

AGENCY FOR INTERNATIONAL DEVELOPMENT WASHINGTON, D. C. 20523 <b>BIBLIOGRAPHIC INPUT SHEET</b>	FOR AID USE ONLY <i>Batch #16</i>
---	--------------------------------------

1. SUBJECT CLASSIFICATION	A. PRIMARY <b>Serials</b>	Y-AF22-0000-GG50
	B. SECONDARY <b>Agriculture--Soil chemistry and physics--Tropics</b>	

2. TITLE AND SUBTITLE  
**Soil fertility and physical and chemical properties of tropical soils, report, 1972/1973**

3. AUTHOR(S)  
**(101) N.C. State. Dept. of Soil Science**

4. DOCUMENT DATE <b>1973</b>	5. NUMBER OF PAGES <b>26p.</b>	6. ARC NUMBER ARC <b>631.4.U58</b>
---------------------------------	-----------------------------------	---------------------------------------

7. REFERENCE ORGANIZATION NAME AND ADDRESS  
**N.C. State**

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publishers, Availability*)  
**(Adm. summary)**

9. ABSTRACT

10. CONTROL NUMBER <b>PN-RAA- 901</b>	11. PRICE OF DOCUMENT
12. DESCRIPTORS <b>Plant nutrition Soil fertility Tropics</b>	13. PROJECT NUMBER
	14. CONTRACT NUMBER <b>CSD-2835 211(d)</b>
	15. TYPE OF DOCUMENT

REPORT OF NORTH CAROLINA STATE UNIVERSITY  
FOR THE PERIOD  
JULY 1, 1972 TO JUNE 30, 1973

A. TITLE: A Grant to Strengthen the Capabilities of North Carolina State University in Special Problems of Tropical Soils (Grant AID/csd 2835)

B. GRANTEE: North Carolina State University

C. DIRECTOR: Dr. P. A. Sanchez

D. STATISTICAL SUMMARY

1. Period of Grant: November 2, 1970 to November 2, 1975

2. Amount of Grant: \$500,000

3. Expenditures

3.1 For report period: \$53,190

3.2 Accumulated: \$101,540

3.3 Anticipated for next year: \$189,960

E. NARRATIVE SUMMARY

The competency of North Carolina State University as a center of expertise in soils of the tropics continues to be significantly and measurably strengthened through the financial support provided by the grant during its third year of operation. Some specific manifestations of these improvements are:

- (1) A closely coordinated and expanded teaching, research and technical assistance program on soils of the tropics involving additional faculty and graduate students.
- (2) Closer coordination of efforts with other Consortium members, AID-sponsored organizations, international institutes and various national research and development agencies in Latin America.

- (3) The initiation of a graduate level course, "Characteristics and Management of Soils of the Tropics" at North Carolina State University and active participation in the Tropical Soils Institute held at Puerto Rico in July 1972.
- (4) Strengthening field research programs in Brazil, Peru and Central America and technical assistance activities in the region.
- (5) Additional on-site experience by 16 faculty members and 7 graduate students in 13 tropical countries.
- (6) Active involvement in planning the Consortium-sponsored Seminar on "Soils and the Development Process in Tropical America" to be held in Colombia in February 1974 as a step towards establishing a more identifiable network of workers in this field.

#### F. DETAILED REPORT

1. General Background and Purpose of the Grant: A grant to strengthen the capabilities of North Carolina State University in special problems of tropical soils was approved on November 2, 1970 for a five-year period. Its purpose is to increase the capability of the Soil Science Department in becoming a center of expertise for training, research, and technical assistance in soils of the humid tropics. The subject matter emphasis is on soil fertility and management; the initial geographical emphasis is Latin America. Additional financial support in the subject matter area is provided by two other AID-funded activities: The International Soil Fertility Evaluation and Improvement Program, (ISFEIP), Contract AID/1a 646 and a research program entitled "Agronomic-Economic Research on Tropical Soils", Contract AID/csd 2806.

