BENCHMARK SOILS PROJECT

benchmark soils

Vol. 2, No. 4
4th Quarter 1978

Research on agrotechnology transfer in the tropics based on the soil family.

Agreement made to "internationalize" Soil Taxonomy

Creation of Worldwide Body for Agrotechnology Transfer Seen in Near Future

Coordinated soil-related agronomic research throughout the tropics is a near reality as a result of the workshop on Operational Implications of Agrotechnology Transference Research, held at ICRISAT (International Crops Research Institute for the Semi-Arid Tropics), Hyderabad, India, from October 23–26, 1978. The results of the workshop may have far-reaching effects on global, national, and local soil research.

The two key achievements were the following agreements:

1. The SCS/USDA (Soil Conservation Service of the U.S. Department of Agriculture) agreed to "internationalize" Soil Taxonomy, the handbook that classifies the soils of the world
2. Workshop participants agreed to create an international body to oversee soil resource inventory quality control and to mobilize talents and resources to begin collecting soil and crop data for soil interpretation, soil correlation, and agrotechnology transfer.

To achieve the objectives of the workshop, it will be necessary to mobilize multidisciplinary teams to match land qualities to crop requirements so that extension agents may use the matched results to predict crop performance.

The high levels of solar radiation, implied in the soil family name "isohyperthermic," contributed to the high maize yields on the clayey, kaolinitic, isohyperthermic Tropeptic Eutrustox at Waipio, Hawaii (see p. 4, Hawaii). This soil is situated in one of the best environments for high crop production in the State.

Benchmark Soils Project participants at the workshop included **Goro Uehara, Jim Silva, Ike Ikawa,** and **Gordon Tsuji** from the Hawaii Project; **Fred Beinroth** from the Puerto Rico Project; **Tej Gill** from USAID/Washington; **Godofredo N. Alcasid,** director, Bureau of Soils, the Philippines; **Senen M. Miranda,** assistant director general for finance, PCARR (Philippine Council for Agriculture and Resources Research); and **D. Muljadi,** director, SRI (Soil Research Institute), Indonesia.

Other participants included personnel from ICRISAT, SCS, FAO, the World Bank, and other international and national centers and various LDCs. **L. D. Swindale,** director of ICRISAT, convened the conference.

The working group of about 20 scientists discussed problems and concerns of

Continued on p. 2

"... wheat, barley, and maize ... continue to provide between 40 and 50% of the calories and protein consumed in developing countries.... In this next decade, most of the increased grain production must come from increased yields on present cropland.... If 30% more grain is to be produced by higher yields, that can be achieved only by better technology at the farm level."

Haldore Hanson, Director General, Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), CIMMYT Review 1977, El Batán, Mexico, p. 8.

Benchmark Soils News

published by the
Benchmark Soils Project

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With the support of:
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Development Support Bureau
Office of Agriculture
Agency for International Development
Department of State
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NEXT ISSUE
Contributions for the next Benchmark Soils News are due in Honolulu by April 5.

The Benchmark Soils Project is researching the correlation of food crop yields with soil properties and soil management practices on deep upland soils to assist cooperating tropical countries in Asia, Africa, and Latin America in improving the use of soils data in formulating agricultural development plans and in tapping the potential of upland areas for intensive food production. Immediate objectives are to establish a network of benchmark soils and to determine scientifically the transferability of agroproduction technology among tropical countries.

The benchmark soils in the network belong to common soil families as defined by the *Soil Taxonomy*. The family is the fifth level of subdivision in the Taxonomy.

Cooperating agencies include:

- Empresa de Pesquisa Agropecuária de Minas Gerais (EPAMIG), Brazil
- International Institute of Tropical Agriculture (IITA), Nigeria
- Philippine Council for Agriculture and Resources Research (PCARR), Philippines
- Soil Research Institute (SRI), Indonesia
- University of Hawaii (UH), U.S.A.
- University of Puerto Rico (UPR), Puerto Rico
- U.S. Agency for International Development (USAID), Washington, D.C., and local missions

Interpretive System Planned for Benchmark Soil Data Bank

Wen-Yuan Huang, systems analyst from ERS, USDA, Iowa State University, recently served as a consultant to the Benchmark Soils Project in developing a framework for a soil interpretation data bank system.

