PD-AAR-562

TRIP REPORT

Date submitted Sept. 17, 1979

931-1311

NAME John L. Malcolm TITLE Soil & Fertilizer Specialist DIV./UNIT TSWM

PERIOD OF TRAVEL (including dates) September 2 through September 6, 1979

ITINERARY Washington, D.C. to Raleigh, N.C. and return
(Use attachment for details, including time schedule)

PURPOSE To meet with the international advisory panel and North Carolina State University staff on the problem assess for the Soil Management Collaborative Research Support Program.

ORGANIZATIONS AND PERSONS CONTACTED:
(Use attachment for details.)
See attachments

RESULTS/ACCOMPLISHMENTS:
1. Criteria for judging ranking of soil problems were established.
2. A priority list of problems for study under the CRSP was prepared.
3. The results were reported to AID/W and to JRC.
Etc. The summary report is attached.

FOLLOW-UP ACTION REQUIRED:
(indicate what, by whom, when.)
1. A comprehensive report will be finalized by NCSU in November, 1979
Research program proposals will be submitted to AID by February 1980.

OTHER REMARKS:
(May include other information, observations, and impressions of general interest.)

Attachments:
(List)

Distribution:
(List)
Regional Bureaus
DS/AGR's Division Chiefs
PPC/PDPR, Douglas Caton, Ms. Simmons

REPORT OF THE FIRST MEETING OF THE EXTERNAL PANEL OF THE SOIL MANAGEMENT CRSP PLANNING PROCESS

Raleigh, N. C., September 3-6, 1979

SUMMARY

The External Panel met to review the information assembled by North Carolina State University encompassing the recommendation on research priorities by 197 individuals from 46 countries representing 118 different institutions. The Panel recommends 1) that the CRSP be structured along agro-ecological zones, 2) twelve criteria for establishing priorities, 3) five priority agro-ecological zones: humid tropics, seasonal non-acid tropics, seasonal acid tropics, steepland and wetlands, 4) potential primary and secondary research sites and a list of main research components of each subprogram. The Planning Agency, North Carolina State University, concurs with these recommendations and submits them to the Joint Research Committee of BIFAD and AID for approval.

SOIL MANAGEMENT CRSP PLANNING PROCESS

REPORT OF THE EXTERNAL PANEL MEETING

September 3-6, 1979

An External Panel was recruited by North Carolina State University, the Planning Entity, to assist in making the following decisions related to the Assessment Phase of the Soil Management Planning Grant: 1) Whether to structure the Program along ecological regions or specific soil constraints, 2) Criteria for assigning research priorities, 3) Assignment of research priorities into coherent sub-programs and 4) Outline the main components of each sub-program.

The meeting was held in the Katherine McKimmon Room of Williams Hall at North Carolina State University from September 3-6, 1979, followed by a presentation of the conclusions to AID officials in Washington on September 7. The Panel was composed of the following members:

Dr. John K. Coulter, Scientific Advisor
Consultative Group on Agricultural Research
The World Bank
1818 H Street, N. W.
Washington, D. C. 20433

Dr. Peter E. Hildebrand
Economist, Rockefeller Foundation
Institutc de Ciencia y Technologia Agropecuaria
Guatemala City, Guatemala

Dr. M. Amirul Islam, Director
Bangladesh Agricultural Research Council
130-B Dhanmondi, R. A., Rd. 1
Dacca 5, Bangladesh

Dr. Frank R. Moormann
Professor of Soils
State University of Utrecht
Princetonplein 5
P. O. Box 80.003 3508TA
Utrecht, Netherlands

Dr. Marlowe D. Thorne
2205 South Cottage Grove
Urbana, Illinois 61801

Dr. Carlos Valverde
Deputy Executive Director
Instituto Nacional de Investigación Agraria
Sinchi Roca 2728
Lince-Lima, Peru

Dr. Kenneth F. S. King
Director General
International Council for Research
in Agroforestry
P. O. Box 14754
Nairobi, Kenya

The Panel was assisted by faculty members of North Carolina State University, who prepared for their consideration, a compilation of soil research priorities proposed by scientists and administrators of developing countries, international agricultural research centers, USAID missions and U. S.-based scientists. This information was compiled in 88 Assessment Reports and 40 cables from USAID Missions. The views of a total of 129 LDC-based individuals, representing 56 institutions from 45 countries along with 68 U. S.-based scientists from 31 different institutions were included in the materials on which the Panel based its conclusions. A summary of the 20 most frequently mentioned research priorities was prepared by NCSU and appears as Appendix I of this report. Appendix II summaries the sources of information received.

