTAL visits and to update on progress of research activities and develop pipeline of technical materials; 8) provide communications support to the office of the Management Entity activities in the CRSP Council and in education of the general public and public officials; 9) develop list of publications/bibliography of the CRSP publications; and 10) other activities to enhance the project in communications and it's role in the CRSP.

Project Leader:

Project Leader: Presently Vacant, NCSU
Project Assistant: Tim McBride (1/2 time) NCSU

Collaborators and Institutions:

The Communications Project Leader plans to collaborate with University Technical Coordinators and Principal Investigators and develop working relationships with similar group within the mergered USDA projects. Future collaborative relationships will be developed with the NitTAL Director, Principal Investigators and head of their communications activities. A collaborative working relationship will also be established with Directors and peers in the seven other CRSPs.

Budget:

Object	Total Funding Source				
	CRSP	External	Matching	Host	Total
			x 100		
Salaries	400	---	---	---	400
Benefits	96	---	---	---	96
Allowances	---	---	---	---	---
Travel, U.S.	15	---	---	---	15
Travel, Int.	10	---	---	---	10
Supplies	22	---	2	---	24
Equipment	15	---	---	---	15
Communications	---	---	5	---	5
Shipping/Freight	---	---	---	---	---
Publications	320	---	---	---	320
Other Direct Costs	160	---	40	---	200
Indirect Costs	491	---	22	---	513
	1529	---	69	---	1598

Human Resource Commitments:

Institutional	Full-Time Equivalents (FTE)			
	Specialist	Project Support	Other	Total
US	1.0	0.5	0	1.5
Host	---	---	---	---
Other	---	---	---	---
Total	1.0	0.5	0	1.5

(Project Leader) (Date)

Roger S. Varson 9/7/91
(Director, CRSP ME) (Date)

Soil Management CRSP
Annual Activities Work Plan and Budget

Fiscal Year: 1991-92

Project Number: PDSS-01

Title: Phosphorus Decision Support System

Global Thrust: To increase the availability and sustainability of food production for the resource poor in tropical agricultural environments through improved management of soil phosphorus.

Problem Statement, Objectives and Justification:

Food production in many tropical countries remains low and sporadic because of phosphorus deficiencies. Much of this condition is a result of insufficient information being given to key managers.

In many regions phosphorus soil tests have not been calibrated for all combinations of crops and soils, nor are funds likely to be available for such calibrations in the foreseeable future. These regions usually have certain similarities to other regions such that, with the use of expert knowledge, reasonable recommendations can be made. The goal of the phosphorus decision support system described here is to provide this expert knowledge.

In other regions where soil test technology is adopted, the effects of soil particle size and clay mineralogy are not being considered in soil test interpretations nor in making recommendations. Evidence from regions with extensive experience and research in phosphorus management suggests that it is important to consider these factors.

The phosphorus decision support system is intended to gather the best diagnosis and recommendation methodology and put it in a form useable by those with little training but with great responsibility for agricultural development planning or for extending modern agricultural technology to enhance food production and stability while protecting the environment.

There is a great deal of phosphorus management experience among the scientists in the TropSoils Universities and Collaborating Institutions and Scientists. This knowledge, together with the necessary local soil data, could substantially improve management of phosphorus by local extension personnel and agricultural planners. Although the TropSoils community has a great deal of management experience, there is also a paucity of characterization data at the local and regional levels. Such data are necessary to develop the best location specific recommendations. The spatially referenced data are also important to identify specific areas of low soil phosphorus availability and absorption characteristics. With local data, the extent of the deficient areas and the estimated fertilization requirements should be delineated to facilitate the planning of fertilization and

fertilization infrastructure. While there is an existing methodology for diagnosing P deficiency using soil tests and calibration experiments, there are aspects of the technology that could be improved through better understanding of P reactions. The relationship between the fundamental sorption processes relating amount of reactive surface, and the reactivity of the surface are needed for improved phosphorus management worldwide. The quest for understanding and describing this more fundamental relationship is a deeper theme of this proposal. The development of such relationships would dramatically reduce the amount of repetitive phosphorus research where a field experiment is thought necessary for nearly every combination of crop, soil, weather, and economic condition. Such efforts would initially be replaced by soil property inventories of fundamental data useful for a variety of soil management purposes.