Project personnel have been successful in collecting and computerizing soil classification information and laboratory data from all sites in the Hawaii and Puerto Rico Projects, information which is useful to soil scientists and researchers. To achieve a further objective of the Benchmark Soil Data Bank, however, which is to provide interpretation for international agricultural land use planning, a comprehensive system design is required.

Four files proposed

Huang's proposal would consolidate data files on soils, crops, and climate—all organized in terms of the soil family of the Soil Taxonomy—for interpretation and utilization. Data would be stored in four types of files:

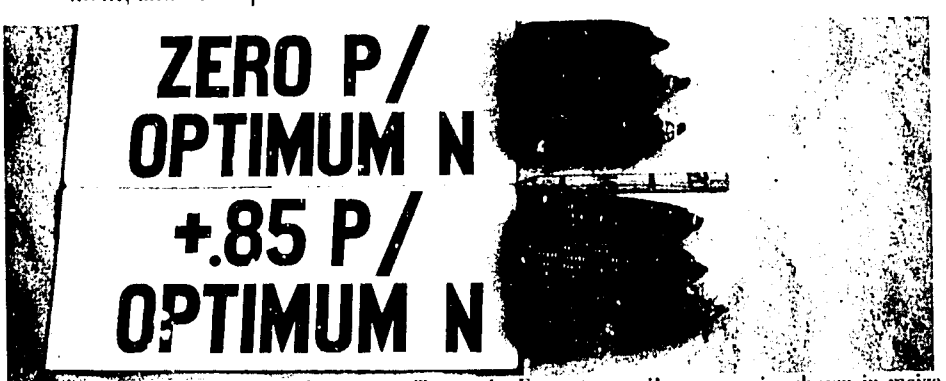
1. Soil files—laboratory data grouped according to soil family;
2. Plant files—including data on plant nutrient requirements, yield data under different forms of management, and other production factors;
3. Climate files—including data on solar radiation, temperature, relative humidity, wind speed and direction, and rainfall; and
4. Constraint files—containing information on other agricultural land use factors including available energy sources, erodability, and accessibility.

These data files would be open-ended to accommodate further inputs on soil properties and updated information on crop performance, such as climatic data over a growing season, as it is generated.

After these four files are established, computer programs can be written to statistically analyze and correlate the files for interpretive use in agricultural planning.

Periodic review desirable

Huang emphasized that the data and interpretation files should be reviewed periodically to insure the systematic development of the data bank as Project needs are modified and updated. For example, the structure of the data files might be changed to improve the efficiency of data processing, or interpretation files might be altered as feedback from users is received. — **Gordon Tsuji** and **Taryn Bigelow**



Favorable response to phosphorus on Tropeptic Eutrustox soils was again shown in maize transfer experiments harvested in November 1978 at Waipio, Hawaii.

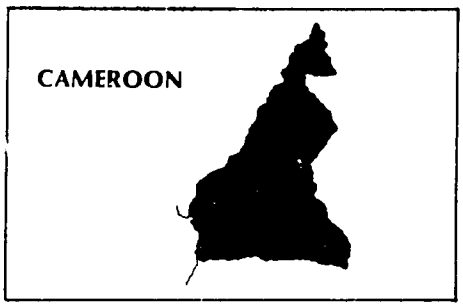
Future Worldwide Body

Continued from p. 1

the adequacy of soil survey information, of internationalizing Soil Taxonomy, of conducting agronomic crop research on defined soils, of coordinating soil-related research activities of nations and international agricultural centers into a global network, and of ways to evaluate and disseminate such information.