PROGRAM OBJECTIVE

The Panel decided that the objective of the Soil Management Collaborative Research Program as stated in the Grant Description could be modified, with advantage to read:

> "To develop, with national institutions, improved soil management technology to increase and sustain agricultural production in the developing world, while conserving and improving the land resource base."

The Panel was unanimous that in evolving or improving soil management systems the existing socio-economic conditions must be taken into account in order to develop scientific and technological answers to soil constraints which are realistic to poor farmers.

AGROECOLOGICAL ZONES VS. SPECIFIC SOIL CONSTRAINTS

The Panel considered whether it would be more advantageous to focus research on specific soil constraints in developing economies or to examine the problems within the context of agro-ecological zones. It was decided that it would be more beneficial to structure the program along agro-ecological zones because:

(a) The primary objective is to evolve feasible soil management systems, and the possibility of evolving these appeared to be greater if a "systems" approach was followed; and perhaps more important,

(b) The soils constraints to agricultural development so far identified in the developing countries are most strongly expressed and correlated with specific agro-ecological zones.

CRITERIA FOR SELECTING PRIORITY AGRO-ECOLOGICAL ZONES

Twelve criteria were chosen as the basis for selecting priority agro-ecological zones. They are:

1. Meets the overall CRSP objective (develop management systems for increasing agricultural production <u>and</u> conserving the soil resource base).

2. Benefits directly the rural and urban poor.
3. Size of the actual area within the agro-ecological zone (target area).
4. Number of people presently in the zone.
5. Number of people the zone potentially can support.
6. Present poverty level (1/GNP).
7. Need for research.
8. Availability of potential collaborators.
9. Technical feasibility.
10. Socio-economic feasibility.
11. Presence of ongoing development projects.
12. Logistical problems involved.

SELECTION OF PRIORITY AGRO-ECOLOGICAL ZONES

A list of major ecological regions of the developing world prepared by NCSU was used, and the criteria weighed in Table 1 on the following page.

In the course of this exercise it was decided to modify the agroecological zones as follows:

a. Seasonal non-acid tropics and semi-arid tropics were combined, so as to include the degree portion of the former and the master portion of the latter, i.e., the zone which has a (cumulative) growth period of 90-210 days, defined as the period of the year when enough soil water is available in upland sites.

b. Volcanic highlands and non-volcanic highlands were combined with other lower areas dominated by steep slopes in one category of steeplands.

Table 1. Weighed score of criteria by agro-ecological zones.

Agro-Ecological Zone	Criteria* and (Weight)										
	3 (x4)	4 (x4)	5 (x3)	6 (x3)	7 (x4)	8 (x1)	9 (x2)	10 (x2)	11 (x1)	12 (x2)	Sum
Seasonal Acid Tropics	8	-4	6	3	4	2	4	2	1	2	28
Seasonal, Non-Acid, Tropics	8	4	3	3	4	2	4	-2	1	2	29
Temperate Wetlands	4	8	-3	6	-4	2	2	2	2	2	21
Humid Tropics	8	-4	3	3	8	0	4	2	1	-4	21
Semi-Arid Tropics	4	4	-3	6	-4	2	2	0	1	2	14
Volcanic Highlands	-8	8	-3	3	4	1	2	2	1	2	12
Tropical Wetlands (Asia)	-4	8	-3	6	-4	1	2	3	1	2	11
Humid Temperate	4	4	-3	3	-4	1	2	2	1	2	12
Seasonal Temperate (Non-Africa)	4	4	-3	3	-4	1	2	2	1	2	12
Mediterranean	4	4	-3	3	-4	1	2	2	1	2	12
Non-Volcanic Highlands	-4	4	-3	3	4	1	2	-2	1	-2	4
Tropical Wetlands (Non-Asia)	-4	-8	3	3	8	-1	4	2	-1	-2	4
Seasonal Temperate (Africa)	4	4	-3	3	4	-1	2	-2	-1	-2	8

* Criteria 1 and 2 were equal in all ecological zones and therefore were not tallied.

c. Temperate and tropical wetlands (both Asia and non-Asia) were combined.

The final choice was made on the considerations that 1) research in soil problems could be expected to increase agricultural productivity within a reasonable time span, 2) the comparative advantages of the U. S. universities to conduct collaborative research, and 3) that the major constraints of the zones are indeed soil related and not water management related.

Five agroecological zones were finally selected, in a ranked order of priority. The Panel decided that the ranking reflects priorities in terms of resource allocation, i.e., if funding is limited to adequately support only the first three priorities, no work should start on the fourth and fifth ones. The five research priority agroecological zones are:

1. Humid tropics.
2. Seasonal, non-acid, tropics (90-210 days available soil moisture).
3. Seasonal, acid tropics.
4. Steeplands.
5. Wetlands, restricted to the management of non-rice crops grown in rotation with puddled rice.

