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## REPORT OF CORNELL UNIVERSITY

Grant AID/csd 2834

## Summary

The introductory soils course now includes more material on tropical soils as a result of the professors in charge participating in a teaching workshop and research activities in a tropical environment. A course was initiated on clay mineralogy with special reference to the tropics. Two graduate students were supported by the grant for duties related to tropical soils. Three new graduate students have been awarded assistantships under the grant for 1971-1972. Two short-term visiting scientists have lectured and consulted with staff and students on soils and agriculture of the tropics. Arrangements have been made for several distinguished Visiting Professors and Scientists to lecture and consult on tropical soils during the next two years. Preliminary plans were developed for a Tropical Soils Institute in 1972. Research on tropical soils problems largely financed by other funding has been augmented by the grant support for graduate assistantships and staff travel to research sites in tropical areas. A significant impact has been made on the teaching, research, and advisory services in tropical soils of staff supported by State and other funds outside of the grant.

The plan of work for 1971-1972 will emphasize: (1) establishing local funding for a position of Professor of Tropical Soils to insure continuation of the program beyond the end of the current 211(d) grant; (2) developing research and instruction on system of culture for crop production on tropical soils; (3) developing the tropical soil component

of resident instruction; (4) developing collaboration and interaction with other institutions both in the United States and abroad, for mutual effectiveness in teaching, research, and consultation on tropical soils and their use.

### Goals

The purpose of this grant, which became effective on June 30, 1970, is to strengthen the existing competency of the New York State College of Agriculture at Cornell University in a collaborative effort with the University of Hawaii, North Carolina State University, Prairie View A and M College, and the University of Puerto Rico, to provide training, related research, technical assistance and consultation in soil science for increasing food production on tropical soils. The main area of concentration of Cornell University in this collaborative effort is to develop instruction and research on practical cultural systems for tropical soils consistent with the biological, economic, and social environments of developing nations.

### Major Accomplishments

#### Teaching.

1. With support from the grant an Assistant Professor, Dr. R. M. Weaver, has been added to the staff to develop a course on clay mineralogy with special reference to soils of the tropics. During the past year, Dr. Weaver has also been supported by other funds for research on the characterization of clay minerals in soils of the humid tropics to provide a basis for the interpretation of the availability of plant nutrients to crops grown in the field. Most soils of the humid tropics are characterized by the high content of iron and aluminum hydrous oxides and the predominance of kaolinite and amorphous material in the clay fraction. These characteristics plus the high temperature and rainfall conditions have a profound influence on the soil management practices, especially the amount, rate,

and method of application of fertilizers used with different crops.

2. The introductory course in Soils is given by Professors Lathwell and Scott who have been interested in introducing more material on tropical soils in their teaching. Over 200 students enroll in the course during the year and the students range from sophomores to graduate students. The grant provided an opportunity for Professor Scott to spend a week in Puerto Rico to become familiar with tropical soils, and in July he attended the two weeks tropical soils workshop in Hawaii with colleagues from the four other universities in the Consortium to exchange ideas and broaden their understanding of the properties and management of tropical soils. Mr. Gordon MacCaskill, who assists Professors Lathwell and Scott in teaching the introductory course in Soils, also attended the workshop.

Professor Lathwell spent his Sabbatic leave in 1970-1971 in Puerto Rico, supported by other funds, doing soil fertility research and became familiar with many of the problems in the management of tropical soils. As a result of his experience there and the experiences of Professor Scott and Mr. MacCaskill at the tropical soils workshop, the introductory soils course will now include more material on tropical soils, which should broaden the perspectives of the students.

3. F. Jurion served as Visiting Professor in the Department of Agronomy for about three weeks in March, 1971. Mr. Jurion was Director of the Belgian Agricultural Research Institute in the Congo (I.N.E.A.C.) for over 25 years. The I.N.E.A.C. with its main station at Yangambi and over 40 substations located throughout the Congo has probably contributed more to our knowledge of tropical agriculture than any other institution. The leadership of Mr. Jurion in organizing and directing this program

was largely responsible for its outstanding contributions. The work of the I.N.E.A.C. has recently been compiled and summarized in a major publication by Mr. Jurion and Mr. Henry entitled, "Can Primitive Farming Be Modernized?"

During his stay at Cornell, Mr. Jurion gave eight illustrated lectures on tropical soils, crops, animal science, and agricultural development. He gave seven seminars on various aspects of tropical agriculture and consulted with staff and students in the Department of Agronomy.