The implications for the Benchmark Soils Project are that we need to (1) complete the test of transference, (2) collect crop performance data through our management experiments, (3) increase the capability of the Soil Data Bank on benchmark soils of an international network, and (4) prepare information to disseminate on agrotechnology transfer via Soil Taxonomy. — **Goro Uehara, Gordon Tsuji,** and **Cynthia Garver**

research



Agreement with ONAREST

An agreement was being negotiated between Hawaii's Benchmark Soils Project (BSP) and Cameroon's National Office for Scientific and Technical Research (ONAREST) in November 1978.

Under this agreement, Hawaii BSP will cooperate with Cameroon in the introduction of applied research directed toward linking soil survey and soil survey data interpretation with research on crop growth and the optimal use of soil resources. The BSP/ONAREST agreement will complement the activities of the FAO/UNDP group in Cameroon who are concentrating their activities on soil surveys and land suitability studies for rural development projects and agroecological studies and on plant and soil analyses. There is a need for crop production information to assist in soil interpretation making the BSP activities very timely.

The Benchmark Project is also being asked to assist in the preparation of a long-term research program in agropedology (applied research in plant and soil relations) for the humid tropical areas of Cameroon based on the results of its research. — **James A. Silva**

Transfer experiments

All six transfer experiments with maize, a residual and an initial experiment at each site, are to be harvested soon, and then six new plantings will follow. Also nearing harvest are the two line-source irrigation experiments conducted by EMBRAPA-EPAMIG/UPR.

Planting date management experiment

A maize and sorghum planting date study, which was begun in mid-October with plantings planned for 20-day intervals until early January 1979, is on schedule. The first three plantings showed good germination and early growth. Insect problems, mainly borers and harvester ants, have necessitated an early insecticide program, but damage has been kept at a minimum. This experiment was designed by **Antonio Marcos Coelho**, EPAMIG agronomist, and **Merv Olson.**

Soybean variety trial

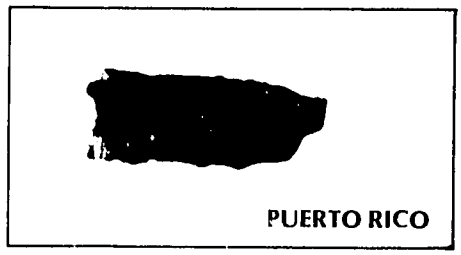
An INTSOY (International Soybean Program) soybean variety trial was harvested in November, and two Brazilian national maize trials (normal and precocious) were planted on November 13. Two new maize composite populations will soon be established.

Mulch management experiment

A mulch experiment, first planted to sorghum in November soon after the first rains of the season, had to be replanted due to a combination of cessation of rains and insect attack. The replant crop selected was maize, 'Cargill hybrid III'.

Multicropping management experiment

The multicropping experiment is approaching maturity of the first set of crops. The mixture of crops consists of beans, maize, onions, and carrots. All species will apparently produce fair to good yields. New relay plantings will be made as each separate crop is harvested. — **Merv Olson and Gene Spain**



Dry season experiments underway

Another series of experiments for the dry season was recently planted at the primary and the two secondary sites in Puerto Rico. All crops are up and growing well, with some treatment differences appearing in the transfer and residual studies.

Currently in the field are the following experiments:

- 3 transfer experiments with maize, variety 'Pioneer X304C'; one each at the primary site and at the two secondary sites
- 3 residual transfer experiments with maize; one at each site
- 1 nitrogen × irrigation experiment with maize at a secondary site.

The nitrogen × irrigation experiment is of the same design as a previous study with six increments of irrigation applied across six levels of nitrogen. — **Steve Nightengale**

FEEDBACK/UPDATE

Name/Title

Address

If you want your name added to or removed from our mailing list, please check the appropriate box below. If your address is incorrect, please advise, giving both old and new addresses.

☐ add name ☐ remove name ☐ change address

We welcome all comments, suggestions, and questions. Selected responses to our News will be printed in the Letters section of future issues.

Single copies of the Benchmark Soils News *are free upon request.*

CONFERENCES

Asian Food Conference Held

Goro Uehara, Soil Scientist with the Benchmark Soils Project, attended the 14th Asian Food Conference in Singapore October 29–November 2, 1978. Held annually in Latin America and Asia, these meetings are sponsored by the International Minerals and Chemical Corporation of Libertyville, Illinois.