Therefore, the purpose of the work proposed here is to address these needs by implementing the existing methodology of soil and fertilizer phosphorus management practiced by the Tropsoils group. This group permits a wide range of other users to make phosphorus diagnoses and recommendations for food crop production. At the same time we seek to develop a more thorough and complete understanding of fertilizer phosphorus reactions and management to promote more efficient use.

Objectives:

To develop a decision support system that quickly and efficiently applies the best current information on diagnosing phosphorus deficient soil-crop situations, and suggests the best possible phosphorus management given the specific situation. We believe that the quality of P decisions can be increased if more location-specific information (i.e.local soil data) is included in the decision making.

The system will be designed to aid those making specific recommendations (tactical decision making) as well as for those making or exploring longer term fertilizer requirements and options under expected conditions (strategic decision making).

We expect that the decision support system will be comprised of a data base of soil data now available, a crops requirement module, with management and economics modules linked as well, so that the economic consequences of agronomic alternatives can be determined. In this way we intend to summarize and apply the best research and experience of the Tropsoil Universities, collaborating institutions, and other relevant institutions, to best diagnose P problems and develop management recommendations and strategies.

Principal Investigators and Institutions:

Russell Yost, University of Hawaii
Fred Cox, North Carolina State University
Shaw Reid, Cornell University
Art Onken, Texas A&M University

Collaborators and Institutions:

Ibere Lins, Campo Grande, Mato Grosso do Sul, Brazil
Puntipa Vichiensanth, Khon Kaen University, Khon Kaen, Thailand
B.T. Kang, International Institute of Tropical Agriculture, Ibadan, Nigeria
I Putu Gedger Widjaja-adhi, Centre for Soils and Agroclimate Research, Bogor, Indonesia

Research Sites: Sitiung, Indonesia; global

Budget:

	CRSP	Matching	Total
Salaries	48,500	16,700	65,200
Fringe Benefits	10,000	4,700	14,700
Travel (US)	2,000	0	2,000
Travel (INT)	0	0	0
Supplies	5,000	1,000	6,000
Equipment	0	0	0
Communications	1,000	0	1,000
Shipping/Freight	500	0	500
Other Direct Costs	4,000	5,000	9,000
Indirect Costs	26,700	0	26,700
TOTAL	97,700	27,400	125,100

Human Resource Commitments:

Institution	Scientist Senior	Scientist Junior	Technician	Admin	Other	Total
UH	.1	1.0	0	0	0	1.1
Other	.5	0	0	0	0	.5
TOTAL	.6	1.0	0	0	0	1.6

Date Initiated: 1987

Expected Completion: 1994

Signatures:

Russell Yost — Project Leader — Oct. 14 — Date

Gary Uehara — Program Coordinator — 10/14/91 — Date

SOIL MANAGEMENT CRSP
ANNUAL ACTIVITIES WORK PLAN AND BUDGET

Fiscal Year: April 17, 1991 to April 16, 1992

Project Number: PDSS-02

Title: TropSoils Workshop on the diagnosis of P deficiency and the prediction of P soil test calibration.

Constraints Addressed:
Lack of information and data to (1) develop details of acceptable P-deficiency diagnosis methodology; (2) make P recommendations based on soil test data or other diagnostic criteria, i.e. soil test P calibration.

Problem Statement, Objectives, and Justification:

Relevance of the proposed workshop to the PDSS effort:
In the context of the current formulation of PDSS there are two major steps in the decison-making process: 1) The diagnosis of P deficiency and 2) the development of P recommendations, hopefully based on soil properties and crop requirements. The importance of knowing something of the relationship is also illustrated in the figure that illustrates the major steps in the P sorption process. The diagnosis of P deficiency through soil tests is discussed in earlier interim reports of the project (PDSS update, March 1990). The development of P recommendations based on calibration of the P soil tests has not been thoroughly addressed by the project as yet and, because of its integral importance to the success of the PDSS decision-aid, must now be addressed. Now is an important time to survey expert opinion and experience in order to develop the necessary information.