## 2. Objectives of the Grant

### 2.1 Objectives restated

- (1) To establish a senior faculty professorial position at North Carolina State University in tropical soils to coordinate efforts of other departmental research activities in the tropics and those of the other four cooperating universities.
- (2) To provide visiting professorships through which North Carolina State University will bring additional expertise and experience from the other cooperating institutions and from other sources.
- (3) To provide graduate research assistantships for students in tropical soils in North Carolina State University degree granting programs.
- (4) To provide (a) for travel of graduate students to tropical areas for training, (b) for support of such students while overseas and (c) for travel and support of faculty to supervise them and to consult with cooperating institutions.
- (5) To provide graduate exchange assistantships so that students of the four cooperating institutions may have access to the strengths of North Carolina State University.
- (6) To modify existing soil courses and develop new courses in tropical soils for use by AID and the personnel involved in tropical soil and crop management and related activities in the less developed countries.
- (7) Strengthen library and other information services and provide support for the preparation of training materials on soil and crop management in the tropics.

2.2 Review of objectives: The activities during this report period remain consistent with these objectives. No modification of the original objectives is contemplated.

## 3. Accomplishments

3.1 Organization and personnel involved: The organizational scheme developed in the previous annual report has proved successful in

keeping the international activities of the Department in sharp focus. The basic approach continues to be direct faculty and graduate student involvement in tropical soils studies in such a way that the increased competence gained is woven throughout the fabric of the Department. At present nineteen professors and seventeen graduate students are involved in various degrees in teaching, research, and services in tropical regions (Table 3.1). Five faculty members and four graduate students are presently stationed in Central and South America and are involved in research or technical assistance activities supported by the two AID contracts.

The campus-based staff presently involved in tropical soils meets monthly to report on current research, field trips and to interchange ideas. An average of 25 people attend these meetings.

Table 3.1 Soil Science Department staff involved in tropical soils teaching, research, and technical assistance programs

Faculty

- C. B. McCants, Professor and Department Head.  
 P. A. Sanchez, Assistant Professor and Project Leader, Grant csd 2835 and Contract csd 2806, tropical soils teaching and research.  
 J. W. Fitts, Professor and Director, International Soil Fertility Evaluation and Improvement Program, (ISFEIP) Contract Ia 646.  
 W. V. Bartholomew, Professor, organic matter transformations.  
 S. W. Buol, Professor, soil genesis teaching and research.  
 R. B. Cate, Visiting Associate Professor, ISFEIP, (Guatemala).  
 M. G. Cook, Professor and Coordinator, Academic Affairs.  
 F. R. Cox, Associate Professor, soil micronutrient research.  
 J. W. Gilliam, Associate Professor, analytical services.  
 A. H. Hunter, Visiting Associate Professor, ISFEIP, Laboratory development.  
 E. J. Kamprath, Professor, soil fertility teaching and research.  
 G. S. Miner, Visiting Assistant Professor, ISFEIP, (Costa Rica).  
 R. E. McCollum, Associate Professor, soil fertility research.  
 D. D. Oelsgle, Visiting Assistant Professor, tropical soils research (Costa Rica).  
 S. S. Portch, Visiting Assistant Professor, ISFEIP, (Panama).  
 J. L. Walker, Visiting Associate Professor, ISFEIP, (Guatemala).  
 D. L. Waugh, Visiting Associate Professor, ISFEIP.  
 S. B. Weed, Professor, soil chemistry teaching and research.  
 A. G. Wollum, Associate Professor, soil microbiology teaching and research.

Graduate students in tropical soils supported by 211(d) funds

- S. T. Benavides (Colombia), soil genesis (Dr. Buol).  
 M. A. Granger (Guyana), soil genesis (Dr. Buol).  
 A. S. Lopes (Brazil), soil micronutrients (Dr. Cox).  
 F. T. Turner (USA), soil chemistry (Dr. Gilliam).  
 D. G. Rossiter (USA), soil genesis (Dr. Buol).

Graduate students in tropical soils supported by other funds

- A. Alvarado (Costa Rica), soil genesis (Dr. Buol).  
 E. Gonzalez (Paraguay), soil fertility (Dr. Kamprath).  
 I. Lepsch (Brazil), soil genesis (Dr. Buol).  
 C. E. Lopez (Dominican Republic) soil fertility (Dr. Sanchez).  
 A. Manzano (Bolivia), soil fertility evaluation (Dr. Fitts).  
 J. Mendez (Panama), soil fertility (Dr. Kamprath).  
 F. Munevar (Colombia), soil microbiology (Dr. Wollum).

