Soil Management C♦R♦S♦P

HORIZON

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SOIL MANAGEMENT COLLABORATIVE RESEARCH SUPPORT PROGRAM NEWSLETTER

Soil Management CRSP activities in Honduras

Hurricane Mitch: The Aftermath

Food and medical supplies are slowly becoming available to residents of Honduras in the aftermath of Hurricane Mitch. All major highways and bridges into Tegucigulpa were closed to traffic and are slowly becoming accessible by relief workers. Excessive rain and strong winds from Hurricane Mitch caused extensive damage in urban Tegucigulpa and in many rural areas.

Watershed studies in southern Honduras, conducted by the SM CRSP project led by Texas A&M University in conjunction with an AID mission sponsored project and scientists with the Ministry of Natural Resources from 1993 to present, show that soil conservation investments such as live barriers or rock walls are particularly useful at easing the vulnerability of the region to natural disasters at the two tails of climatic extremes.

In terms of flooding and landslides, the two wet years of our data set (excluding this year) averaged 92 tons/ha/yr soil loss on traditional slash and burn sites, 43 tons/ha/yr soil loss on the mulched sites (i.e., no burning but no investments to tie the soil into the hillside), 0.9 tons/ha/yr on the vetiver grass contours sites (without the vetiver strips this site would have been expected to lose 73 tons/ha/yr if mulched only B as determined using EPA paired plot calibration techniques) and 0.7 tons/ha/yr on previously cropped land being reclaimed using a nitrogen fixing tree fallow). I just heard that cropped sites with vegetation contours, rock walls and tree fallows withstood the storm quite well, but the sites that did not have these investments were devastated by massive landslides. Thus the only places farmers will harvest crops this season will be from fields where the extra soil conservation investments have been made. The massive erosion that took place on the unprotected sites will reduce future production potential. The downstream costs in terms of siltation and flooding will be huge (our data on the impacts of steepland use practices on downstream industries such as shrimp production are DRAMATIC).

On the other tail of climatic disaster, during the El Nino drought of last year the only places that had meaningful crop production were on the soil conservation sites. The soil that had accumulated behind the vegetation barriers and rock walls had greater potential to store water as opposed to sites with no soil conservation where the water storage potential has declined. This trend of soil loss has increased the frequency and consequences of agricultural drought.

With our Soil Management CRSP activities in Honduras, Nicaragua and Haiti we are well along the way to fusing a powerful story from different environments that will provide policy relevant insight for the global challenges associated with steepland management. Politicians and bankers are talking about making future investments in a manner that will reduce the vulnerability of the region to natural disasters. If an opportunity comes up along these lines within USAID, I just wanted to remind you that we are gathering data that can help these decisions be more effective and more cost efficient.

T. Thurow

Inside the Horizon

Constraints to Food Security Are Targeted by SM CRSP

The restructured Soil Management CRSP (SM-CRSP) has refocused its research efforts to develop tools which non-experts can use to solve important soil management problems on a location-specific level. While new knowledge is desirable and needed, the CRSP is primarily concerned with soil management research that will result in customer adoption of proven technologies. The new SM-CRSP recognizes that it must draw on expertise from other disciplines to satisfy customer needs and has, therefore, adopted an interdisciplinary and systems approach incorporating researchers with diverse backgrounds. Projects address problems at both the field and regional levels, and the adoption of a hierarchical approach allows researchers from different disciplines to relate processes at one level with processes both above and below it.

Early in the restructuring process, five major constraints blocking the adoption and application of integrated nutrient and soil management were identified. The constraints are: nitrogen deficiency, phosphorus deficiency, soil acidity, water deficiency, and soil erosion and degradation. As of last year, researchers from six U.S. universities and numerous collaborating institutions around the world have come together to focus on these constraints. Most of the projects address issues involving two or more constraints. Much of the first year was devoted to preparing the projects for action. Even so, all projects had achievements beyond start-up activities to report.

Achievements are reported according to constraints they address. Nitrogen, phosphorus, and acidity have been grouped together and soil degradation is listed separately. Each project had achievements addressing these constraints. Water efficiency is implicit to all projects and, therefore, was not singled out here.

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Layout:
May Izumi

Soil Management CRSP editorial board: Gordon Tsuji and Goro Uehara

Our address is:
2500 Dole Street, Krauss 22
Honolulu, Hawaii 96822
Telephone: (808) 956-8858
Fax: (808) 956-3421
E-Mail: smcrsp@agrss.sherman.hawaii.edu
Web: http://agrss.sherman.hawaii.edu/sm-crsp

NITROGEN, PHOSPHORUS, AND ACIDITY

Are Cheaper Sources an Answer?