This year's meeting was entitled "Promise for Tomorrow," and the keynote address was prepared by **Arturo Tanco,** president of the World Food Council.

Uehara was asked to present a talk on the Benchmark Soils Project at the next conference, tentatively scheduled for Taipei, Taiwan. Members at the 14th conference were provided copies of the BSP Progress Report, Research on Agrotechnology Transfer in the Tropics.

— **Goro Uehara**

PCARR Sponsors Workshop-Seminars

Philippine project leader, **Martin Raymundo,** participated in three seminar-workshops sponsored by PCARR (Philippine Council for Agriculture and Resources Research) in 1978.

Raymundo discussed a paper on soil conservation and the Regional Development Project at the National Seminar-Workshop on Soil Conservation, July 28–30; he also presented papers on "Soil Management" at the FAO-Philippines National Workshop on Development and Management of Rainfed Crop Production, July 31–August 1 and on the "Minimum Pedological Data for Field Experiments" at the National Workshop on Minimum Sets of Data for Field Experiments on Crops, September 29–30.

All the workshops were held at PCARR headquarters in Los Baños, Laguna, the Philippines, and included BSP concepts when appropriate. — **Martin Raymundo**

Seminar Series Begun

Graduate students are presenting their BSP-supported research results at a new seminar series initiated in fall 1978 at the Hawaii BSP.

To date, presentations have been made by **David Harris** on the response of maize to phosphorus placement and sources and by **Cris Escano** on the greater value of studying nutrient availability in relation to other factors among soil families for land evaluation. Both were attended by about 25 BSP personnel and other staff and students from the Department of Agronomy and Soil Science at the University of Hawaii.

The seminars offer students the opportunity to receive peer feedback on their research and to gain experience in public speaking while audiences keep up to date with current information. — **Taryn Bigelow**

PUBLICATIONS

Progress Report published

A compilation of BSP's achievements from 1974 to December 1977 was released on October 19, 1978 as Progress Report 1, "Research on Agrotechnology Transfer in the Tropics Based on the Soil Family."

This publication, a joint report from the Universities of Hawaii and Puerto Rico, summarizes Project objectives, explains the concept of agrotechnology transfer, reports on field activities, and describes existing information dissemination activities.

Copies of this publication and other information on the BSP are available by writing to the University of Hawaii, the University of Puerto Rico, or the Development Support Bureau (see p. 2 for addresses).

Hardbound book out

The BSP recently announced the publication of the book "Soil-Resource Data for Agricultural Development," edited by **Leslie D. Swindale,** director of ICRISAT.

The material in the book, including chapters by BSP personnel **Ike Ikawa** and **Goro Uehara** from Hawaii and **Fred Beinroth** from Puerto Rico, was adapted from papers presented at the seminar on "The Uses of Soil Survey and Classification in Planning and Implementing Agricultural Development" held at Hyderabad, India, January 18–22, 1976. The seminar was attended by natural resource planners and soil scientists from 19 tropical and 9 temperate countries.

The book describes the classification, collection, interpretation, and presentation of soil resource data for land-use planning in the tropics.

A limited number of copies are available to libraries and institutions through the Hawaii Agricultural Experiment Station, College of Tropical Agriculture, University of Hawaii, 3190 Maile Way, Honolulu, Hawaii 96822. — **Taryn Bigelow**

BENCHMARK SOILS PROJECT

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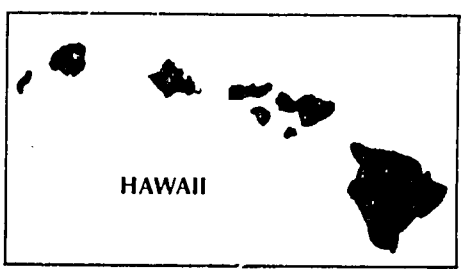
Harvests due in January

Two transfer experiments and one variety experiment on two Typic Paleudult sites in Sumatra are showing vigorous growth and will be harvested near the end of January.