The approximate location of the five zones is illustrated in Figure 1.

PRIMARY AND SECONDARY RESEARCH SITES

The Panel spent considerable time deciding where the most appropriate sites for conducting research would be. All sites are those where either a national or an international agricultural research center is presently work-

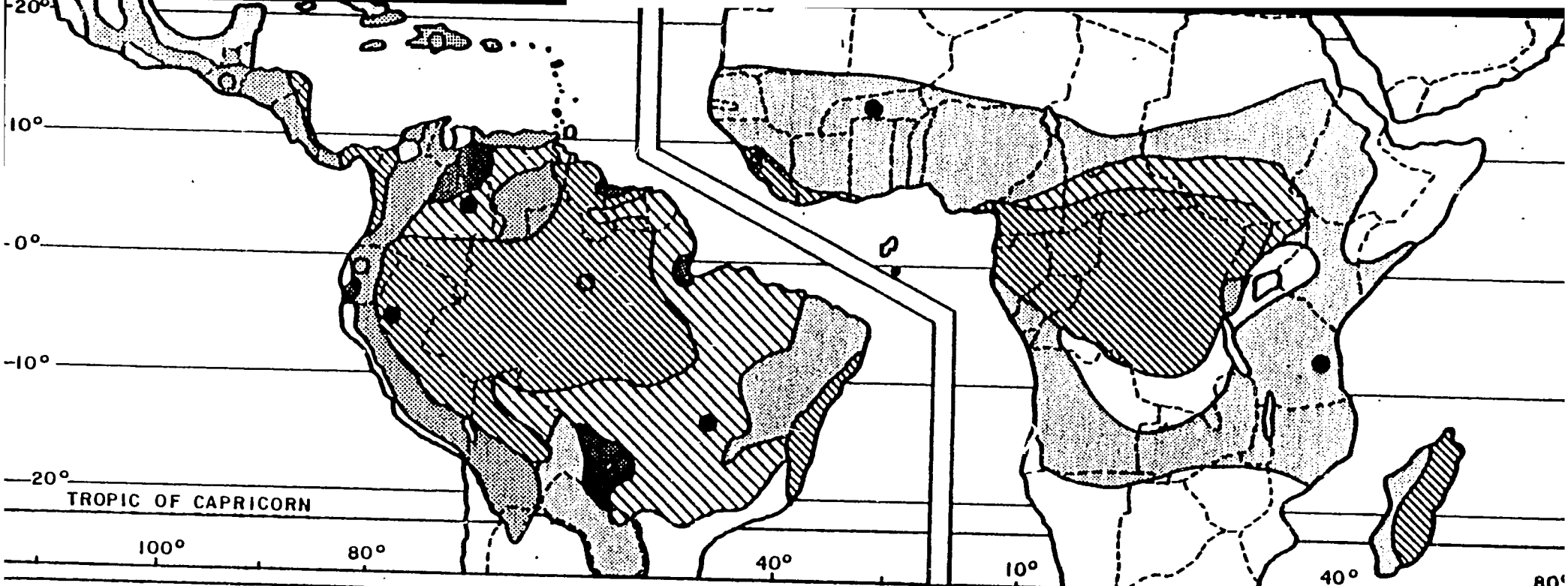


Figure 1.