Another problem with field calibration of soil tests is that the precision with which the quantitative relationship between the P soil test level and the P requirement to attain the critical level is probably not as great as most of us would like. We have recently estimated the precision with which estimates of lime requirement (based on Cochrane's equation for estimating lime requirement) might be made. The results suggest that the precision is not nearly as great as most agronomists and soil scientists might think.

Objectives:

1. Bring together written and experiential information on the diagnosis of P deficiencies through soil test, cropping history, indicator plants, and other sources of information--together with estimates of reliability the respective sources as indicators of deficiency.
2. Bring together available information on the calibration of P soil tests (including Bray P-1, Mehlich 1 and 3, Olsen methods of soil P extraction) for soils with a range in texture, oxide content, and acidity.

3. Discuss and suggest a methodology to simulate the calibration of soil test P with incubation studies in the laboratory.

Justification:

The question the PDSS project must consider is 'How are the calibration data to be generated then?' The traditional solution seems to be to try estimate the functional relationship from research data on similar soils but if similar soils are not available then try to estimate it based on the most similar soils or crops for which data are available. Currently, seldom is the reliability of the calibration documented and rarer is it included in computations of fertilizer requirement and even less often is the recommendation given together with an estimate of its reliability.

There is a quasi-simulation way to estimate the amounts of fertilizer P needed to increase soil test levels. This is the laboratory incubation approach (manuscript, A. Hunter 1990). This approach has also been compared (Sharpley, 1989; Widjaja-Adhi, 1982) but the methods differ sharply: some incubate for 2 weeks, some incubate at field capacity, and some incubate at a 1:1 soil:water ratio. Greater discrepancies, however, were noted in the interpretations of the results. In some cases the laboratory estimates were multiplied by 3x in others 1x. We, therefore, anticipate some laboratory studies in the PDSS project to attempt to simulate field results using laboratory incubation methods. The proposed workshop is an ideal forum to propose and discuss research objectives and procedures and come to some consensus on procedures that various investigators use to conduct such studies.

Principal Investigators and Institutions:
Russell S. Yost, University of Hawaii
Art Onken, Texas A&M University
Fred Cox, North Carolina State University
Shaw Reid, Cornell

Collaborators and Institutions:
Participants: (something of a wish list at present):
A. Bationo (West Africa)
Central America (Univ of Costa Rica? F. Bertsch?) Hector Barreto or Bill Raun?
Brazil: (Djalma Sousa)
Philippines: Dennis Garrity, IRRI
Indonesia: I Putu Gedjer Widjaja-Adhi, Center for Soil and Agroclimate Research.
Thailand: Puntipa Vichiensanth, Khon Kaen University
Cameroon: Gavin Gillman or his postdoctoral associate, IITA.
United States:
Neil Caudle, North Carolina State University
Stephen Itoga, University of Hawaii
Walter Bowen, University of Florida
Upendra Singh, IFDC
Jot Smyth, North Carolina State University
Lloyd Hossner, Texas A&M
Tony Juo, Texas A&M

Location: Texas A&M University (pending discussion with Onken and Juo)

Duration: 3 days

Tentative dates: March 25 to 27, 1992

Work Plan:

Each participant (including US participants) will be asked to make a 30 minute presentation that will consist of the following:

1. Presentation of the methods used in his (her) home institution to a) Diagnose P deficiency in crops of local economic importance and b) Procedures and Results of Calibration trials determine the functional relationship between soil test P and P fertilizer recommendations for those crops.
2. Their recommendations on the best methods that PDSS might include for A) Diagnosis and B) Calibration of soil tests for P. The possibly different clientele, data availability, and economic resources of PDSS should be kept in mind in making this recommendation.
3. A written manuscript that includes in text form the content of items 1 and 2.
4. The manuscripts should be submitted two months before the workshop so that they might be duplicated and distributed to the attendees prior to the workshop.