C. E. Seubert (USA), soil fertility (Dr. Sanchez).  
P. Solorzano (Venezuela), soil fertility (Dr. McCollum).  
E. J. Tyler (USA), soil genesis (Dr. Buol).  
S. Villagarcia (Peru), soil fertility (Dr. McCollum).  
M. K. Wade (USA), soil fertility (Dr. Sanchez).  
R. S. Yost (USA), soil fertility (Dr. Kamprath).

---

3.2 Teaching: A new course entitled "Characteristics and Management of Soils of the Tropics" (SSC 501) was taught during the fall semester by Dr. P. A. Sanchez. The course applies the principles of soil science to tropical environments with emphasis on (1) geographical occurrence and morphological soil properties in major tropical regions, (2) fertility problems in tropical areas, and (3) soil management systems such as flooded rice culture, shifting cultivation, subsistence cropping, extensive pasture production and plantation crops.

Most of the students who enroll in the course are involved in tropical soils research but some are majoring in other disciplines such as forestry, crop science and agricultural engineering. The student evaluation indicated that such a course was useful to their needs. About half the students were U. S. citizens and half from Latin America, Africa and Asia.

Three faculty members and three graduate students participated in the Tropical Soils Institute held at the University of Puerto Rico on July 10 to August 4, 1972. Dr. S. W. Buol lectured for two weeks on soil classification, Dr. E. J. Kamprath lectured and served as

discussion leader in the soil chemistry and fertility section for three weeks. Dr. P. A. Sanchez organized the soil management section, lectured and served as discussion leader for four weeks. Messrs. C. E. Seubert, E. Gonzalez and R. S. Yost, students from North Carolina State University, took the course for credit in preparation for research assignments in Peru and Brazil. The faculty and graduate students felt that the course was worthwhile experience and appreciate the efforts of the University of Puerto Rico in making it a success.

The Soil Fertility Evaluation Seminar was held for its eighth consecutive year under the sponsorship of ISFEIP. Lectures were given by faculty employed under the 1a 646 and csd 2806 contracts, the 211(d) grant and state and federal appropriations for operation of the University.

3.3 Visiting scientists and seminars: Ing. Carlos Zamora, head of the soil survey of Peru spent two weeks on campus lecturing and consulting with the faculty on matters of mutual interest. Dr. John Freeney, CSIRO, Australia spent three days lecturing and consulting on sulphur aspects of tropical areas. Dr. Carlos Valverde of the Peruvian Ministry of Agriculture also spent three days discussing cooperative soil fertility programs. Dr. E. W. Russell of the University of Reading, England spent several days visiting the Department and giving inspiring lectures on tropical agriculture. All these visits were sponsored by the 211(d) program.

Many other visitors spent a few days consulting and usually gave seminars to the Department or at the tropical soils meeting. During this year the following scientists visited us in relation to tropical soils activities: Dr. Christopher R. Panabokke, Mahaweli Development Board, Sri Lanka; Dr. Thomas H. Wickham, International Rice Research Institute, Philippines; Dr. A. Colin McClung, Centro Internacional de Agricultura Tropical, Colombia; Dr. Richard L. Sawyer, Centro Internacional de la Papa, Peru; Dr. Earl H. Heady, Iowa State University; Dr. Adrian Yñiguez and Ing. Carlos Miaczynski, Universidad de Buenos Aires, Argentina.

3.4 Research: There are currently three students on Doctoral programs and one on a Master's degree program funded by the 211(d) grant (Table 3.1). The nature of their program was described in the previous annual reports. Mr. Benavides obtained his doctorate in January 1972 after completing his studies of characteristics of soils of the Colombian Amazon Jungle.

The 211(d) grant has been used to supplement the support of research by faculty and graduate students in order to make their efforts more meaningful to developing areas. For example, Mr. José Mendez-Lay is a graduate student from Panama whose tuition and subsistence is supported by a USAID scholarship. Funds from the 211(d) grant were used to enable him to travel to Panama and obtain soil samples for greenhouse and laboratory studies on lime-phosphorus interactions.

Similar supplemental support has been provided for research projects conducted by graduate students on soils from Costa Rica and Colombia.