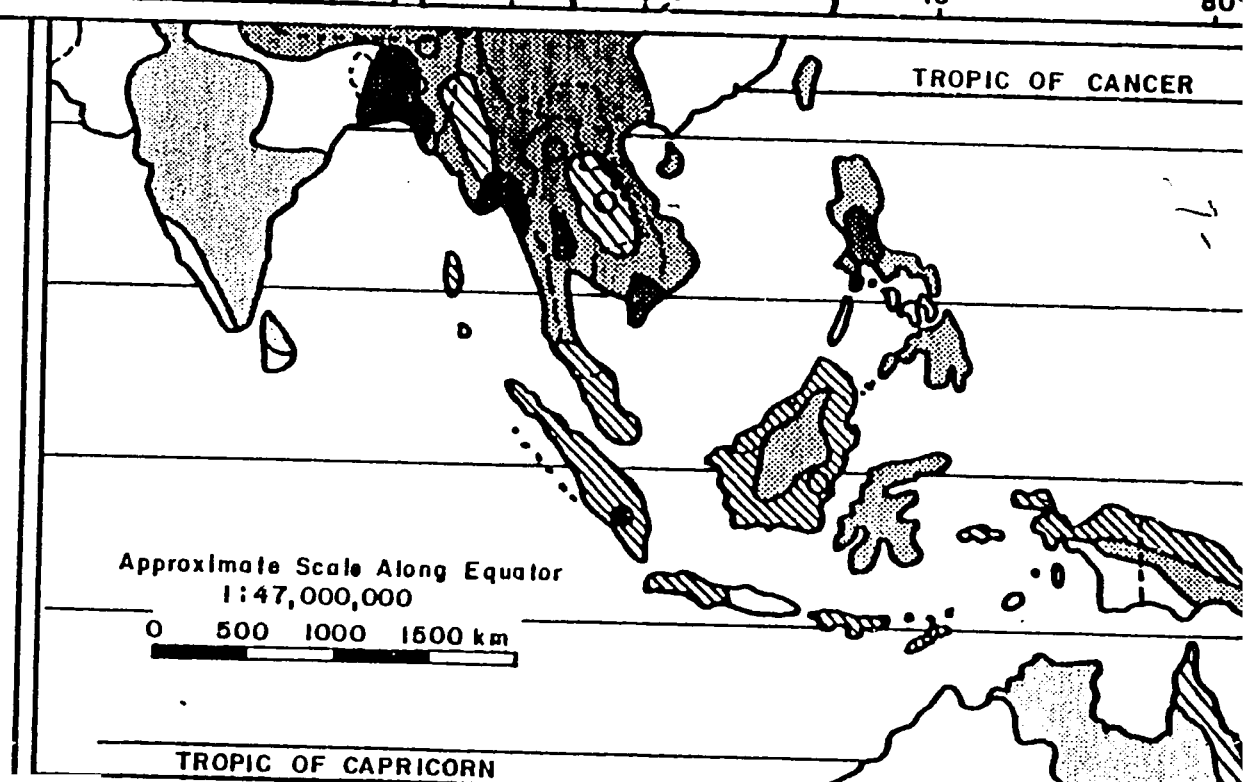
SOIL MANAGEMENT PLANNING GRANT

Target Areas of Priority Research Projects:

1. Humid Tropics
2. Seasonal, Non-Acid Tropics
3. Seasonal, Acid Tropics
4. Steeplands
5. Wetlands

● Potential primary research sites

O Other potential sites



ing, in order for the CRSP to be truly collaborative in nature. A primary site reflects major concentration on technology generation while a secondary site indicates technology validation research in a network fashion. The same criteria used for the selection of agroecological zones was applied to the site selection process.

1. Humid Tropics

The principal objective is to develop agronomically, economically and ecologically sound soil management systems for sustained agricultural production in these fragile but potentially very productive environments. America, Africa, and Asia were graded in relation to the criteria used to select the agroecological zones as follows:

Location	Area	Actual population	Future population	Research needs	Potential collab.	Devlpmt. projects	Logistics	Total
America	12	-4	6	4	2	1	2	23
Africa	8	8	3	4	-1	-1	-2	19
Asia	4	4	6	8	1	1	2	26

The Panel selected America (Amazon Basin) and Asia to be considered with equal priority, while Africa as an expansion area. The sites in each continent were ranked as follows:

1° Peru (Yurimaguas)

1° Sumatra (Palembang)

2° Cameroon (South of Yaounde)

3° Sierra Leone (Njala)

4° Brazil (Manaus)

5° Kalimantan, Indonesia (no location proposed)

2. Seasonal Non-Acid Tropics.

Seasonal non-acid tropics have high base status soils, and include both low activity clays, and to a lesser extent, high activity clays (mainly Vertisols), and are most significant in the African continent and the Indian subcontinent. Evolving management systems that prevent erosion and maximize the use of limited available soil moisture supplies are the main concerns.

The Panel agreed that the sites to be selected should cover both West and East Africa. The countries considered were the following: Senegal (Bambey), Gambia, Upper Volta (Ouagadougou), Niger (Niamey), Nigeria (Samaru), Sudan (Southern), Tanzania (Morogoro), Zambia (Lusaka), Brazil (Northeast), India and Sri Lanka (Maha Illupalamia). Network arrangements with IITA and ICRISAT could be developed.

On rating the above locations, the following priorities were proposed:

East Africa:

1. Tanzania (Morogoro)
2. Zambia (unspecified)

West Africa:

1. Upper Volta (Ouagadougou)
2. Niger (Niamey)

3. Seasonal, Acid Tropics.

Important areas of soils with low base status and a strong dry season are located in South America, mainly in the savannas of Brazil, Colombia, Venezuela and Bolivia. In Africa, areas of this nature exist in the central part, which are inaccessible at present. In Asia, smaller but socio-economically

very important areas are located on terraces of the main rivers, particularly in Northeast Thailand. The potential locations for primary sites are Brazil (Brasilia), Colombia (Carimagua), Bolivia (San Ignacio) and Thailand (Khon Kaen). A network arrangement with CIAT could be developed.

