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9. ABSTRACT

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REPORT OF CORNELL UNIVERSITY
FOR THE PERIOD
JULY 1, 1971 TO JUNE 30, 1972

A. TITLE: A Grant to Strengthen the Capabilities of Cornell University for Special Problems of Tropical Soils (Grant AID/CSD 2834)

B. GRANTEE: Cornell University

C. DIRECTOR: Drs. Matthew Drosdoff and Marlin G. Cline

D. STATISTICAL SUMMARY

1. Period of Grant: June 30, 1970 to June 30, 1975

2. Amount of Grant: \$500,000

3. Expenditures

3.1 For report period: \$86,763.73

3.2 Accumulated: \$111,994.32

3.3 Anticipated for next year: \$129,500.00

E. NARRATIVE SUMMARY

The effort expended on teaching the applications of soil science to the tropics had increased at Cornell to approximately 2.6 times its 1969-70 level by the end of FY 1971-72. The effort by permanent staff had doubled and represented about 13 percent of the total staff effort in soil science. Approximately 60 percent of this was supported by University resources.

The increased effort included: (1) incorporation of subject matter for the tropics in regularly scheduled courses in elementary soils, soil fertility, soil chemistry, and soil classification and genesis by permanent staff; (2) introduction of a course in soil mineralogy and a seminar on soils of the tropics by permanent staff; and (3) special lectures and seminars on soils of the tropics by

visiting authorities. A syllabus for a new course on cultural systems for soils of the tropics to start in FY 1972-73 had been developed. Plans and teaching material had been developed for the Cornell contribution to a Tropical Soils Institute sponsored by the Consortium in Puerto Rico for July-August of FY 1972-73. Counseling of graduate students from the tropics had increased in both quality and amount. Most of these accomplishments were made in 1971-72 but were initiated or planned during the first year of the grant, 1970-71.

Research effort under the grant has focused on answering questions raised by research conducted under an AID research contract for tropical soil investigations. It has included studies of micro-nutrients, organic matter, magnesium, the fate of applied nitrogen, interactions of weather, and mineralogy of tropical soils to explain and interpret data generated by the research contract.

Consultation in 1971-72 included visits to 10 institutions in five African countries and has resulted in documentation of those institutions distributed to AID and Consortium members. It also included one visit to Colombia, one to Brazil, and a number of meetings with AID officials and representatives of Consortium institutions.

Library holdings on soils of the tropics have been increased and consolidated, and reference card files have been developed for holdings in the departmental and college libraries.

Perhaps the most important accomplishment has been developed by depth and perspective of the subject matter of soil science for the tropics by permanent faculty and coordination of subject matter areas, stressing the interactions of specialized knowledge of soils of the tropics.

F. DETAILED REPORT

1. General Background and Purpose of the Grant: The general background and purpose of the five grants to Consortium members are described in the first section of this report. Within that context, Cornell University based its proposal on its need to develop broader and more unified perspective of the applications of soil science in the tropics for quality education, research, and service.

Cornell is far from the tropics. It has long recognized, however, that quality university programs cannot be achieved if the perspective of its faculty is provincial. The University has also recognized obligations as a public institution to serve as a resource for national and international programs and policies. This also requires broad perspective. Consequently, many University faculty, including those in soil science, have been encouraged to work in varied physical and cultural environments as a matter of policy.

Under these policies, faculty representing most of the major specialties of soil science had had substantial experience with soils of the tropics before the grant was initiated. That experience, however, had focused mainly on problems of individual specialties within soil science. Gaps in the range of subject matter also existed, as in the areas of mineralogy and soil-water relationships of soils of the tropics. The grant proposal of Cornell, therefore, focused on development of a comprehensive but unified perspective of soils of the tropics in relation to their uses and culture by concentrating on "Cultural Systems for Tropical Soils."