The NifTAL (Nitrogen Fixation by Tropical Agricultural Legumes) project exemplifies the benefits CRSPs can gain by joining forces with the private sector. Over the past year, the NifTAL project has helped privatize the legume inoculant production industry in Nicaragua with dramatic results. USAID-Nicaragua sponsored the technical assistance to the then defunct government owned GRAINCO Company through a sub-agreement with NifTAL. NifTAL assisted in facility design, equipment procurement and installation, and training staff in inoculant production and quality control techniques. During the first year of this collaborative effort, inoculant production increased from 25,000 bags produced during previous years to 45,000 bags under the new technical assistance contract. GRAINCO's product inoculated 32,000 ha. in the first year. With an eye towards increasing future production, GRAINCO has recently ordered peat carrier sufficient to produce more than 100,000 bags in 1998. Field research on inoculant response in this region indicate a yield increase ranging from 15% - 172% may be expected depending upon site. The economic impact of such activities are indeed dramatic. Given average yields of 1600 kg ha^{-1} and prices at minimum, the average yield increase from inoculation could exceed 7,680 metric tonnes worth more than $2.3 million U.S. (FAO, 1992 Production Yearbook data).

Next year NifTAL plans to field test a new method for inoculating legume seeds with a nitrogen fixing Rhizobium. Unlike most current products which are based on solid carrier materials, usually peat, the new method employs a liquid inoculum. Liquid inoculants are especially needed in many Sub-Saharan African and Asian countries where peat is expensive or not commonly available.

Farmers' Choices

Opportunities for poor farmers around the world are limited by their common lack of choices. Two CRSP projects are designed to increase options in nutrient management strategies available to farmers, both male and female, in Africa, Asia, and Latin America.

Under the direction of North Carolina State University, a multi-disciplinary team of 16 scientists from four U.S. universities will collaborate with overseas investigators from national agricultural research and extension systems, international agricultural research centers, and selected private volunteer and nongovernmental organizations in developing a globally applicable, computer-assisted Integrated Nutrient Decision Support System (IntDSS). The IntDSS consists of three components. The first component diagnoses nutrient related problems. Based upon the diagnosis, the second component prescribes alternative strategies for curing the problem, and third, an economic module is fed cost-return information to enable customers to compare the economic advantage of each option. The system will incorporate a range of decision aids, varying from guides to assist in nutrient management at a regional level to those that provide site-specific nutrient diagnoses and prescriptions applicable to users at the local level.

During the first year of the project, the first prototype of an integrated nutrient decision support system was produced. The prototype will be field tested and refined in a network of test sites in Asia, Latin America, and Africa. The testing sites will represent three agroecological zones (semi-arid, wet-dry, and humid) where there is significant potential for products developed by this project to alleviate soil acidity, N and P constraints to food production, and to promote environmental security. Testing area activities will begin with a baseline assessment of social, economic and cultural conditions, and infrastructure and nutrient requirements. The assessment will include extensive contacts with farmers, extension agents, planners, and decision-makers. Potential remedial actions and approaches developed through subsequent research and outreach activities will be tested in these areas and refined to provide satisfactory performance. Throughout the five year duration of the project, the team of U.S. scientists and collaborators will engage in critiques and discussions to refine the prototypes on both the local and global scales.

In Sub-Saharan Africa, women produce the bulk of food for family consumption, but lack the financial means to adopt new products and practices such as seeds of high performance crops and the use of chemical fertilizers. On the other hand, men who are engaged in growing cash crops can afford to use fertilizers. The University of Florida initiated a project in East Africa (Malawi) that focuses on providing women farmers with options that help them achieve household food security. Preliminary research has identified two possible options: 1) reduce fertilizer recommendations (e.g., 18 kg N ha^{-1} or 40 kg urea ha^{-1}) so that fertilizer purchases become more affordable for women; and 2) recommend that women farmers switch a small portion of their land (e.g., 1/10 ha) out of the subsistence crop and replace it with highly profitable cash crops, so that they can repay fertilizer loans with proceeds from the cash crop.

Fertilizer Management Options

Cornell University and its collaborators are currently searching for solutions to stagnant crop productivity in the face of rapid population expansion in India, Bangladesh, and Nepal. This region benefited considerably from the green revolution when farmers adopted short strawed, high yielding rice and wheat varieties that responded to chemical fertilizers. Today, however, farmers can no longer afford to apply sufficient fertilizers and productivity has come to a standstill.