4. Steeplands

Important areas of steeplands are located throughout the developing world. The major and overriding requirement for steeplands is improved management of sloping land to conserve the soil resource base and to protect the adjacent-lower lands. In steeplands, therefore, there is a need for a multidisciplinary effort, rather than just a soil management approach. No areal priority could be established from technical considerations. However, it was felt that sites should be considered within the following steepland areas: Foothills of the Himalayas (India and Nepal); Ridge and valley region of continental Southeast Asia (Bangladesh, N. Thailand); South and Central American Andes (Ecuador, Guatemala); and the Caribbean (Dominican Republic/ Haiti).

5. Wetlands

The main problems of wetlands (i.e., lowland with rice-based cropping systems) are related to water management, and to specific adverse soil conditions (Histosols, acid sulfate soils, salinity/alkalinity, etc.). In most aspects related to soils, sufficient research is going on at present. However, the physical soil problems related to the use of hydromorphic rice land for "off season" dryland cropping is not sufficiently researched. There-

fore, wetlands are included in this priority list for this purpose only. In view of the large areal extent, the Ganges-Bramaputra Plain (Bangladesh) is proposed for possible site selection.

MAIN RESEARCH COMPONENTS

Table 3 shows a summary of the main research components to be considered by priority ecological zones. The first section of this table lists those components considered essential to all agro-ecological zones. Specific ones for each agro-ecological zone are listed in order of priority.

Table 2. Main research components common to all zones and specific ones per zone, the latter in ranked order of priority.

Agro-Ecological Zone	Main Research Components
All Zones	1. Soil fertility evaluation, including characterizing soil nutrient deficiencies and critical plant nutrient levels.
	2. Improving the land resource data base, including soil characterization and classification, evaluation, use and improvement of Soil Taxonomy.
	3. Technical soil classification systems for practical management purposes.
	4. Training soil scientists on the job, including graduate training.
	5. Continued field research to determine long-term effects of management practices.
1. Humid Tropics	1. Land clearing methods.
	2. Fertility management for continuous production with emphasis on the management of soil acidity, phosphorus, micronutrients, nitrogen (organic and inorganic) and cation balance.
	3. Select plants and rhizobia tolerant to soil constraints, mainly acidity and low P.
	4. Develop stable, low input systems to change from shifting to continuous agriculture, including intercropping or sequential plantings of annual crops, grass-legume pastures and/or trees. Emphasis on nutrient recycling.
	5. Erosion control, prevention and reclamation of eroded or compacted land.
	6. Residual effects of liming, phosphorus fertilization, organic and inorganic nitrogen.

Table 2 (continued)

Agro-Ecological Zone	Main Research Components
2. Seasonal, non-acid tropics	1. Practices to prevent or reduce detrimental effects of surface capping or crusting.
	2. Erosion control, prevention and reclamation.
	3. Develop low input systems that maximize the use of available soil water and maintain a continuous plant cover, including intercropping and agroforestry.
	4. Select plants and rhizobia tolerant to drought, low P and salinity.
	5. Management of soils with low activity clays to prevent secondary acidity and cation imbalances, including phosphorus and micronutrient research.
	6. Nitrogen fertilizer research with emphasis on minimizing risk.
	7. Alternatives to shifting cultivation, including use of improved land clearing methods, grass:legume pastures.
	8. Supplemental irrigation, where appropriate.
3. Seasonal, acid tropics	1. Phosphorus fertilizer management in high fixing soils.
	2. Select plants and rhizobia tolerant to acidity, low P and drought.
	3. Control of soil acidity, including Al chemistry, Al and Mn toxicity, liming, base recycling and secondary acidity.
	4. Soil-crop management systems to most economically utilize limited soil water, particularly during temporary droughts.

Table 2 (continued)

Agro-Ecological Zone	Main Research Components
	5. Low input cropping systems, including crops, pastures and trees, either intercropped or in sequence.
	6. Erosion control, prevention and reclamation via improved soil management systems.
	7. Secondary and micronutrient research, particularly S, Mg and Zn.
	8. Supplemental irrigation or intensive agriculture.
4. Steeplands	1. Erosion control is the overriding problem.
	2. Develop low input soil covering systems, including continuous cropping, intercropping crops with pastures and trees, promoting nutrient recycling, conserving lands with permanent forests.
	3. Optimize utilization of limited soil water.
	4. Fertility management with emphasis on acidity, nitrogen and phosphorus.
	5. Select plants that develop a quick soil cover, and rhizobia both tolerant to acidity, low P and drought.
	6. Irrigation, small systems with minimum investment.
5. Wetlands	1. Physical and chemical dynamics of wetland cultivation under flooded, puddled and dry conditions.
	2. Select plants and rhizobia adapted to poor soil physical conditions after rice growth.