2. Objectives of the Grant: The objective of the grant to Cornell is to develop a comprehensive and unified perspective of soils of the

tropics in relation to their uses and culture. The objective implies a focus on the combination of practices necessary for viable cultural systems for tropical soils. Achievement of the objective requires coordinating knowledge of at least four areas of soil science-- (1) soil characteristics and classification, (2) plant nutrient requirements, (3) soil-water-plant relations, and (4) conservation and protection of different kinds of tropical soils. In addition, it requires supporting inputs for (1) the impact of climatic conditions on soil and crop behavior, (2) water management, (3) crop management, and (4) the economic and social environments within which knowledge and technology must be applied. To fulfill the objective, the grant provides for:

- (1) Participation of Cornell faculty, one of whom would serve as Cornell project leader and would coordinate Cornell's efforts with those of the other four cooperating institutions.
- (2) Visiting professorships through which Cornell would bring additional expertise and experience to the project.
- (3) Graduate assistantships and related support for students contributing to this project, including exchange students from the four cooperating institutions.
- (4) Travel of contributing staff and students.
- (5) Modification of existing soils courses and development of new courses to enhance teaching about soils.
- (6) Strengthening library and other informational services and preparation of training materials.

The activities under the grant have remained consistent with the original objective and provisions of the grant for implementation. No modification of the objective is contemplated.

3. Accomplishments

3.1 Teaching: Approximately \$35,800 of 211(d) funds were used for teaching a variety of aspects of soils of the tropics. The high

enthusiasm generated among students was a qualitative measure of substantial accomplishment. Specific activities include the following.

(1) Initiation of "Tropical Soil Discussions." This non-credit informal seminar met bi-weekly throughout the academic year. At each meeting a faculty member, student, or visiting professor led open discussion on a specific topic. Although attendance was voluntary, the number of participants was consistently between 25 and 45 people.

(2) Teaching activities of visiting professors and scientists. Five prominent scientists were brought to the campus on 211(d) funds for varying periods during the year:

Dr. S. K. DeDatta, Soil Scientist, International Rice Research Institute, for one week

Mr. Fernando Abruña, Soil Scientist, Agricultural Research Service, USDA, Puerto Rico, for two weeks

Dr. John Coulter, Tropical Soils Advisor, British Overseas Development Administration, for six months

Dr. James Silva, Professor of Soils, University of Hawaii, for nine months

Dr. Madan Dewan, Soil Scientist, FAO, for six weeks

These men gave 35 lectures and seminars during the academic year for students and faculty of soil science, crops, animal science, the college-wide International Agriculture program, and special student groups. In spite of competition with many other events, attendance was large and student enthusiasm remained high.

In addition to formal presentations, the visitors taught informally throughout their residence. They were available to graduate students and faculty for personal counseling. They participated actively in classes that focused on tropical soils and in a variety

of seminars. They injected a wealth of practical and scientific knowledge into the learning experience of at least 20 graduate students who engaged in personal communication with them.

(3) Modification of courses. Regularly scheduled courses in elementary soils, soil fertility, soil chemistry, and soil genesis and classification were modified substantially to accommodate knowledge acquired through the program in tropical soils. These four courses served about 340 students during the past year. Their enrollment is increasing steadily. Funds from the 211(d) grant contributed. Contributing funds from State sources are represented in the contributions other than 211(d) funds listed for teaching in Table 9.1.

(4) Tropical field laboratory. During the January intersession, 30 students from several fields of study were taken to Puerto Rico for two weeks' study of tropical agriculture, including its relationships to soils. This course was not initiated as a consequence of 211(d) funding, but 211(d) resources contributed to the teaching about tropical soils, both in Puerto Rico and during the seminar sessions that followed during the spring term.

(5) Tropical Soils Institute. During the 1971-72 fiscal year, 211(d) funds were used for planning and preparation of teaching material for the Tropical Soils Institute sponsored by the Consortium for July-August 1972 in Puerto Rico. The results of that project will be reported for FY 1972-73.

(6) Course in Cultural Systems for Tropical Soils. This course will be offered for the first time in the spring of 1973, but 211(d) funds were used in FY 1971-72 to develop the initial syllabus.

Dr. John Coulter developed a detailed outline while he was on the campus, and he tested it in part in lectures following the Puerto Rico field laboratory. Dr. Richard Fox, who will teach the course, spent two weeks at Cornell on leave from his duties in Puerto Rico to work with Dr. Coulter on the course outline.