Human Resource Commitments:

Institution	Scientist Senior	Scientist Junior	Technician	Admin	Other	Total
UH	.05	0	0	.02	0	.07
Other	.05	0	0	0	0	.05
TOTAL	.10	0	0	.02	0	.12

Date Initiated: April 17, 1991

Expected completion: April 16, 1992

Signatures:

Russell Yost
Project Leader Date

Goro Uehara
Program Coordinator Date

Project Number: PDSS-02

Title: TropSoils Workshop on the diagnosis of P deficiency and the prediction of P soil test calibration

Revised Budget:

	CRSP	Matching	Host	Total
Salaries				
Texas A & M support	3,000	3,000	0	6,000
UH support	3,000	6,000	0	9,000
Supplies	0	250	0	250
Communication	0	500	0	500
Other	0	500	0	500
Travel				
Off-Campus				
Foreign Participants				
Africa	4,500	0	0	4,500
C. America	1,500	0	0	1,500
S. America	3,000	0	0	3,000
Indonesia	3,500	0	0	3,500
Thailand	3,500	0	0	3,500
U.S.	2,000	0	0	2,000
Phil (other funds)	0	0	0	0
On-Campus				
Domestic U.S. Participants				
5 part. x $800	4,000	0	0	4,000
3 part. x $900	2,700	0	0	2,700
Indirect Costs	9,615	0	0	9,615
TOTAL	40,315	10,250	0	50,565

Soil Management CRSP
Annual Activities Work Plan and Budget

Fiscal Year: 1991-92

Project Number: UHTX-02

Title: Backstopping

Objectives and Justification:

The backstopping activities on the University of Hawaii campus are to provide administrative, fiscal, logistical and technical support for on-campus faculty and staff involved in TropSoils activities and for the support of the collaborative agreement between TropSoils and CSAR, Indonesia. This support is provided according to USAID and University of Hawaii guidelines. The principal tasks include:

- Personnel action for faculty and staff including payroll and travel coordination and reimbursement.
- Facilitate communications between Hawaii, Indonesia, Management Entity, collaborating institutions and individuals.
- Accounting of expenditures.
- Procurement of equipment, supplies, and services, etc.
- Monitoring of budget by projects and the workplan. Review of on-campus and off-campus projects.
- Reporting of annual technical and financial activity reports, workplans and budgets.
- Inventory and equipment management.

Principal Investigator and Institution:

Goro Uehara, University of Hawaii

Budget:

	CRSP	Matching	Total
Salaries	30,000	6,000	36,000
Fringe Benefits	8,400	1,700	10,100
Travel (US)	3,300	0	3,300
Travel (INT)	0	0	0
Supplies	1,200	0	1,200
Equipment	0	5,000	5,000
Communications	3,000	0	3,000
Shipping/Freight	1,000	0	1,000
Other Direct Costs	1,800	2,000	3,800
Indirect Costs	18,300	0	18,300
TOTAL	67,000	14,700	81,700

Human Resource Commitments:

	Scientist					
Institution	Senior	Junior	Technician	Admin	Other	Total
UH	.25	0	0	.75	0	1.00
Other	.20	0	0	0	0	.20
TOTAL	.45	0	0	.75	0	1.20

Date Initiated: 1987

Expected Completion: 1994

Signatures:

Gon Uehara 10/14/91
Project Leader Date

Gon Uehara 10/14/91
Program Coordinator Date

IV. MANAGEMENT ENTITY

The Soil Management CRSP Management Entity

TropSoils Three-Year Calendar

THE SOIL MANAGEMENT CRSP MANAGEMENT ENTITY

THE MANAGEMENT ENTITY OFFICE

The Management Entity Office carries out the responsibilities of the management Entity (ME), namely, leadership and oversight of program and fiscal affairs for the Soil management CRSP. The ME receives and administers the AID grant funds for the CRSP and enters into subgrant agreements with the participating and the host country institutions for their respective projects, according to the global plan developed for the CRSP. The ME is responsible for the global plan developed for the CRSP. The ME is responsible for implementation of the program and leading the development of annual work plans and budgets. It is responsible for the program and is accountable to AID for all expenditures. The ME establishes the system to facilitate and manage travel. It reports on the program and represents the CRSP in dealings with AID/W, and internationally. The ME, through its subagreements with participating institutions, holds them responsible for programs and accountable for use of funds. A system for effective management of the program and control and accounting of funds, including matching resources contributed by participating institutions is developed between the Office of the ME and participating institutions.