In recognition of this situation, plant breeders in Bangladesh and Nepal are screening for rice varieties that perform even under reduced nutrient inputs. Preliminary results indicate that BR-32, a shorter duration rice variety, out-yielded a longer duration variety (4.59 versus 4.08 t ha^{-1}) at reduced N inputs (80 kg N ha^{-1} versus 120 kg N ha^{-1}) when micronutrients were added. This rice variety not only increases rice

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yields by 0.5 t ha^{-1}, but also increases wheat yields equally because it has a shorter growth duration and allows for a more timely planting of the wheat crop. Similar research is in progress evaluating wheat cultivars for P efficiency to address the widespread P deficiency in wheat commonly found in the rice-wheat rotation.

An initial screening trial showed substantial differences in P efficiency amongst cultivars. Preliminary research in north-west Bangladesh investigating micronutrient deficiencies in the rice-wheat cropping system found that wheat yields increased by 40% or 0.84 t ha^{-1} in 6 of 14 sites when seeds were enriched with micronutrients.

In addition to plant breeding efforts in Bangladesh, results from screening trials of legume and a few non-legume green manure species in India and Nepal suggest that green manures show considerable promise used as soil conditioners to correct specific nutrient deficiencies or imbalances in addition to supplying N. For example, in the Terai of Nepal, crotolaria or pearl millet green manures corrected K deficiency problems, and cowpea, with high Mn content, suppressed nematodes in rice and wheat.

As of this writing, the USAID mission in Bangladesh has committed additional funds to the Cornell project to investigate the relationship between calcium deficiency in soils and rickets in children.

Soil Degradation

Two projects with sites in Latin America address critical issues in the complex relationship between agricultural productivity, environmental quality, and human health. Scientists from Montana State University (MSU) are heading up a collaborative effort that addresses environmental quality and human health concerns in the potato-pasture production system in the Andean highlands of Ecuador and Peru. To the north in the densely populated steeplands of Central America, Texas A&M University and its collaborators in Nicaragua, Honduras, and Haiti are looking at ways to improve peasant cultivation practices that will maintain productivity in a sustainable manner.

Tradeoffs in the Highlands

Increases in agricultural productivity, in both the developed and developing nations of the world, are largely dependent on the use of pesticides and chemical fertilizers. Use of these chemicals, however, has been linked with environmental pollution and public health concerns. In Ecuador, for example, extensive use of the pesticide carbofuran to control the damaging effects of the Andean weevil (*Premnotrypes vorax*) on the potato crop lead environmental groups to claim that carbofuran was contaminating the environment and its use should be prohibited. Poor farmers whose livelihood depends on potato production, on the other hand, contended that profitable potato yields were dependent on carbofuran use, and any prohibition would have serious repercussions on yields and farmer incomes. In response to this dilemma, the MSU project entitled "Tradeoffs in Sustainable Agriculture and the Environment in the Andes" has set out to design a decision support system that will assess quantitatively the economic, environmental, and human health tradeoffs associated with the use of agricultural technologies, and provide options promoting more sustainable practices. This decision support system has the following key features: 1) provides policy makers with information on tradeoffs between key sustainability indicators under alternative policy and technology scenarios; 2) utilizes minimum data sets; 3) links disciplinary data and models in a GIS framework enabling results to be extrapolated to larger geographic regions; and 4) the generic structure of the system can be easily adapted to other geographic settings and applications.

Conservation Practices of Steeplands

Population pressures in Central America have forced subsistence farmers to expand cultivation of fragile steeplands to make up for diminishing productivity caused by soil erosion. This has resulted in rapid and devastating land degradation downstream with adverse long-run consequences

including flooding, siltation of hydroelectric facilities and destruction of coastal ecosystems. More recently, as reported on page 1, catastrophic events such as Hurricane Mitch reinforce the necessity to emphasize conservation of steepland areas prone to natural events. Texas A&M University, Auburn University, and North Carolina State University, in collaboration with host country scientists in Honduras, Nicaragua, and Haiti have developed a project titled "Soil Management Practices for Sustainable Production on Densely Populated Tropical Steeplands" that utilizes a systems approach to understanding peasants' immediate motives and constraints, as well as, how their decision-making is linked with downstream effects and downstream users. Sustainable use of steeplands is not merely a question of proposing sound soil management practices, but also dependent upon a variety of environmental, economic, social, and cultural considerations. The project is designed to manage these multi-faceted and inter-connected issues with the following impacts: 1) Develop soil conservation methodologies that are transferable on a global scale; 2) Reduced soil degradation and erosion enhancing the sustainability of production on sites; 3) Reduced conflict between upstream farmers and downstream interests; 4) Reduced risk and greater economic returns to the farmers; and 5) More effective economic assessment tools that can be used by policy makers to assess costs:benefits of soil and water conservation and farming system technologies.