Approximately 41 percent of the 1971-72 expenditure of 211(d) funds was used to develop the teaching in tropical soils. Since the initiation of the grant, a course in soil mineralogy has been established; knowledge about soils of the tropics has been introduced into courses in elementary soils, soil genesis and classification, soil fertility, and soil chemistry; and a syllabus for a course in cultural systems for tropical soils has been developed. The perspective of the teaching staff generally has been broadened through direct experience in the tropics and the impact of visiting professors.

3.2 Research: Approximately \$26,800 of 211(d) funds was used for research on soils of the tropics. All of this was used to augment research conducted under research contract AID/CSD 2490 for investigating the fertility requirements of important soils of the humid tropics. Work under that contract has raised many questions for which answers are needed to explain and interpret results. Funds of the 211(d) grant have been used to investigate these questions. The areas of investigation included the following during 1971-72.

- (1) The fate of nitrogen applied as various kinds of fertilizer to the kinds of soils used in field experiments
- (2) Micronutrient status of various kinds of soils used in field experiments
- (3) Microbiological aspects of organic matter decomposition under tropical conditions

- (4) The magnesium status of major kinds of soils of the humid tropics
- (5) Climatic data in relation to the incidence of drouth and its interaction with fertility in field experiments
- (6) Transformations of nitrogen in flooded soils
- (7) Mineralogical composition of major kinds of soils used for field experiments

Graduate research assistants were employed for varying periods on 211(d) funds for investigations 1-6; a research specialist was employed part time for investigation 7. Funds of the 211(d) grant were also used for part salary of the research project leader, for travel and subsistence of staff and graduate assistants to the Puerto Rico base of research operations, and for supporting supplies, communications, and clerical service.

Most of the investigations supported by 211(d) funds are still in progress, and the results obtained to date are significant mainly in the context of the research project to which they contribute. Results of that project are given in the annual report of the AID research contract. Investigations of the fate of nitrogen applied as fertilizer on soils used in the field experiments are complete, however. The results are of some interest by themselves and are summarized here.

Nitrogen transformations from applied ammonium sulfate and urea were followed with time in fallow field plots on each of three kinds of soil--a quartzipsammentic Haplorthox, an oxidic Tropeptic Haplorthox, and a kaolinitic Aquic Tropohumult. Movement of nitrate and ammonia was followed with depth over time and related to movement of chloride applied in parallel treatments. In all soils, urea produced ammonia

maxima within two weeks; nitrates formed rapidly and at about equal rates from ammonium sulfate and urea; and nitrates formed from either source moved downward in the soil as a function of water movement at the same rate as chloride. In the more sandy Psammentic Haplorthox, ammonium ions were also leached downward. Nitrogen applied before or at planting in the form of either ammonium salts or urea is subject to loss before crop roots can intercept it if water movement occurs during germination and seedling establishment.

Publications and manuscripts reporting work by Cornell on tropical soils during FY 1971-72 are listed below. Funds from the 211(d) grant contributed to research by Ferreira and by Weaver. The other work cited was supported mainly by other funds, though 211(d) resources supported travel by Dr. Fox to present his paper.

3.3 Published or in press

- Drosdoff, M. 1972. Soil micronutrients, pp. 151-162. In Soils of the Humid Tropics. National Academy of Sciences, Washington, D. C.
- Ferreira, F. F. 1972. The fate of nitrogen fertilizers applied to tropical soils. M. S. thesis, Cornell University.
- Lathwell, D. J., Dubey, H. H. and Fox, R. H. 1972. Nitrogen supplying power of some tropical soils of Puerto Rico and methods for its evaluation. Accepted for publication, Agron. Jour., November-December issue.
- Santiago, P. 1972. The role of organic matter in the inhibition of aluminum toxicity in an Ultisol. M. S. thesis, Cornell University.
- Van Raij, B. and Peech, M. 1972. Electrochemical properties of some Oxisols and Alfisols of the tropics. Soil Sci. Soc. Amer. Proc. 36:587-593.
- Zandstra, H. G. 1971. Aluminum toxicity in some highly weathered soils of the tropics. Ph. D. thesis, Cornell University.