4. Dr. Charles E. Kellogg, Deputy Administrator for Soil Survey of the USDA Soil Conservation Service was a Visiting Scientist for three days in March, 1971. He gave lectures on tropical soils to four different classes, presented two seminars, and consulted with many of the staff and graduate students on various aspects of tropical soils.

5. Preliminary arrangements have been made for several distinguished Visiting Professors and Scientists to be on the Cornell campus during the coming year. Their identity and the plans for their activities are given in a subsequent section of this report on the Plan of Work for Next Year.

6. Preliminary plans have been made for a four week Tropical Soils Institute to be held in Puerto Rico in the summer of 1972. The details of this program as well as other courses being planned are given in a subsequent section of this report on the Plan of Work for 1971-1972.

### Research.

1. A research project in cooperation with the University of Puerto Rico and in collaboration with the U.S. Department of Agriculture is financed largely under an AID research contract. Though Puerto Rico is a base for the research activity, related research financed from

other sources has been carried out in Colombia, and preliminary plans have been developed for on-site research in Brazil. This research is being coordinated with the tropical soils research activity of North Carolina State University under an AID research contract. Within this framework, the grant funding has served to augment the research effort. It has provided staff travel to research sites in tropical areas and minor items of supplies and services.

2. Two graduate students were on research assistantships under the grant during the past year. One is a Ph.D. candidate who is now doing his thesis research in Puerto Rico on the factors limiting plant growth on subsoils of Oxisols and Ultisols. He has a particular interest in micronutrient problems in tropical soils, and as part of his assistantship duties he has prepared an annotated bibliography of the literature on manganese and molybdenum in soils of the tropics. The other student started on a M.S. program, but because of family circumstances took a leave of absence for a year. While at Cornell, his assistantship duties involved the preparation of an annotated bibliography on "Soil Management Systems in the Tropics." Three new graduate students with a career commitment to tropical soils have been awarded assistantships for 1971-1972 under the grant.

#### Involvement of Other University Resources.

The grant has had a substantial impact on many of the staff in stimulating a broadened perspective in teaching and research. Five professors supported by State funds devote 10 to 20 percent of their time to tropical soils and five others contribute significantly. All the necessary facilities have

been provided to support the objectives of the grant in teaching, research and advisory and consulting services.

Personnel Involved in Tropical Soils Research and Teaching.

1. Project leader - M. Drosdoff
2. Professorial staff - contributing
  - D. R. Bouldin - Research and teaching, soil fertility
  - D. J. Lathwell - Elementary teaching, soil fertility research
  - T. W. Scott - Elementary teaching, soil fertility research
  - M. Peech - Soil chemistry, teaching and research
  - R. M. Weaver - Soil mineralogy, teaching and research
  - M. Alexander - Soil microbiology, research and teaching
  - R. H. Fox - Soil fertility research
3. Graduate Students with Support from 211(d) Funds
  - D. Ritchey - Micronutrients, Professor Fox
  - G. Linvill - Cultural systems, Professor Drosdoff
4. Graduate Students with Support from other than 211(d) Funds
  - H. Zandstra - Soil fertility, Professor Bouldin
  - G. Naderman - Cultural systems, Professor Drosdoff
  - G. Amedee - Soil chemistry and mineralogy, Professor Weaver
  - F. Ferreira - Soil fertility, Professor Scott
  - P. Santiago - Cultural systems, Professor Drosdoff
  - M. Carrasco - Soil chemistry, Professor Peech
  - B. Van Reij - Soil chemistry, Professor Peech

\* 1/2 salary from 211(d) funds.

Plan of Work, 1971-1972

The work for 1971-1972 will emphasize the following goals:

- (a) Establishing local funding for a position of Professor of Tropical Soils to insure continuation of the program beyond the end of the current 211(d) grant;
- (b) Developing research and instruction on systems of culture for crop production on tropical soils;
- (c) Developing the tropical soil component of resident instruction;
- (d) Developing collaboration and interaction with other institutions both in the United States and abroad, for mutual effectiveness in teaching, research, and consultation about tropical soils and their use.

Establishing Continuing Local Funding for a Professorial Position for Tropical Soils.

During the 1971-1972 operational year, the duties of an existing professorial position financed as a continuing line item of the departmental budget will be adjusted to include about 50 percent effort on tropical soils. Dr. M. G. Cline will serve as 211(d) project leader under this arrangement with the collaboration of Dr. M. Drosdoff. During the years that follow, the tropical soils duties of the position will be increased. The professor in that position will work intimately with the professor provided by 211(d) funding to the end of the grant. At that time, the position on 211(d) funds will terminate, but it is anticipated that a continuing position will be available to assume responsibilities

for the tropical soils program, subject to unforeseeable budgetary limitations.