The wet season maize transfer experiments are now in the blister stage at the Nakau and Balai Masyarakat Desa (BPMD) sites and are showing a clear response to phosphorus with marked treatment differences.

The variety trial at the Nakau site is showing a response to phosphorus with the best growth exhibited by varieties 'H6' and 'H159'.

Three transfer, four residual transfer, and one management experiment at 3 Hydric Dystrandept sites in Java are scheduled for harvesting in late December. — **R. G. Manuelpillai**



Eutrustox yields of 11 metric tons

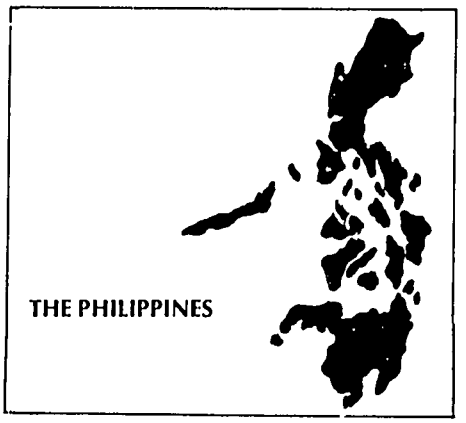
Results from two recently harvested transfer experiments with 'Pioneer X304C' on Oahu and Molokai research sites exhibit the tremendous crop production potential of these soils. The similarity of the response generated by the phosphorus and nitrogen variables in these experiments should also contribute to the growing body of proof of the hypothesis of agrotechnology transfer based on the soil family.

Four high-fertility treatments produced yields of more than 10 tons/hectare and one treatment receiving 139 kg P and 108 kg N/hectare yielded 11 metric tons/hectare (176 bushels/acre).

Since a second crop cycle during the wetter part of the year would be expected to produce only somewhat lower yields, it is not unreasonable to expect that maize production on this soil family can reach 20 metric tons per hectare per year.

Production potential of this magnitude on these moderately extensive but underutilized tropical soils portends well for the future world food supply.

— **Alan Hurdus**



Typhoons destroy crops

At Naga, all the wet-season experiments except the residual sorghum plantings were destroyed by typhoons in September and October.

BSP personnel in the Philippines hope that damage from typhoons can be limited in the future by completing wet-season plantings by June 15, assuring harvests before the September-to-November typhoon season.

The residual remaining corn crop was harvested and is being analyzed for total dry-matter yields.

Harvests completed

Dry-season harvests at Davao included the corn transfer experiments (with 'Tiniguib'), the residual P corn experiment (with 'UPCA Var. 1'), and an N-P-K corn transfer experiments (with 'Tiniguib'), the residual P corn experiment experiment. Three locations near Calinan were examined as possible secondary sites. Selection of two sites wait confirmation of mineralogy tests. — **Martin Raymundo**

Because water is a limiting factor in growth for Tropeptic Eutrustox, irrigation is required. This pump was installed one mile from Hawaii's second Tropeptic Eutrustox site at Waipio before the planting of maize experiments in July 1978.

LETTERS

Thank you for the copies of the Benchmark Soils Project information. The information is very useful and I would like to be on the mailing list to receive further information as it evolves.

Raymond E. Fort, Chief, AGR, AID, Kabul, Afghanistan

This winter quarter 1978, I became aware of the Benchmark Soils Project. I am a senior at the Ohio State University majoring in agronomy with soils as my area of interest. Your project interested me and I would like to know more about your system of classifying and studying tropical soils. Any general information would aid me in writing a report and relating this information to fellow classmates at OSU Agronomy Department.

Timothy L. Shank, OSU, Columbus, Ohio

In-country BSP

Philippine Advisory Committee Recommends Classification of Soils

The first meeting of the Benchmark Soils Project Advisory Committee was held on October 9, 1978 in Los Baños, the Philippines. Strong interest was exhibited by Philippine government agencies in utilizing the concept of agrotechnology transference based on soil classification according to Soil Taxonomy, which is the basis of the Benchmark Soils Project.