3.5 International travel: Faculty travel to tropical regions supports many of the grant's objectives. It increases the individual's experience in specific tropical areas and problems, it allows him to become personally acquainted with personnel and on-going programs at different institutions, and it often provides consultation services to the host countries. A total of 16 professors and 7 graduate students either are stationed in or spent short-term assignments in 13 countries of Latin America, during this year, for a total of 23 man-months away from the campus. Three professors and three graduate students traveled to Puerto Rico under grant support. Eighteen days of faculty travel within the United States to coordinate activities among the Consortium universities was also supported by grant funds.

A summary of travel activities follows:

Dr. S. W. Buol, E. J. Kamprath, P. A. Sanchez, and three graduate students: Christopher Seubert, Enrique Gonzalez, and Russell Yost participated in the Tropical Soils Institute held in Puerto Rico from July 10 to August 5, 1972 as previously described.

Mr. Jose Mendez-Lay, a graduate assistant from Panama, returned to his country to obtain soil samples for his study on lime-phosphorus interactions from June 12 to July 5, 1972.

Dr. P. A. Sanchez attended the annual meeting of the American

Society of Agronomy at Miami, Florida from October 30 to Nov. 3, 1972.

During the year, there was a significant amount of international travel, and almost exclusively in the tropical regions, by members of the faculty and staff in fulfilling the responsibilities of contracts 1a 646 and csd 2806. The details of these trips are recorded in the annual reports for these contracts. Although no 211(d) grant funds were involved the experience gained and contributions made by the individuals are supportive of the general objectives of the 211(d) program.

3.6 Information resources: A significant amount of reference material relevant to tropical soils that was previously not available in Raleigh has been obtained by the department. This includes valuable unpublished materials as well as an increased number of books and periodicals now organized and shelved in a place accessible to staff and graduate students.

3.7 The following articles on tropical soils were written by the Soil Science Department staff during the report period. Those supported by the 211(d) grant are identified.

- Bartholomew, W. V. 1972. Soil nitrogen in the tropics. In Sanchez (ed): "A Review of Soils Research in Tropical Latin America". pp. 93-120. Soil Science Department, North Carolina State University.
- Bartholomew, W. V. 1972. Soil nitrogen: supply processes and crop requirements. Int. Soil Fertility Evaluation and Improvement Program. Tech. Bull. No. 16.
- Benavides, S. T. 1972. Mineralogical and chemical characteristics of some soils of the Amazonia of Colombia. Ph.D. thesis, North Carolina State University. 216 pp. (Supported by 211(d) funds).
- Buol, S. W. 1972. Soil genesis, morphology and classification. In Sanchez (ed): "A Review of Soils Research in Tropical Latin America". pp. 1-51. Soil Science Department, North Carolina State University.
- Buol, S. W., F. D. Hole and R. J. McCracken. 1973. Soil Genesis and Classification. The Iowa State University Press, Ames. 348 pp. (A basic text with ample references from the tropics).
- Cox, F. R. 1972. Potassium. In Sanchez (ed): "A Review of Soils Reserach in Tropical Latin America". pp. 183-192. Soil Science Department, North Carolina State University.
- Cox, F. R. 1972. Micronutrients. In Sanchez (ed): "A Review of Soils Research in Tropical Latin America". pp. 244-263. Soil Science Department, North Carolina State University.
- Ezeta, F. N. and R. E. McCollum. 1972. Dry matter production, nutrient uptake and removal by Solanum andigena in the Peruvian Andes. Amer. Potato Journal. 49:151-163.
- International Soil Fertility Evaluation and Improvement Program. 1971. The evaluation and improvement of fertility in Latin America. Annual Report. Soil Science Department, North Carolina State University.