APPENDIX I

Discussion Document #3

Summary of Research Priorities

August 30, 1979

The following tables are a compilation of the responses obtained from the USAID Missions and about 82 Assessment Reports. They are listed in order of their frequency in which they were mentioned as research priorities. Such frequency should not be considered as the main criterion for ranking since this is not a popularity contest, and because some original and highly important priorities may have been proposed by only one person.

Some difficulty was encountered in arriving at what was a common priority since each person expressed their thoughts in different terms.

The proposers of the top 20 priorities are tabulated as representatives of national or international institutions in which only the name of the country or the institution is given where appropriate. Numbers in parentheses after each country indicate more than one national institution. Individual U. S. based scientists are identified without mentioning affiliated institutions.

These tables are no substitute for reading the Assessment Reports and USAID Mission cables which describe with various degrees of emphasis and detail why the priorities were chosen. Considerable thought has been given to this task by approximately 150 scientists from both the developing and developed world.

You are not restricted to considering these 65 priorities. Feel free to add others if you wish, lump them or split then in different arrangements for analysis.

August 30, 1979

Soil Management Planning Process

Summary of Most Common Priority Research Areas in Assessment Reports and USAID Mission Responses

Research Priority (not ranked in order of importance)	Proposed by			
	National or International Institutions	USAID Missions	US based scientists	Prequenc
1. MANAGEMENT OF SOILS WITH LOW ACTIVITY CLAYS. (Oxisols, Ultisols, oxic alfisols) in humid and seasonal tropics, for sustained production and conservation.	Sierra Leone, CIAT, Univ. of Utrecht (Moormann), Thailand Sri Lanka, Peru (3), Brazil (5), ICRAF, IITA, Costa Rica, Guatemala, Sudan, FAO (Dudal), Kenya, FAO (Indonesia)	Ecuador, Bolivia, Indonesia, Colombia, Panama, Costa Rica, Zaire, Brazil, Peru	Van Wambeke, Kamprath Calhoun, Singer	35
2. EROSION, Predictability, control, prevention and reclamation in rainfed areas via improved soil management systems.	Sierra Leone, IITA, CIAT Univ. of Utrecht, IICA, Peru, Kenya, U. West Indies	Ecuador, Bolivia, Peru, Indonesia, D. Rep., Panama, Paraguay, Salvador, Jamaica, Lesotho, Costa Rica, Philippines	Mugwira, Simpson, Van Wambeke, Young, Singer, Cunningham, Blevins, Johnson, Brams - Collins, El-Swaify, Ekern, Fox	33
3. SOIL FERTILITY EVALUATION. Including research on characterizing soil nutrient deficiencies and matching with crop requirements, development of new soil tests, critical levels and nutrient balances for macro and micronutrients, specialist training, transfer to farmers.	Brazil (3), Sierra Leone, CIAT, Peru, IRRI, Guam, Kenya, Fed. Rep. of Germany	Bangladesh, Indonesia, Peru, Colombia, Dominican Republic, Costa Rica, Guatemala, Lesotho, Philippines	Cope, Young, Bleyins Johnson, Cunningham, Kanehiro, Kamprath, Kurtz, Uehara, Silva, Fox	30

;earch Priority ›t ranked in order of ›ortance)	Proposed by			
	National or International Institutions	USAID Missions	US based scientists	Frequency
IMPROVING THE LAND RESOURCE DATA BASE, including soil classification, use and improvement of Soil Taxonomy	ICRISAT, FAO(Indonesia), University of Wageningen, CIAT, Thailand, Sri Lanka	Guatemala, Philippines, Niger, Mali	Taylor, Simpson, Young, Hill, Brams - Collins, Silva, Hsiao	18
TECHNICAL SOIL CLASSIFICATION SYSTEMS FOR PRACTICAL MANAGEMENT PURPOSES, emphasizing topsoil properties or benchmarks, as technology transfer tools	Bangladesh, CIAT, FAO (Dudal), Brazil (2), Sri Lanka		Buol-Nicholaides, Hendershott, Mugwira Young, Cunningham, Johnson, Uehara Steckel, Fox	16
SOIL-CROP MANAGEMENT SYSTEMS TO MOST ECONOMICALLY UTILIZE LIMITED SOIL WATER, in semi-arid tropics, during temporary droughts, in acid sandy Sahel, moisture stress research networks	ICRISAT, ICRAF, Kenya, Guatemala, Sudan	Niger, Lesotho, Mali	Calhoun, Van Wambeke Johnson, Simpkins, Hsaio	13
SELECT PLANTS TOLERANT TO SOIL CONSTRAINTS, (acidity, salinity, low P, drought), involves breeding	FAO(Indonesia), ICRISAT, IRRI (2), CIAT, Peru		Kittrick, Bouldin-Lathwell, Simpson, Tucker, Hsiao	12
SHIFTING CULTIVATION/AGROFORESTRY, including changing from shifting to continuous cultivation, intercropping crops with pastures and trees and promoting nutrient cycling.	FAO(Indonesia), Brazil (2), Sri Lanka, Peru, ICRAF, CIAT	Peru, Indonesia, Philippines	Simpson, Thomas	12