3.4 Manuscripts

- Fox, R. H. Nitrogen fertilization in the humid tropics. A paper presented at a Tropical Soils Research Seminar sponsored by the International Institute of Tropical Agriculture, the Ford Foundation, and L'Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres at Ibadan, Nigeria, May 22-29, 1972.
- Weaver, R. M. Mineralogy of highly weathered and leached soils of the humid tropics. Submitted for publication in McGraw Hill Yearbook of Science and Technology.
- Weaver, R. M. Clay mineralogy of Ultisols and Oxisols of Puerto Rico. To be submitted to Soil Science.
- Weaver, R. M. pH dependent cation exchange selectivity of Oxisols and Ultisols. To be submitted to Soil Sci. Soc. Amer. Proc.
- Weaver, R. M. Influences of amorphous iron oxides and organic matter on the charge characteristics of highly weathered soils of the tropics. To be submitted to Clays and Clay minerals.
- Zandstra, H. G. and Bouldin, D. R. Measurement of aluminum toxicity: I. Effects of aluminum in soil solution on root growth. Submitted for publication in the Soil Sci. Soc. Amer. Proc.

3.5 Consultation: This item is divided into domestic and foreign consultation in the financial report. Domestic consultation includes Consortium Executive Committee meetings, consultation with and reporting to AID officials, consultation with individuals of Consortium institutions on plans for joint activities, and consultation with staff of Consortium and other U. S. institutions and individuals on subject matter of the Consortium. Foreign consultation includes participation in foreign seminars and conferences and consultation with scientists at foreign institutions. Salaries, travel and subsistence, and stenographic services for these activities are charged to consultation in Table 9.1.

Approximately \$9,300 of 211(d) funds were used for domestic consultation. Activities include two Executive Committee meetings,

one in Hawaii; the annual report and review by AID; two trips to consult AID officials, and consultation with scientists of TVA and North Carolina State University.

Approximately \$10,100 of 211(d) funds were used for foreign consultation. Professor Martin Alexander participated in a meeting of the Colombian Society of Soil Science and consulted with Colombian scientists while in the country. Professors Cline, Drosdoff, and Fox and Visiting Professor Coulter participated in a week-long seminar on tropical soils at Ibadan, Nigeria. Each had an assignment in the program. (Costs for air transportation were billed in FY 1972-73 and are not included in expenditures for 1971-72.) Following the seminar, the individuals visited various African institutions to establish relationships and assemble information about the institutions for the Consortium:

- M. G. Cline - (1) Soil Research Institute, Council for Scientific and Industrial Research, Kumasi, Ghana
- (2) University of Science and Technology, Kumasi, Ghana
- (3) IRAT Agricultural Research Center, Bambey, Senegal
- M. Drosdoff - (1) ORSTOM Center, Adiopodoume, Ivory Coast
- (2) IRAT Research Center, Bouaké, Ivory Coast
- (3) IRAT Agricultural Research Center, Bambey, Senegal
- (4) ORSTOM Center, Dakar, Senegal
- R. Fox - (1) Institute for Agricultural Research, Samaru, Nigeria
- (2) Ahmadu Bello University, Samaru, Nigeria
- J. K. Coulter - (1) Agricultural Officials, the Gambia

Reports on all of these visits have been distributed to Consortium members and AID. Individuals also consulted with officials of each AID country mission.

These visits provided an opportunity to appraise the facilities, staff, and work of eight African institutions that work with tropical soils and related problems. They provided bases for appraisal of published research results and of records of students who apply for graduate studies. Of equal importance, they provided personal contacts with scientists of the African institutions and with officials of AID country missions, which greatly assist communication. The visits also established contacts for potential work of American graduate students abroad. One such arrangement is currently being investigated. In most instances, the hosts also gave the visitors valuable information about soils and agriculture of the country, and opportunities were provided for field observations of soils and farming.

Professor Richard Arnold went to Venezuela in February 1972 for a year to consult with Venezuelan authorities on soil classification, soil survey, and resource planning. Two thousand dollars of 211(d) funds for his support is reported under foreign consultation in Table 9.1.

3.6 Library and reference: Approximately \$4,700 of 211(d) funds was spent on library acquisitions and compilation of reference material during 1972-72.