Developing Instruction and Research on Systems of Culture for Crop Production on Tropical Soils.

This is the area programmed for emphasis under the 211(d) grant.

1. During 1971-1972, the initial steps will be taken to develop a formal course on cultural systems for crop production on tropical soils. Dr. J. K. Coulter, Tropical Soils Advisor, Rothamsted Agricultural Experimental Station, will be a Visiting Professor at Cornell and will develop an outline and bibliography for the course. He will work intensively with Professor Richard Fox, who is currently headquartered in Puerto Rico, for a two week period on course content and organization. It is anticipated that Professor Fox will be on the Cornell campus for one semester in 1972-1973 and in subsequent years to offer the course. Professor E. W. Russell of the University of Reading is expected to be available in 1972-1973 as a Visiting Professor for consultation with Dr. Fox.

2. The AID-sponsored research project on soil fertility in the humid tropics will continue as the nucleus of research on cultural systems for tropical soils. In addition to Professor Fox, Professors Drosdoff, Bouldin, Lathwell, Peech, Weaver, Arnold and Alexander will be actively working on this and related projects. Four graduate students supported by 211(d) funds and nine supported from other sources will be engaged in research and related instructional activities. Dr. James A. Silva, on Sabbatic leave from the University of Hawaii, will compare the response of plants to silica on Hawaiian and Puerto Rican soils.

Developing the Tropical Soil Component of Resident Instruction.

1. The literature on tropical soils available in both the departmental and the college libraries will be inventoried, and lists of available material will be prepared. A search will be made for publications on tropical soils and related subjects not available at Cornell, and important items will be purchased. Annotated bibliographies will be assembled on specific aspects of tropical soils.

2. Four visiting scientists will be brought to the campus for short periods (one week to one month) as consultants and lecturers for broadening tropical soils components of courses and graduate training. The two visiting professors, J. A. Silva and J. K. Coulter, referred to above, will serve similarly for periods of one year and six months, respectively.

3. To insure communications and interactions among the many faculty and students in varied fields of interest concerned with tropical soils, informal seminars will be held regularly for reports of individual activities, exchange of information and ideas, and discussion of relevant subjects.

4. As indicated in a previous section of this report, during 1970-1971 the two professors responsible for elementary soils teaching gained experience with tropical soils, one in a year's work in Puerto Rico and the other at the Tropical Soils Teaching Workshop in Hawaii. That experience will be applied to broaden the perspective of elementary soils teaching. Similarly, the experience of three other professors with research on tropical soils will be applied in the teaching of soil chemistry, soil fertility, and soil mineralogy. A course that requires

a ten-day study period in Puerto Rico will be continued, and the instructional staff will change to provide broader impact on resident faculty.

Developing Collaboration and Interaction with other Institutions.

1. During the 1971-1972 operational year, the first of what is intended to be continuing Tropical Soils Institutes will be offered by the Consortium. It will be an intensive four week school for professional workers in tropical soils and will carry graduate credit for successful participants. It will have inputs from all, or most, Consortium members with the objective of providing service in a cooperative program. It is planned to have the first Institute in Puerto Rico in July and August, 1972. Cornell is one of the contributing institutions.

2. During the year, each of the collaborating institutions will be visited to obtain first hand knowledge of their programs for tropical soils, to explore possibilities for exchange of staff, and to investigate potential exchange or transfer of students.

3. Each of the five visiting professors and scientists will provide a contact with a different institution overseas, and a sixth will be an additional contact with the U.S. Department of Agriculture. These contacts will be maintained as important links with institutions active in tropical soils teaching and research. Looking beyond 1971-1972, it is the intent to establish communications with these and other major institutions in the U.S. and abroad for developing an inventory at Cornell of the on-going work on tropical soils in a major segment of the world. Visits will be made to various institutions in future years for direct observation of their programs, personnel, and facilities.

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Expenditures

June 30, 1970 to June 30, 1971

International travel.

F. Jurion - Belgium	\$ 401.00
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Other expenditures.

Salaries, stipends, and wages	\$ 21,235.19
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Student fees	937.50
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U.S. travel and subsistence	1,689.56
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Supplies	555.75
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Other costs	<u>411.59</u>
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TOTAL	\$ 25,230.59
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Budget for Next Year

July 1, 1971 to June 30, 1972

Salaries, stipends, and wages	\$ 72,000.00
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Student fees	2,500.00
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International travel	4,300.00
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Other travel and subsistence	6,700.00
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Supplies	5,000.00
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Other costs	<u>1,500.00</u>
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TOTAL	\$ 92,000.00
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