Research Priority (not ranked in order of importance)	Proposed by			
	National or International Institutions	USAID Missions	US based scientists	Freque
9. CORRECTION OF SOIL ACIDITY, Al chemistry, Al and Mn toxicity, liming, base recycling, secondary acidity, extension.	Peru (2)	El Salvador	Kamprath, Cope, Mugwira, Kurtz, Lathwell - Bouldin, Blue, Thomas	12
10. SOIL CHARACTERIZATION AND MANAGEMENT IN BENCHMARK CROPPING SYSTEMS NETWORKS, in small farms, marginal mountain soils.	IRRI, Indonesia, Philippines, University of Wageningen, Sri Lanka	Philippines, Barbados Salvador, Colombia	Blevins, Kanehiro, Calhoun	11
11. INTERCROPPING SYSTEMS - FERTILITY MANAGEMENT, and other low input systems.	FAO (Indonesia), Sri Lanka, Peru	Barbados	Lathwell - Bouldin, Calhoun, Hill, Cope, Thomas, Silva	11
12. NITROGEN FIELD FERTILIZER RESEARCH, to maximize output per unit fertilizer N, sources, interactions, crop residues, organic manures, N fixation.	Guam, IRRI, Brazil		Bouldin - Lathwell, Cope, Kurtz, Blevins, Thomas, Tucker, Kissel	11
13. PHOSPHORUS FERTILIZER MANAGEMENT, fixation, rock phosphate, management, internal and external requirements	Thailand, CIAT, ICRISAT, Upper Volta		Lathwell - Bouldin, Blue, Kamprath, Kurtz	10
14. SALINITY, including correction by drainage, assessment, development of tolerant varieties, secondary (management induced) salinity.	IRRI	Syria, Tunisia, Bolivia, Jamaica, Dominican Republic	Cope, El-Swaify, Tucker	9

Research Priority (not ranked in order of importance)	Proposed by			
	National or International Institutions	USAID Missions	US based scientists	Frequen
15. TRAINING SOIL SCIENTISTS, on-the job, graduate education, developed country students, refresher courses.	Brazil (2), Kenya, ICRAF, Guatemala	Tunisia	Kanehiro, Buol-Nicholaides	9
16. MICRONUTRIENT FERTILIZATION RESEARCH, including soil status, plant requirements, responses, residual effects.	Brazil, Peru, Guam, IITA	Bangladesh, Philippines	Cope, Young	8
17. NITROGEN FIXATION AS RELATED TO SOIL CONSTRAINTS, including survival, selection of tolerant strains, use of legumes in crop rotations and pastures.	ICRISAT, CIAT	Mali	Halliday, Alexander, Tucker, Cunningham Fox	8
18. LONG-TERM FIELD RESEARCH, to determine residual effects of liming, P, crop residues, organic matter.	Fed. Rep. of Germany, Peru, CIAT		Kamprath, Cope, Van Wambeke, Bouldin-Lathwell	8
19. IRRIGATION, in general, extension into rainfed areas, drip irrigation.	Guam, FAO (Indonesia)	Tunisia, Jamaica, Bolivia	Young, Simkins, Johnson	8
20. ALTERNATIVE MECHANIZED LAND CLEARING SYSTEMS, for the humid tropics, where manual clearing is impossible.	FAO (Indonesia), Peru, IITA, Brazil (2)	Zaire		6

SUMMARY OF OTHER RESEARCH PRIORITIES: PHYSICAL PROPERTIES

Other Research Priorities (not ranked in order of importance, but listed in order of frequency)	Proposed by	No.
1. Minimum tillage	USAID/DR, Thomas, Blevins, Hill	4
2. Potential rooting depth of main crops in main soils	Taylor, Hsaio	2
3. Dynamic geochemistry of soil water	Thailand, Sri Lanka	2
4. Integrated watershed management	IITA, Buford	2
5. Soil compaction	Cunningham, Singer	2
6. Reduce energy requirements for breaking soil compaction	Nicou (Senegal)	1
7. Soil aggregation	Johnson	1