Jonathan Deenik

Office of Agriculture and Food Security, USAID

EGAD to Review Its Strategic Plan

Emmy Simmons, Director of USAID's Center for Economic Growth and Agricultural Development(EGAD) in the Global Bureau, announced that there will be two day-long retreats this fall to review how the Center is performing under its existing strategic framework. The Center provides technical leadership, manages activities, and supports field missions with the development of: economic policy and institutions which underpin global economic growth; technologies which translate science into increased productivity and human health; financial systems which provide credit to micro-entrepreneurs and small businesses; and business linkages which permit American firms to transfer technology and know-how directly to their counterparts in developing and transitional countries. There are four offices in the Center: Agriculture and Food Security, Business Development, Emerging Markets, and Microenterprise Development. To increase the quality of its product and facilitate compliance with Government Performance Results Act (GPRA) requirements, the Center will review its strategic and performance monitoring plans, performance indicators, present organizational structure, and relationship to customers. The process of reviewing and modifying the current strategy includes feedback from field missions, Bureaus, and our partners on potential changes before an updated strategic plan is implemented. We expect some changes will emerge for collaborating with our partners in measuring and reporting on progress toward Agency goals and for assisting missions.

Charles Sloger

The Collaborative Research Support Program (CRSP): A Unique USAID Partnership with Higher Education

"Steepland Soil Management: Taking Account of Watershed-Level Effects" was the title of SM CRSP's representative, Dr. Thomas Thurow's slide presentation in the morning session. Dr. John Yohe, chair of the CRSP Council and director of the INTSORMIL CRSP at the University of Nebraska and Dr. Harvey Hortik, Chief of the Sustainable Technology Division of the Agriculture and Food Security office of USAID. led off the session with their overview presentations of the CRSP from the university's and AID's viewpoints, respectively. Dr. Emmy Simmons, Assistant Deputy Administrator of the Center for Economic Growth and Agricultural Development of AID closed the morning session with a look towards the future with her presentation on "CRSPs: A look at their future within the research agenda of AID."

The CRSP symposium was organized by the International Agronomy division of the American Society of Agronomy at its annual meetings in Baltimore, Maryland from October 18 to 22, 1998. Poster presentations from several CRSPs followed in the afternoon portion of the program. A number of the SM CRSP posters ended up as part of technical sessions the following day.

Poster presentations by SM CRSP scientists and their collaborators are listed below.

Soil Management Research in South Asia's Rice-Wheat Systems. J.M. DUXBURY*, J.G. LAUREN, P.K. KATAKI, C.A. MEISNER, P.R. HOBBS Rise-Wheat Consortium of South Asia and Cornell Univ.

Diagnosing Soil Constraints to Rice-Wheat Productivity With Solarization. S. PARVIN*, A SHAHEED, G.S. ABAWI, J.G. LAUREN, J.M. DUXBURY, C.A. MEISNER, Bangladesh Agric. Res. Inst., Cornell Univ., and CIMMYT, Bangladesh.

Effects of Micronutrient Seed Enrichment on Rice-Wheat Production. M. BODRUZZMAN*, C.A. MEISNER, J.M. DUXBURY, R.M. WELCH, J.G. LAUREN, Bangladesh Agric. Res. Inst., Cornell Univ., and CIMMYT, Bangladesh.

Performance of Micronutrient Enriched Wheat Seeds in Three Soil Types. P.K. KATAKI*, S. BEDI, C.L. ARORA, R.M. WELCH, J.M. DUXBURY, Cornell Univ.

Nutrients in Mulched Annual Cropping Systems in the Tropics. K.J. SCHLATHER*, J.M. DUXBURY, Cornell Univ.

Interdisciplinary Research on Soil Management and Conservation in Haiti. D.A. SHANNON*, C.M. JOLLY, L. ISAAC, C.W. WOOD, G.L. MULLINS, J.R. BOSSA, Auburn Univ. and CRDA/Haiti.

Building an Integrated Nutrient Management Decision Support System for the Tropics. D.L. OSMOND*, W.S. REID, T.J. SMYTH, R.S. YOST, North Carolina State Univ., Cornell Univ., and Univ. of Hawaii.