Acquisitions for the departmental library collection on tropical soils numbered 97. Duplicates were already available or were acquired for the stacks of the library of the college.

The card file of the departmental library was searched for holdings on soils of the tropics, and a separate card file was established for easy reference. The extensive card file of the college library was also searched and, when necessary, items of questionable

relevance were inspected in the stacks. A separate card file of college holdings on tropical soils, indexed by country or region and character of subject, was then established in the card catalog of the departmental library. This occupies one standard card file drawer.

A bibliography on manganese in soils of the tropics was completed and awaits editing before reproduction and distribution.

Cornell purchased a compilation of 480 abstracts of active research projects on soils and climates of the tropics from Smithsonian Science Information Exchange, Inc. and distributed sets to all Consortium members.

Initial contacts were made with TVA, the USDA-SCS Soil Geography Unit, and the CUSUSWASH Consortium about potential collaboration on bibliographical service for soils of the tropics. Cornell is proceeding with investigation of means for making the extensive bibliography of the SCS Soil Geography Unit available to the Consortium, or to a greater audience. Collaboration with TVA, CUSUSWASH, or both should be discussed at the next meeting of the Executive Committee.

4. Impact of Grant-Supported Activities in Developing Institutional Capabilities: Most of the impact has been on involvement and perspective of people. The grant has been used deliberately to sponsor activities that will involve as many as possible of the Cornell faculty in a variety of aspects of soil science applied to the tropics. Twelve of the faculty in soil science are actively contributing to studies of soils of the tropics. Graduate students supported by the grant involve the faculty members who represent their special interests. Visiting professors and scientists are used to involve both faculty

and students in scientific discourse and relevant problems. Faculty are provided travel and other support if it involves them in study of the subject or teaching about it. Devices such as seminars, special lectures, and small group or individual conferences are used to develop integrated perspective of the varied aspects of soils of the tropics and their use. It is believed that these impacts will be the ones of greatest long-term value for developing a resource for tropical soils at Cornell that will persist after the grant has terminated.

The impact is difficult to measure in quantitative terms, and that part which is attributable to the 211(d) grant is difficult to appraise as distinct from that resulting from the AID research contract. No attempt is made here to make that distinction, though those elements that relate to teaching, consultation, and library and reference are predominantly consequences of the 211(d) grant. The involvement of financial resources other than 211(d) funding given in Table 9.1 is the best quantitative estimate available. These aggregate about \$110,000 for 1971-72 and exceed expenditures under the grant. About \$48,000 of this is in Cornell salaries paid from sources other than AID funds, representing approximately 1 1/5 full-time equivalents of Cornell faculty and 1 3/4 full-time (40-hour week) equivalents of graduate students.

Functionally, the grant has strongly influenced teaching in three regularly scheduled courses that enrolled about 340 students. It has stimulated addition of two new courses, one in soil mineralogy and one in cultural systems for soils of the tropics. It has stimulated applications for graduate work on various aspects of tropical soils,

especially from African nations. It has established contacts between Cornell faculty and foreign scientists, which should provide continuing liaison and dialogue. The grant has provided library and reference resources that will have continuing value. Finally, the grant has made it possible to maintain a faculty position devoted mainly to enhancement of Cornell's capabilities in the subject, with prospects for continuation beyond the termination of the grant.

5. Utilization of Institutional Resources in Development: During FY 1971-72 three members of the faculty in soils were engaged in developmental work in lesser developed nations:

- R. Reuer; Philippines - Rice and corn programs
- R. Arnold; Venezuela - Soil survey and resource planning
- G. Olson; Iran - Soil survey interpretation

M. Drosdoff, D. Bouldin, and R. Fox consulted with Brazilian officials on establishment of cooperative soil research at Brasilia. M. Alexander consulted with Colombian scientists on problems of soil microbiology.

Three graduate students in soil science conducted thesis research in lesser developed countries on problems related to their development:

- W. Phillipson; Philippines - Aerial photo interpretation
- H. Zandstra; Colombia - Soil fertility
- G. Naderman; Colombia - Nutritional diseases of rice

Two of these have completed graduate studies and have accepted positions in developing nations. A fourth individual worked as a member of the Peace Corps in Brazil on rice research between his M. S. and Ph. D. candidacies.