- Kamprath, E. J. 1972. Potential detrimental effects from liming highly weathered soils to neutrality. Proc. Soil Crop. Sci. Soc. Florida. 31:200-203.
- Kamprath, E. J. 1972. Soil acidity and liming. In Sanchez (ed): "A Review of Soils Research in Tropical Latin America". pp. 167-172. Soil Science Department, North Carolina State University.
- Kamprath, E. J. 1972. Phosphorus. In Sanchez (ed): "A Review of Soils Research in Tropical Latin America". pp. 205-237. Soil Science Department, North Carolina State University.
- Kamprath, E. J. 1972. Sulfur. In Sanchez (ed): "A Review of Soils Research in Tropical Latin America". pp. 238-243. Soil Science Department, North Carolina State University.
- Kawano, K., P. A. Sanchez, M. A. Nureña and J. Velez. 1972. "Upland Rice in the Peruvian Jungle". pp. 637-643. "Rice Breeding" International Rice Research Institute, Los Baños, Philippines.
- Lepsch, I. F. 1973. Genesis, morphology and classification of soils in an Oxisol-Ultisol toposequence in Sao Paulo State, Brazil. M.S. thesis. North Carolina State University. 89 pp.
- Lutz, J. F. 1972. Soil physical properties. In Sanchez (ed): "A Review of Soils Research in Tropical Latin America". pp. 52-61. Soil Science Department, North Carolina State University.
- McCants, C. B. 1972. Movimiento de nitrógeno en el suelo. Suelos Ecuatoriales. 4(1):29-34. (Partially supported by 211(d) funds).
- Sanchez, P. A. 1972. Nitrogen fertilization and management in tropical rice. North Carolina Agr. Exp. Sta. Tech. Bull. 213. Spanish version in Suelos Ecuatoriales. 4(1)197-240. (Partially supported by 211(d) funds).
- Sanchez, P. A. 1972. Técnicas agronómicas para optimizar el potencial productivo de las nuevas variedades de arroz en la America Latina. Centro Internacional de Agricultura Tropical, Cali, Colombia. (Supported by 211(d) funds).

- Sanchez, P. A. 1972. Soil management under shifting cultivation. In Sanchez (ed): "A Review of Soils Research in Tropical Latin America". pp. 62-92. Soil Science Department, North Carolina State University.
- Sanchez, P. A. 1972. Nitrogen fertilization. In Sanchez (ed): "A Review of Soils Research in Tropical Latin America". Soil Science Department, North Carolina State University.
- Sanchez, P. A. and M. A. Nureña. 1972. Upland rice improvement under shifting cultivation systems in the Amazon Basin of Peru. North Carolina Agr. Exp. Sta. Bull. 210.
- Sanchez, P. A. and N. Larrea L. 1972. Influence of age of seedlings at transplanting on rice performance. Agronomy Journal 64(6):828-833.
- Sanchez, P. A. 1973. Puddling tropical rice soils I: Growth and nutritional aspects. Soil Science 115:149-158.
- Sanchez, P. A. 1973. Puddling tropical rice soils II: Effects of water losses. Soil Science 115:303-308.
- Sanchez, P. A. and A. M. Briones. 1973. Phosphorus availability of some Philippine rice soils as affected by soil and water management practices. Agronomy Journal 65:226-228.
- Soil Science Department. 1972. Agronomic-economic research on Tropical Soils. Annual Report Contract AID/csd 2806. 43 pp.

3.8 Proportion of expenditures: Grant expenditures during this year were approximately distributed as follows: teaching 32%, visiting scientists and seminars 6%, research 43%, on-site studies 12%, services and consultation 5%, library resources 2%.

#### 4. Impact of Grant-Supported Activities in Developing Institutional Capabilities:

The above activities have strengthened demonstratively the Soil Science Department's expertise in soils of the tropics. The strategy

of involving a major proportion of the faculty and graduate students in tropical studies directly or indirectly insures a truly departmental effort. The new and modified courses plus the many seminars and informal discussions have increased the international atmosphere of the department. Study trips to new areas have substantially broadened the personal experience of the faculty and has reduced local biases caused by limited experience in one or two tropical regions.

Frequent contacts with the staff from the other Consortium members has been extremely worthwhile due to the many and intensive informal discussions.

5. Utilization of Institutional Resources in Development:

Since its inception, the Soil Science Department has directly contributed to the development of soil science in the tropics through various means. A summary of such contributions related to the training of graduate students for tropical areas, the North Carolina State University Agricultural Mission to Peru, (Contract AID/1a 510), the International Soil Fertility Evaluation and Improvement Program (Contract AID/1a 646) and the Tropical Soils Research Contract (Contract AID/csd 2806) have appeared in the previous annual report. With the exception of the Peru Contract which terminated on January 31, 1973, all the other activities have continued and in many cases expanded.