OPERATIONAL STRUCTURE

Advisory Council

The Advisory Council consists of a representative from each of the participating U.S. and host country institutions. To facilitate economic operations, much of the business is conducted by the Board of Directors, composed of one member from each of the participating U.S. institutions. The AID program officer and the director of the Office of the ME serve as ex-officio members of the Advisory Council and the Board of Directors. The chair of the Board of Directors is elected by the members of the Board. The Board of Directors deals with policy issues, reviews and passes on plans and proposed budgets, assesses programs, suggests program principles, and advises the Office of the ME on these and other matters.

Technical Council

The Technical Council is composed of the U.S. institutions Technical Committee, host country program coordinators and can include scientists outside the CRSP. To facilitate economic operations, much of the business is conducted by the Technical Committee. The AID program officer and the director of the Office of the ME serve as ex-officio members of the Technical Committee. The Technical Committee provides the technical leadership that sets priorities for research, develops work plans, formulates budgets, reviews technical progress of the

total research program, coordinates networking and training activities, proposes modifications in technical aspects of the program, is responsible for meeting the CRSP technical reporting obligations, and recommends allocations of funds for research. Special projects and programs are proposed and developed by the Technical Committee, within the available budget, in concordance with the Board of Directors and director of the Office of the ME.

External Evaluation Panel

The External Evaluation Panel is composed of three senior scientists recognized for their knowledge of a research discipline in tropical soil management, as well as their experience in research and administration. The panel conducts evaluations and develops recommendations with respect to status, funding, progress, plans and prospects of the research activities of the CRSP. Reviews are conducted in accordance with AID/S&T CRSP guidelines and are based on the stage of development of the program, concerns on progress or funding status, and research objectives. The External Evaluation Panel reports are submitted to the ME for appropriate action and distribution.

MANAGEMENT STRATEGY

The Soil Management CRSP developed their research activities for the global plan to focus on researchable soil management constraints that address broad issues in natural resource management and sustainable agriculture production.

Research Project Development

A research project or activity, based on a five-year horizon including an estimated budget, is prepared by the principal investigators and program coordinators of the U.S. and host country participating institutions. The research activities are reviewed by the External Evaluation panel for suggestions to maximize opportunities for collaboration and ensure program focus within the mandate of the CRSP. The research projects are submitted to the Office of the Director of the ME, which, in conjunction with the Board of Directors, determines the level of funding.

Funding Allocation Process

Funding allocation, in the present context, would be from those core funds received under the grant. The recommended level of funding for individual research activity is received from the Technical Committee and final approval is made by the Board of Directors and the director of the Office of the ME.

Project Implementation

Research projects or activities, will be implemented with the four universities by subgrants through the ME. Funds for the

approved individual projects or activities will be made available through the process of financial amendments to the subgrants. Annual work plans and budgets for the research activities must be submitted to the ME before funds will be allocated to the universities. Funds to support the activities of USDA/ERS, USDA/ARS and USDA/SCS are made available through reimbursable agreements based on their plan of work and suggested level of funding. Research activities and use of these funds are the responsibility of the program coordinators and the principal investigators of the recipient institutions.

Evaluation

The director of the Office of the ME and the Board of Directors will meet annually to review work plans and budget. The External Evaluation Panel, in concert with AID, will serve as the overall CRSP evaluator and will contribute to program direction.

FUTURE OPERATIONS

Efforts over the past two years to increase or restore core funding to the functioning CRSPs did result in an increase for six of the CRSPs. Whether this will be continuous remains to be seen. The USDA/ARS and USDA/ERS program in Technology for Soil Moisture Management (TSMM) and the USDA/SCS program in Soil Management Support Services (SMSS) have been merged with the Soil Management CRSP. The program in Nitrogen Fixation for Tropical Agricultural Legumes (NifTAL) is also in the process of merger. How the new CRSP is being planned in Sustainable Agriculture and Natural Resource Management might enhance or detract from the Soil Management CRSP remains to be seen.