Eighteen students from lesser developed nations were candidates for advanced degrees with majors in soil science at Cornell during FY 1971-72. Five others worked in soil science as a minor subject.

Three soil scientists from developing nations conducted post-doctoral studies at Cornell. These students in residence represented 11 developing nations of Africa, Latin America, Southeast Asia, and South Asia. Five graduate majors and six graduate minors in soils from North America have career commitments to work in developing nations.

6. Other Resources for Grant-Related Activities: The value of resources contributed from funding other than AID for 1971-72 are estimated in Table 9.1 as approximately \$110,300. This is exclusive of funds used for research on fertility of soils of the humid tropics under contract AID/CSD 2490. Table 9.1 gives the estimated distribution of these funds among teaching, research, consultation, and library and reference.

Approximately \$63,000 of the total was for salaries and wages, of which \$31,000 was from State appropriations, \$5,000 from institutional grants, and \$27,000 from direct support to individuals from sources outside Cornell. A Cornell contribution of \$31,000 for indirect costs of facilities and services used on the project is included in the total, calculated at the official rate for indirect costs based on 211(d) salaries and wages (Table 9.2). The total also includes costs of \$12,700 to New York State for fringe benefits provided employees on 211(d) salaries and wages. The State assumes these costs for all employees, whatever the source of funds. Minor expenditures for supplies, services, and communications from funds administered by Cornell are included. These contributions are summarized as follows.

Salaries and wages

State appropriations	\$31,000
Other institutional funds	5,000
Individual support	27,000
	<hr/>
Indirect costs (based on salaries and wages--Table 9.1)	\$ 63,000
	31,000
Fringe benefits (based on full-time salaries)	12,700
Supplies and services	3,000
Communications	600
	<hr/>
Total	\$110,300

7. Next Year's Plan of Work: Table 9.2 includes estimated grant expenditures by line items for 1972-73. Table 9.1 includes their estimated distribution by areas of activity.

7.1 Teaching: The 1972-73 estimate for teaching in Table 9.2 is approximately \$20,200 more than was spent for that function in 1971-72. The activities of 1971-72 will continue. These include (1) a course in Geography and Appraisal of Soils of the Tropics for graduate and advanced undergraduate students, (2) a resident course following field studies in the Caribbean area for graduate students, (3) a course in soil mineralogy oriented to the tropics, (4) the informal seminar "Tropical Soil Discussions," and (5) seminars and special lectures similar in number to those offered in 1971-72. The input of applications of soil science in the tropics into regularly scheduled soil courses will continue or increase but will be supported by funds other than those of the 211(d) grant. The increased expenditure will be mainly for the Cornell contribution to a Tropical Soil Institute sponsored by the Consortium in Puerto Rico during July and August 1972 and a new course "Cultural Systems for Tropical Soils" to be offered during the spring semester. Assistant Professor Richard Fox, who is headquartered in Puerto Rico, will be brought to the Cornell campus to

teach that course. Salaries are expected to account for \$16,000 of the \$20,200 increase; teaching supplies and services, for about \$1,600; student fees, for about \$1,700; and minor items of equipment, for most of the remainder. Mr. Carlos Zamora of Peru and Dr. E. W. Russell of England will contribute to the teaching as visiting professors.

7.2 Research: The expenditures for research in 1972-73 are expected to be about \$23,700 more than in 1971-72. Most of the work underway in 1971-72 will continue. Studies in support of the AID-financed research project will be increased through two additional graduate assistants on special problems and a research specialist for supporting laboratory studies. Salaries account for about \$18,000 of the estimated increase. The remaining increase has been budgeted for increased travel to overseas research locations and for research supplies and services.

7.3 Consultation: The estimated 1972-73 budget for consultation is approximately \$7,400 less than expenditures for 1971-72. The reduction is in foreign consultation, for which no major commitments of faculty have been scheduled as of this time. The amount budgeted for foreign consultation is mainly for the air fare for staff travel for the 1971-72 African consultations, for which transportation charges were billed after the end of the 1971-72 fiscal year. The expenditures for foreign consulting could exceed the budgeted amount, depending largely on whether or not AID takes initiative in requesting assistance.