Present Philippine soil maps are mostly soil reconnaissance surveys conducted before the Soil Taxonomy existed. **Gody Alcasid,** a member of the advisory committee, and director of the Bureau of Soils, supported the concept of developing a more useful basic classification system but explained that he had neither the personnel nor the equipment to undertake such a classification.

Committee members agreed that a taxonomic survey might provide the best framework of soil classification upon which to build and to which information would be added so interpretations for irrigation, drainage, fertilizer response, and adaptability for different crops could be made. They suggested that classification of soils should be initiated in three areas: Cagayan Valley, Isabela; Ilocos Norte; and the Bicol River Basin.

Assistance was offered by **Nicanor Fernandez,** associate dean of agriculture, University of the Philippines at Los Baños (UPLB), who indicated that research efforts at the university could be tied into the classification effort, as well as by **Manny Briones,** director, Cagayan Integrated Area Development Program (CIADP), who offered both financial and research assistance. It was suggested to **Bill McCluskey** that USAID/Manila assist the effort.

In addition to those mentioned above, the advisory meeting was also attended by **Senen Miranda,** chairman, and **Martin Raymundo, Aurelio Briones, Eduvigis Pantastico, Ponciano Batugal,** and **Santiago Tito.** — **Taryn Bigelow**

BSP and IFDC agreement

Collaborative Research on BSP Soils Network

A new linkage between the Benchmark Soils Project (BSP) and the International Fertilizer Development Center (IFDC) was established in November 1978, when an agreement was signed for a collaborative research project on the "Evaluation of Phosphorus Fertilizer Materials and Placement Effects in a Network of Benchmark Soils of the Tropics."

David Harris, doctoral candidate at the University of Hawaii and graduate assistant with the BSP, will supervise plantings and harvests of maize, the test crop, at five BSP sites: Luzon, the Philippines; Mindanao, the Philippines; Java, Indonesia; Sumatra, Indonesia; and Hawaii, U.S.A.

The experiments will compare phosphorus fertilizer materials at each site, including ground rock phosphates from two sources and minigranules made from these rocks by a process developed by the IFDC.

Phosphorus deficiency is costly

Large areas of currently cultivated or potentially arable land in the nonarid upland regions of the tropics are occupied by soils for which phosphorus deficiency is the factor most limiting crop production. The BSP has already shown this to be true on their soils.[1] Therefore, finding economical methods for overcoming phosphorus deficiency is a vital part of any solution to the problems of food and agricultural development in most developing countries of the tropics.

[1] Benchmark Soils Project. 1978. Research on Agrotechnology Transfer in the Tropics Based on the Soil Family. Project Report 1, p. 31.

Research on economics for small farmers

The best phosphorus source and method of use depend on the available resources, the soil, the crop management system, and, ultimately, the economic situation. Thus, this type of basic agronomic information about phosphorus materials and their use in a given soil and cropping system is essential information required for planning phosphorus fertilizer strategies to benefit small farmers with limited capital.

Most important, as an adjunct to the BSP, this research will lead to results that can then be transferred to other sites with similar soils.

Final harvests for the experiments are scheduled for mid-1980, and results will be compiled in Harris' doctoral dissertation. — **Taryn Bigelow**

PEOPLE

Antonio Marcos Coelho, an agronomist with EPAMIG, recently joined the EPAMIG/UPR group at the Brazil BSP site at Jaiba, Minas Gerais.

Antonio Marcos has wide experience with corn and sorghum production in the tropics. He will work part time for the BSP, concentrating his efforts on management experiments. He will also provide the technical liaison with local EPAMIG staff. Antonio Marcos replaces **Umbemar Silveira Dias** who has left EPAMIG. — **FB**

M. Sujadi, new project coordinator at the Soil Research Institute, Bogor, Indonesia, visited Hawaii BSP on October 1–3. Sujadi was on his way to Indonesia after finishing requirements for his Ph.D. at North Dakota State University. He joins **Ir. Soepartini** as replacement for **I P.G. Widjaja-Adhi** who is now doing graduate work at the University of Hawaii. — **BC**