Site Operations

The Soil Management CRSP has defined, by level of participating, host country sites. Since inception, the Soil Management CRSP has functioned principally on the primary site basis, with at least one senior scientist located ont he primary site in each of the host countries. Because of the need to establish the major part of the research operations where the soil management constraints exist and high degree of site specificity, this was a very effective system to ensure high quality and productive collaborative research activities. Reduced funding has resulted in, even under the most austere management, nearly 50 percent of the grant funds being utilized for site maintenance operations and campus backstopping. The Board of Directors voted that specific core funded projects for primary site operations and campus backstopping end on September 30, 1991. Continuation of primary sites will be funded from: 1) host country USAID missions through buy-ins; 2) funded out of individual research activities being conducted on the site; and 3) funded through other non-core source of funds. The primary site in Niamey, Niger, is being funded through a USAID mission

buy-in project. Yurimaguas, Peru, is being funded in part from research activities, external funds and mission support. The Sitiung, Sumatra, Indonesia, site is being changed to a participating site.

Collaboration with International Agriculture Research Centers

It has been suggested by USAID, BIFADEC and others that the Title XII institutions and CRSPs link up with the International Agricultural Research Centers (IARCs). The U.S. Government funded much of the original construction and continues to provide substantial operating funds to the IARCs. There is emphases placed on the IARCs to move from their genetic based commodity programs to broader based programs with focus on constraints to sustainable agriculture production and management of the soil and water resources. This broader emphases suggested by some donors is to effect an outreach of technology and has increased the interest for collaboration between some IARCs and the Soil Management CRSP.

The Soil Management CRSP has now signed general Memorandum of Understandings to collaborate with the International Institute for Tropical Agriculture (IITA), the International Rice Research Institute (IRRI) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). An addendum understanding wa signed with IRRI to define the protocols and agreements for collaborative graduate training.

CRSP Council

The CRSP Council is composed of the directors of the Office of the MEs, chairpersons of the Boards of Directors and Technical Committee of each CRSP. The directors of the Offices of the MEs serve as the Steering Committee or Executive Board of the CRSP Council. The purpose of the CRSP Council is to collaborate in communication efforts with clientele and support groups and seek InterCRSP program opportunities to maximize available expertise and experiences within the 35 CRSP institutions.

The director of the Soil Management CRSP has taken the leadership to prepare the CRSP Council By-Laws and a general Memorandum of Understanding. Two potential countries for Inter-CRSP activities that will warrant monitoring during the coming year are Honduras and Niger.

Phosphorus Decision Support System Workshop

The Phosphorus Decision Support System (PDSS) Workshop sponsored with special enhancement funds is scheduled for March 11-13, 1992, in College Station, Texas. The purpose of this workshop is to finalize inputs into PDSS and start the process of data input and should set the deadlines to bring forward a product from this cross-cutting activity.

Adaptation of Plants to Stress Soil Environments Workshop

This workshop is being sponsored by the Sorghum/Millet, Bean/Cowpea and Peanut CRSPs requesting participation from the Soil Management and other interested CRSPs. The dates and location are April 19-24, 1992, to be at the University of Nebraska in Lincoln, Nebraska. There will be a planning meeting in Rosslyn, Virginia, on October 11, 1991.

Niger InterCRSP Planning Workshop

The CRSP Council has discussed a possible InterCRSP Planning Workshop to be held in Niamey, Niger, sometime in early 1992. The Sorghum/Millet CRSP and the Purdue University Niger Cereals Project plan to take the leadership in organizing this workshop. The workshop theme will focus on accomplishments of this program and planning of an InterCRSP program.

Soil Management CRSP Planning Workshop

The Soil Management CRSP Planning Workshop is scheduled for January 17-23, 1993, tentatively in Houston, Texas. This workshop will serve as the information exchange and collection activity upon which the research focus of the 1994-1999 global plan will be based. The participants invited to this workshop will be members of the Advisory Council, host country and U.S. research coordinators, participating U.S. scientists, representatives of other CRSPs, AID administration and program officers and invitees. The Workshop Steering Committee will be very active in the coming year in the organization of this workshop.