7.4 Library and reference: Approximately \$5,300 more has been budgeted for library and reference service than was spent for that function in 1971-72. The increase is for services and supplies to make

the bibliographical material on tropical soils held by the Soil Geography Unit of the Soil Conservation Service available to Consortium members. There is some possibility that this material should be published, but that remains to be explored. Only a minor sum has been budgeted for publication in 1972-73.

8. Other: No additional matters to report.

9. Report of Expenditures

9.1 Distribution of 211(d) grant fund expenditures and contributions from other sources of funding (see Table 9.1).

9.2 Expenditure report, actual and projected (see Table 9.2).

9.3 Budget: Summary (see Table 9.3).

9.4 Budget: Detail (see Table 9.3).

Table 9.1. Distribution of 211(d) grant fund expenditures and contributions from other sources of funding (review period July 1, 1971 to June 30, 1972)

Object	211(d) Source ^a				Non 211(d) Source
	Period Under Review	Cumulative Total	Projected Next Year	Projected to End of Grant	
Teaching	\$35,800	\$ 46,900	\$ 56,000	\$200,000	\$ 30,100
Research	26,800	36,100	50,500	190,000	57,000
Consultation					
Domestic	9,300	12,300	9,300	37,000	10,700
Foreign	10,100	10,100	2,700	26,000	8,800
Library & Reference	4,700	6,600	10,000	44,000	3,700
Publication			500	2,000	
Other			500	1,000	
Total	\$86,700	\$112,000	\$129,500	\$500,000	\$110,300

^aTo nearest \$100

Table 9.2. Expenditure report, actual and projected (review period July 1, 1971 to June 30, 1972)

Line Items	Actual Expenditures		Projected Expenditures			
	Period Under Review	Cumulative Total	Year			Total
			3	4	5	
<u>Personnel Salaries & Wages^a</u>						
Resident Professors	\$28,753.46	\$ 43,116.63	\$ 48,500.00	\$ 46,500.00	\$ 26,000.00	\$164,116.63
Visiting Professors	16,494.34	18,794.34	15,000.00	24,000.00	20,000.00	77,794.34
Graduate Assistants	12,964.82	16,064.66	22,000.00	22,000.00	22,000.00	82,064.66
Clerical	5,654.65	7,126.83	6,000.00	6,000.00	6,000.00	25,126.83
Lab & Technical	<u>2,764.71</u>	<u>2,764.71</u>	<u>10,000.00</u>	<u>15,000.00</u>	<u>15,000.00</u>	<u>42,764.71</u>
Total	66,631.98	87,867.17	101,500.00	113,500.00	89,000.00	391,867.17
<u>Operational Support</u>						
Travel & Subsistence						
Domestic	8,896.69	10,915.46	7,000.00	7,000.00	7,000.00	31,915.46
Foreign	<u>2,822.07</u>	<u>3,223.07</u>	<u>5,000.00</u>	<u>5,000.00</u>	<u>5,000.00</u>	<u>18,223.07</u>
Total	11,718.76	14,138.53	12,000.00	12,000.00	12,000.00	50,138.53
Supplies & Services						
Equipment	4,855.99 ^b	5,024.12	8,000.00	8,000.00	8,005.68	29,029.80
Communications	97.50	567.50	2,000.00	2,000.00	2,000.00	6,567.50
Student Fees	664.50	664.50	1,500.00	1,500.00	1,500.00	5,164.50
Total	<u>2,795.00</u>	<u>3,732.50</u>	<u>4,500.00</u>	<u>4,500.00</u>	<u>4,500.00</u>	<u>17,232.50</u>
Total	20,131.75	24,127.15	28,000.00	28,000.00	28,005.68	108,132.83
Grand Total	\$86,763.73	\$111,994.32	\$129,500.00	\$141,500.00	\$117,005.68	\$500,000.00

^aIncludes hourly wages shown under "Operational Support" in original budget

^bIncludes library acquisitions, \$421.37; expendable supplies, \$2,224.62; services, \$210.00; advance for supplies overseas, \$2,000.00