An estimation of the degree of the total involvement of the

Department in tropical soil science is the actual time spent overseas by Soil Science Department faculty and graduate students (Table 3.2). This table shows that the Department devoted approximately 10.3 man-years overseas in assignments related to tropical soil science. Of these, 8.4 man-years were contributed by the faculty and graduate students stationed in several countries, some of which also devoted considerable time to assistance in neighboring countries.

The campus-based staff spent a cumulative total of 1.9 man-years in 55 short-term visits to 14 countries by 16 professors and 7 graduate students. Most of these short visits provide support for on-going technical assistance and research projects in various Latin American countries. A small proportion of them served to establish and continue relations with local soil scientists and AID Missions as well as continuing contacts with former graduate students now occupying key positions in Latin America.

The absence of visits outside of Latin America emphasizes our commitment to this region but does not imply lack of interest towards other regions. During the months immediately preceding this report period, several faculty members travelled to Africa, Europe and Asia. The successive visits to specific countries imply gathering more in-depth knowledge and deeper involvement in the development process of those countries.

Some of this year's highlights in direct involvement overseas

Table 3.2. Actual overseas involvement by North Carolina State University, Soil Science Department Staff from July 1, 1972 to June 30, 1973 (Includes personnel on contracts la 646 and csd 2806.)

Country	Campus-based Staff		Overseas staff	Total
	Trips	Man-days	Man-days	Man-months
Brazil	8	189	810	33.3
Peru	6	62	870	31.0
Costa Rica	9	63	540	20.1
Guatemala	4	83	275	12.0
Panama	4	14	245	8.6
Ecuador	4	42	120	5.4
Puerto Rico	6	160	0	5.3
Nicaragua	2	6	90	3.2
El Salvador	3	9	60	2.3
Honduras	1	2	30	1.1
Guyana	2	29	0	1.0
Colombia	4	23	0	0.8
Paraguay	1	3	0	0.1
Venezuela	1	3	0	0.1
Total trips	55			
Total Man-months		1.9	8.4	10.3

are summarized below:

1) Establishment of new soil testing laboratories in Ecuador and on-site training courses in Ecuador and Guyana. (Contract Ia 646).

2) Teaching the Tropical Soils Institute at Puerto Rico to 50 participants from 11 developing countries. (211(d) grant).

3) Initiation of on-site field research progress in Yurimaguas, Peru; Brasilia, Brazil; Turrialba, Palmar Sur, Liberia in Costa Rica; and in five sites in northern El Salvador. (Contract csd 2806).

4) Assisting USAID/Panama in evaluating the technical adequacy of soils and land use classification in relation to a proposed sector loan. (211(d) grant).

5) Assisting the Ford Foundation and CIAT in evaluating the needs for increasing upland rice research in Brazil. (Foundation support).

6) Organizing a seminar on "Soil Management and the Development Process in Tropical America" to be held at CIAT, Colombia in February 1974 sponsored by the Consortium, AID, CIAT, the Colombian and Latin American Societies of Soil Science. The purpose of this seminar is to gather the leading Latin American and U. S. soil scientists to discuss recent relevant advances in tropical soils research as a means for developing a "research network" among tropical soil scientists in this hemisphere. A Steering Committee was formed by Dr. J. M. Spain, (CIAT); F. Fernandez, (CIAT); R. Pietri, (Puerto Rico); L. A. Leon, (ICA); T. S. Gill, (AID); and P. A. Sanchez, Chairman. The Steering

Committee timetable is proceeding on time. (211(d) grant).

7) Close cooperation with Cornell University in a joint research project at Brasilia. Cornell and North Carolina State University each are providing two scientists who work together as a team. (Contract csd 2806).

8) Assisting the Tennessee Valley Authority in the operation of their new AID contract for testing new fertilizers in tropical crops. (TVA support).

9) Assisting the Research and University Relations Office of USAID Washington in developing strategies towards improving the transfer of information to developing countries. (211(d) grant).

10) Translation into Spanish of the "Review of Soils Research in Tropical Latin America" with the assistance of the Instituto Interamericano de Ciencias Agricolas in Turrialba, in order for this information to be more accessible to Latin American soil scientists. (Contract csd 2806).