Cameroon Initiative

With the signing of a Memorandum of Agreement with the Republic of the Government of Cameroon, Cornell University will provide the leadership for the Soil Management CRSP initiative targeted for northern Cameroon. The collaborative plan of work will need to be prepared and presented for approval during the Planning Conference scheduled for late January or early February, 1992.

Central America

The initiative in Costa Rica and other potential collaborative opportunities in Central America will be followed and, when appropriate, formalized with appropriate institutions.

CALENDAR OF ACTIVITIES

The attached calendar of activities to schedule meetings and timing of reports was prepared jointly with the Board of Directors and the Technical Committee. This provides scheduling guidelines for meetings, workshops, annual work plans and budgets

and technical program summaries.

BUDGET FOR 1991-92: MANAGEMENT ENTITY OFFICE AND OPERATION EXPENSES

The budget is divided into two parts to reflect the anticipated expenses by the Office of the Management Entity and the other necessary CRSP operational costs. This budget is for use of funds form the basic Soil Management CRSP core funds. In addition, there is an annual 1991-94 $200,000 earmarked to the Office of the Management Entity to fund the planning and administrative activities for the merger of the NifTAL, SMSS and TSMM activities with the Soil Management CRSP. These earmarked funds are not included in the budget.

	Object	
A.	Office of the Management Entity	
	Salaries	$ 98,594
	Benefits (23.9%)	23,564
	Telephone and fax	5,000
	Postage and mailings	4,000
	Services/rents/repairs	3,000
	Supplies	3,000
	Equipment	4,000
	Travel, visas, shots, etc.	46,000
	Miscellaneous and contingency	15,000
	Held in reserve	25,000
	Indirect costs (45% minus equipment)	107,842
	Subtotal	$335,000
B.	CRSP Operational Costs	
	Board of Directors Travel	$ 8,600
	Technical Committee Travel	8,600
	External Evaluation Panel Travel	10,000
	External Evaluation Panel Consulting	12,000
	Subtotal	$ 58,000
	TOTAL	$393,000

TROPSOILS THREE-YEAR CALENDAR

	1991-92	1992-93	1993-94
October	ANNUAL REPORT SUMMARY REQUESTS 26-27 PIs MEET DENVER	ANNUAL REPORT SUMMARY REQUESTS	ANNUAL REPORT SUMMARY REQUESTS
November	28 OLD ACCOUNTS CLEARED 29 REPORT SUMMARIES DUE	10/31-11/01 PIs MEET MINNEAPOLIS 30 REPORT SUMMARIES DUE	6-7 PIs MEET CINCINNATI
December	10-12 CRSP COUNCIL MTG. WASHINGTON, DC	CRSP COUNCIL MTG.	CRSP COUNCIL MTG.
January	ANNUAL EXECUTIVE SUMMARY REPORT DUE	ANNUAL EXECUTIVE SUMMARY REPORT DUE 17-22 CRSP PLANNING WORKSHOP, HOUSTON, TX	ANNUAL EXECUTIVE SUMMARY REPORT DUE
February	REQUEST FOR ANNUAL WORK PLANS	REQUEST FOR ANNUAL WORK PLANS	REQUEST FOR ANNUAL WORK PLANS
March	09-10 BOD, TC MTG. COLLEGE STATION, TX 11-13 PDSS WORKSHOP COLLEGE STATION, TX	BOD & TC MEETING NORTH CAROLINA	BOD & TC MEETING HAWAII
April	20-25 PLANT & SOIL STRESS WORKSHOP NEBRASKA (TENTATIVE)		
May			
June	1ST ANNUAL WORK PLANS DUE EEP REVIEW WORK PLANS	1ST ANNUAL WORK PLANS DUE EEP REVIEW WORK PLANS	1ST ANNUAL WORK PLANS DUE EEP REVIEW WORK PLANS
July	13-14 BOD, TC, EEP BUDGET MEETING WASHINGTON, DC	BOD, TC, EEP BUDGET MEETING WASHINGTON, DC	BOD, TC, EEP BUDGET MEETING WASHINGTON, DC
August			
September			