Table 9.3. Budget detail (review period July 1, 1971 to June 30, 1972)

Name	Position	% of full time on project
SALARIES AND WAGES		
<u>Resident Professors</u>		
Drosdoff, M.	Professor (Project Leader)	63
Cline, M. G.	Professor	6
Weaver, M.	Assistant Professor	50
Total full-time equivalents: 1.19		
<u>Visiting Professors & Scientists</u>		
Abruña, F.	Visiting Scientist	4
DeDatta, S. K.	Visiting Scientist	2
Coulter, J.	Visiting Professor	50
Dewan, M.	Visiting Professor	8
Total full-time equivalents: 0.64		
<u>Graduate Assistants</u>		
Ferreira, F. F.	Graduate Research Assistant	11
Ritchey, D.	Graduate Research Assistant	50
Odeyemi, O.	Graduate Research Assistant	44
Kao, C.	Graduate Research Assistant	46
Rodriguez, M.	Graduate Research Assistant	25
Bockus, J.	Graduate Research Assistant	8
Forbes, T.	Graduate Assistant	23
Total full-time equivalents (based on 40-hour week): 2.07		
<u>Clerical</u>		
Hays, M. A.	Stenographer II	30
Schoneman, A.	Stenographer II	55
Total full-time equivalents: 0.85		
<u>Laboratory & Technical</u>		
Sardi	Research Specialist	13
Other, Temporary	Technicians	5
Total full-time equivalents: 0.18		

Table 9.3 (Cont.)

Name	To	Purpose	Cost
TRAVEL (T) AND SUBSISTENCE (S)			
<u>Domestic</u>			
Drosdoff, M.	Washington, D. C. (3 trips)	Consult & report, AID	\$ 324.42(TS)
	Hawaii	Executive Committee meeting	554.88(TS)
	Puerto Rico	Tropical soil research	221.55(TS)
Cline, M.	Washington, D. C. (2 trips)	Consult & report, AID	228.00(TS)
	Hawaii	Executive Committee meeting	541.48(TS)
	Puerto Rico	Cornell winter field course	263.75(S)
Weaver, M.	Puerto Rico (2 trips)	Tropical soil research	439.90(TS)
Lathwell, D.	Puerto Rico	Tropical soil research	102.85(S)
Ritchey, D.	Puerto Rico	Tropical soil research	2,138.99(S)
Scott, T.	Hawaii	Soils teaching workshop	356.20(S)
McCaskill, G.	Hawaii	Soils teaching workshop	353.65(S)
Coulter, J.	Puerto Rico	Cornell winter field course	261.50(S)
	N. C. State; Muscle Shoals	Consultation	244.00(TS)
Silva, J.	Cornell (from Hawaii)	Visiting Professor	807.48(T)
Dewan, M.	Cornell	Visiting Professor	987.11(S)
Abruña, F.	Cornell (from Puerto Rico)	Visiting Scientist	354.16(TS)
DeDatta, S. K.	Cornell	Visiting Scientist	98.82(S)
Fox, R.	Cornell (from Puerto Rico)	Consultation re. teaching	486.70(TS)
		Total Domestic	\$8,896.69
<u>Foreign</u>			
Drosdoff, M.	Nigeria	Tropical Soil Seminar IITA	
	Ivory Coast, Senegal	Consulting	565.46(S) ^a
Cline, M.	Nigeria	Tropical Soil Seminar IITA	
	Ghana, Senegal	Consulting	475.35(S) ^a
Fox, R.	Nigeria	Tropical Soil Seminar IITA	
	Kenya, Nigeria	Consulting	724.00(S) ^a
Coulter, J.	Nigeria	Tropical Soil Seminar IITA	273.50(S) ^a
	Cornell (from London)	Visiting Professor	251.00(T)
Alexander, M.	Colombia	Colombian Soc. Soil Sci., Consulting	532.76(TS)
		Total Foreign	\$2,822.07

^aTransportation billed FY 1972-73

Table 9.3 (Cont.)

EQUIPMENT COSTING MORE THAN \$100--None