11) Distribution of the Department's publication to a list of over 350 soil scientists throughout the world. (Contract csd 2806).

6. Other Resources for Grant-Related Activities:

The Soil Science Department conducts extensive programs in four broad categories: (1) teaching, (2) research, (3) extension, (4) international. Involved in these programs are 47 professional soil scientists (38 Ph.D., 7 M.S., 2 B.S. degree) and a supporting staff

of 27 technicians and 13 secretaries, for a total full-time personnel input of 87. In addition, there are 37 graduate students working on projects within these categories. The approximate annual cost for salaries and fringe benefits for the faculty and staff is \$1.2 million. About 75 percent of this personnel cost is paid from appropriated funds. The approximate annual cost for operation, other salaries and fringe benefits, is \$750,000; less than 2 percent is paid from the 211(d) grant.

There is a thorough intermix of personnel activities among the four categories described above and only a small percentage are engaged totally in one category. The data in Table 3.1 shows that approximately 40 percent of the faculty in the department (19 of 47) are involved in international programs that are directly related to the purpose of the 211(d) grant. Of the total cost of operating the department (approximately \$1.95 million dollars), approximately \$600,000 (see Table 9.1), or 30 percent, is directed to activities related to the 211(d) grant; whereas the financial support from the grant is less than 3 percent of the total. These facts clearly illustrate that the University, through its Soil Science Department, has a solid base of expertise in soil science, is providing major support to sustain the base, and is involving a high percentage of the faculty in the department in 211(d)-related activities. Funds provided by the 211(d) grant have been and will continue to be used

to deepen, rather than broaden, the base with emphasis on increasing the expertise of faculty interested and engaged in teaching, research or extension programs related to tropical soils.

7. Next Year's Plan of Work: The process of further analyzing and modifying current courses offered by the department will continue to incorporate, where appropriate, subject matter relevant to tropical areas.

Three faculty members will participate in the Tropical Soils Mineralogy workshop to be held in Hawaii from July 8-22, 1973 under the auspices of the Consortium.

The main 211(d) effort for next year will involve the planning and execution of the Seminar to be held at CIAT in Colombia. North Carolina State University has been given the responsibility for providing the coordinating leadership.

Dr. Goro Uehara of the University of Hawaii will be a Visiting Professor on campus from January to August 1974 while on sabbatical leave. Several short term visitors are expected to be supported by 211(d) funds.

The extensive involvement in graduate programs on tropical soils will be continued. Additional graduate student programs funded by the 211(d) grant are anticipated during the year.

On-site visits will continue to countries where related research and technical assistance is conducted. Requests for consultation

services from various countries have been received and plans are being made for their implementation.

Continued emphasis will be given to coordinating the activities sponsored by the 211(d) grant with those under the Tropical Soils Research Program and the Soil Fertility Evaluation and Improvement Program to insure that the expertise of the department in tropical soils is strengthened and its overall contribution to international soil science is advanced.

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 3.3).

9.2 Expenditures report, actual and projected (see Table 3.4).

9.3 Budget: Summary

9.4 Budget: Detail

Table 3.3. Distribution of 211(d) grant fund expenditures and contributions from other sources of funding (July 1, 1972 through June 30, 1973).

Object	Previous Expenditures	Period Under Review	Cumulative Total	Projected Next Year	Projected to End of Grant	Non 211(d) Source <sup>a/</sup>
Research	\$26,485	\$23,480	\$49,965	\$100,000	\$200,000	\$300,000
Teaching	7,240	17,575	24,815	50,000	100,000	100,000
Libraries	462	544	1,006	6,000	13,000	2,000
Consultation	450	3,000	3,450	5,000	10,000	3,000
Publication	0	500	500	3,000	6,000	5,000
Travel	9,603	5,091	14,694	15,000	33,000	75,000
Other	4,110	3,000	7,110	10,960	36,460	115,000
<b>Total</b>	<b>\$48,350</b>	<b>\$53,190</b>	<b>\$101,540</b>	<b>\$189,960</b>	<b>\$398,460</b>	<b>\$600,000</b>

<sup>a/</sup> These are reasonable estimates of the total financial inputs from non-211(d) sources which have resulted in accomplishments that are supportive of the objective of the 211(d) grant. These sources are: North Carolina State University, North Carolina Agricultural Experiment Station, Contract AID/csd 2806, Contract AID/1a 646, USAID/Costa Rica, USAID/Panama, USAID/Bolivia, ICA, Rockefeller Foundation, and the Brazilian Government.