SUMMARY OF OTHER RESEARCH PRIORITIES: FERTILITY & MICROBIOLOGY

Other Research Priorities (not ranked in order of importance, but listed in order of frequency)	Proposed by	No.
1. Sulfur field fertilizer research	USAID/Bangladesh, Peru, IITA, Blair	4
2. Alternate oxidation-reduction conditions in rice soils	IRRI, University of Wageningen	2
3. Soil organic matter and its recycling	Brazil, Bouldin	2
4. Soil fertility management for grain legumes	Lathwell-Bouldin	2
5. Mycorrhiza inoculation in legumes	ICRISAT	1
6. Azolla and blue green algae	ICRISAT	1
7. Potassium	Blue	1
8. Use of sulfur to reclaim saline soils	Tucker	1
9. Methods of fertilizer application	Blue	1
10. Iron toxicity in wetlands adjacent to plinthite	Sudan	1

SUMMARY OF OTHER RESEARCH PRIORITIES: MANAGEMENT; MISCELLANY

Other Research Priorities (not ranked in order of importance, but listed in order of frequency)	Proposed by	No.
1. Delivery of soil management information to the farmer	USAID/Colombia, Cunningham, Johnson, Kanehiro	4
2. Data bank of soil and crop performance	Costa Rica, Uehara, Ikawa	3
3. Training planners and decision makers	Uehara, Buol-Nicholaides	3
4. Promote scientific workshops	Peru, Costa Rica, Brazil	3
5. Range management in semi-arid and arid areas	Johnson, Rafsnider	2
6. Desert encroachment	USAID/Ecuador, Rafsnider	2
7. Research on research coordination	Brazil, Van Wambeke	3
8. Logistical support to LDC institutions (reagents, etc.)	Brazil (2)	2
9. Open new lands in African wetlands	University of Utrecht	1
10. Integrating desert grazing and irrigated pastures	Rafsnider	1
11. Soil management for home gardens	Kurtz	1
12. Modern teaching aids	Brazil	1

APPENDIX 2

LIST OF COUNTRIES AND INDIVIDUALS WHO CONTRIBUTED TO THE ASSESSMENT PHASE OF THE SOIL MANAGEMENT PLANNING GRANT

(September 11, 1979)

1. Foreign-based institutions (except International Centers, including USAID Missions listing constraints).

Country	Institutions	Individuals	Country	Institutions	Individuals
Australia	1	1	Lesotho	1	1
Bangladesh	2	2	Malaysia	1	1
Barbados	1	1	Mali	1	1
Bolivia	2	2	Netherlands	3	3
Brazil	11	14	Niger	1	1
Burundi	1	1	Nigeria	1	1
Canada	1	1	Panama	1	1
Central Afr. Emp.	1	1	Paraguay	1	1
China, People's Republic	1	1	Peru	3	5
Colombia	1	1	Philippines	2	8
Costa Rica	2	2	Senegal	1	1
Dominican Rep.	4	5	Sierra Leone	1	1
Ecuador	1	1	Sri Lanka	1	12
El Salvador	1	1	Sudan	1	1
Ethiopia	1	1	Syria	1	1
France	1	3	Thailand	1	8
Germany, West	2	2	Trinidad	1	1
Ghana	1	1	U. Kingdom	1	1
Guatemala	2	2	Upper Volta	1	1
Guyana	1	1	Zaire	1	1
India	4	4			
Indonesia	2	2			
Jamaica	1	1			
Japan	1	1			
Kenya	3	7			
			Total		
				45	76	99

2. International Centers or Institutions

Institution	Individuals
CIAT	4
CIP	1
FAO	2
ICARDA	1
ICRAF	5
ICRISAT	6
IFDC	1
IICA	1
IITA	4
ILRAD	1
IRRI	4
11	30

3. U. S.-Based Institutions

Institution	Individuals
Alabama A & T	1
Arizona, Univ. of	1
California, Univ. of	2
Conn. Agr. Exp. Sta.	1
Colorado State Univ.	1
Cornell University	4
Florida, Univ. of	1
Guam, Univ. of	1
Hawaii, Univ. of	8
Illinois, Univ. of	2
Iowa State Univ.	1
Kansas State Univ.	3
Kentucky, Univ. of	2
Minnesota, Univ. of	1
Mississippi State Univ.	2
N. C. State Univ.	12
Ohio State Univ.	1
Oregon State Univ.	1
Penn. State Univ.	1
Prairie View A & M Univ.	2
Purdue Univ.	7
Rockefeller Foundation	1
Rutgers Univ.	1
Stephen Austin State Univ.	1
Soil Conservation Service	1
Texas A & M Univ.	1
Tuskeegee Institute	1
Utah State Univ.	1
Washington State Univ.	3
Wisconsin (River Falls)	2
World Bank	1
Total 31	68

4. Grand Total

	Total	Foreign	U. S.
Countries	46	45	1
Institutions	118	87	31
Individuals	197	129	68