Table 3.4. Expenditure report, actual and projected.

Object	Actual Expenditures		Projected Expenditures		
	Period Under Review	Cumulative Total	4	5	Total
Salaries and Wages					
Eligible for fringe benefits	15,980	30,479	50,000	50,000	130,479
Visiting professors	3,000	3,450	30,000	40,000	73,450
Graduate assistants	15,793	29,968	50,000	50,000	129,968
Subprofessional assistants	2,785	5,907	9,000	9,000	23,907
Fringe Benefits	2,132	4,062	8,000	10,000	22,062
Travel					
Domestic	1,400	3,294	5,000	5,000	13,294
International	3,691	11,400	15,000	18,000	44,400
Communications	725	939	1,000	1,500	3,439
Contractual	1,756	3,586	4,000	5,000	12,586
Supplies	2,370	3,398	5,960	6,000	15,358
Equipment	3,014	4,051	6,000	7,000	17,051
Library Acquisitions	544	1,006	6,000	7,000	14,006
Total All Objects	\$53,190	\$101,540	\$189,960	\$208,500	\$500,000

## 9.3 Budget: Summary

	<u>Total Expenditures</u>
<b>Salaries and Wages</b>	
Eligible for fringe benefits	\$ 15,980
Visiting professors	3,000
Graduate assistants	15,793
Sub-professional assistants	<u>2,785</u>
Total	37,558
Fringe Benefits	2,132
<b>Travel</b>	
Domestic	1,400
International	<u>3,691</u>
Total	5,091
Communications	725
Contractual	1,756
Supplies	2,370
Equipment	3,014
Library Acquisitions	<u>544</u>
Total all objects	53,190

## 9.4 Budget: Detail

## 9.4.1 Salaries and wages

<u>Name and Position</u>	<u>% of Time on Project</u>
A. S. Lopes, Graduate Assistant	100
M. A. Granger, Graduate Assistant	100
F. T. Turner, Graduate Assistant	100
S. T. Benavides, Graduate Assistant	100
D. G. Rossiter, Research Assistant	100
M. H. Moore, Secretary	50
P. A. Sanchez, Assistant Professor	50
C. B. McCants, Head	10

#### 9.4.2 Travel

Jose Mendez-Lay, June 12, 1972 - July 3, 1972, to Panama to obtain soil samples for characterization of acidity properties of soils of that area.

P. A. Sanchez, July 8 - August 6, 1972, Mayaguez, Puerto Rico to teach in Tropical Soils Institute.

E. J. Kamprath, July 15 - August 15, 1972, Mayaguez, Puerto Rico to teach in Tropical Soils Institute.

S. W. Buol, July 23 - August 4, 1972, Mayaguez, Puerto Rico to teach in Tropical Soils Institute.

P. A. Sanchez, October 4-5, 1972, Prairie View, Texas to teach in Tropical Soils Workshop.

P. A. Sanchez, October 29 - November 2, 1972, Miami, Florida to participate in Annual meetings of the American Society of Agronomy.

P. A. Sanchez, November 26-28, 1972, Washington, D.C. to attend annual review of University Consortium on Soils of the Tropics.

C. B. McCants, November 26-28, 1972, Washington, D.C. to attend annual review of University Consortium on Soils of the Tropics.

C. B. McCants, January 3-6, 1973, San Francisco, California to attend meeting of CUSUSWASH.

P. A. Sanchez, April 11-13, 1973, Prairie View, Texas to attend executive committee meeting of University Consortium on Soils of the Tropics.

## D.4.3 Equipment costing more \$100

Desk (2)	\$519.56
Ectographic Visual maker	272.31
Collator	317.36
Projector	255.85
Gas Chromatograph (total cost \$ 9590)	1590.85
	<hr/>
Total	\$2955.93
Total equipment expenditures	\$3014.79