Steepland Soil Management: Taking Account of Watershed-Level Effects. T.L. THUROW, Texas A&M Univ.

Cost/Benefit Tradeoffs Associated With Soil Conservation Options, Southern Honduras. H.R. SANTOS*, T.L. THUROW, A.P. THUROW, R.W. KNIGHT, Texas A&M Univ.

Improving Water Quality with the Use of a Native Vegetation Filter Strip. M.S. LANDRY*, T.L. THUROW, R.W. KNIGHT, Texas A&M Univ.

Soil Erosion as Affected by Land Use and Land Tenure, El Pital Watershed, Nicaragua. M. SOMARRIBA, T.L. THUROW*, A.S. JUO, Nat'l Agric. Univ. Nicaragua and Texas A&M Univ.

Modeling Extractable Phosphorus in Soils Amended with Rock Phosphate. X. WANG, R.S. YOST*, Univ. of Hawaii.

Predicting Phosphorus Buffer Coefficients from Potential P Sorption Sites and Soil Aggregation. R.S. YOST*, X. WANG, J. JACKMAN, B.A. LINQUIST, Univ. of Hawaii and Lao/IRRI Project, Vientianne, Laos.

Soil Management—The Lifeline to Food . G. UEHARA*, G.Y. TSUJI, Univ. of Hawaii.

SM CRSP

At the Ronald Reagan Building in Washington, D.C.

CRSP Exhibit on Display

The Council of the Collaborative Research Support Programs (CRSPs) and the U.S. Agency for International Development (USAID) invite you to visit an exhibit highlighting the many development activities and achievements of the nine CRSPs. These programs link U.S. Land Grant universities with national and international research institutions around the world and provide mutual benefits to the US as well as to participating countries.

The exhibit will be on display at the USAID Information Center, Ronald Reagan Building and International Trade Center, 1300 Pennsylvania Avenue, NW, Suite M1, Washington, DC from September 21, 1998 through December 31, 1998 and is open to the public. The exhibit hall is open Monday through Friday from 900 a.m. -500 p.m., except Federal holidays. The exhibit hall is located on the Mezzanine level, opposite the 14th Street entrance. For further information regarding the exhibit, please contact Howard Salter or Joe Fredericks by phone at 202-712-4810 or by fax at 202-216-3524. Inquires by e-mail should be sent to <pinquiries@usaid.gov>.

The CRSPs focus their research on nutrition and income generation through improved food production and natural resource management in the developing countries of Africa, Latin America and the Caribbean, Southeast Asia, and Eurasia while making important contributions to agriculture and agribusiness in the U.S. When in Washington, DC, please visit the new Ronald Reagan Building and the informative CRSP exhibit.

If you are unable to visit the exhibit in Washington, DC, please feel free to browse the CRSP' web site at http// www.ianr.unl.edu/crsps/ for a "virtual tour" and also for more detailed information regarding the mission, activities, and results of the Collaborative Research Support Programs.

Danielle Hartman

External Evaluation Panel Members Named

Five nominees for the SM CRSP's External Evaluation Panel were approved by USAID in September 1998. The ME subsequently reported the acceptance and confirmation communications from each of the five nominees. This group will serve as the first EEP for the restructured SM CRSP. Members include, Dr. Will Blackburn, Director, USDA/ARS/Northern Plains Area, Ft. Collins, Colorado; Dr. Eric Craswell, Director General, IBSRAM (International Board Soil Research and Management), Bangkok, Thailand; Dr. Jean Kearns, Executive Director, CID (Consortium for International Development), Tucson, Arizona; Dr. David MacKenzie, Executive Director, NERA (Northeastern Regional Association of State Agricultural Experiment Station Directors), College Park, Maryland; and Dr. Amit Roy, President and CEO, IFDC (International Fertilizer Development Center), Muscle Shoals, Alabama.

SM CRSP

Announcements

The following publications are now available.

- Economic, Environmental, and Health Tradeoffs in Agriculture: Pesticides and the Sustainability of Andean Potato Production, edited by Charles C. Crissman, John M. Antle, and Susan Capalbo and published by Kluwer Academic Publishers. The book is available in paperback from the International Potato Center for $40.00 or as a hardbound for $170.00 from Kluwer.

- Integrated Nutrient Management for Sustained Crop Production in Sub-Saharan Africa (A Review) by Kathrin Franzluebbers, Lloyd R. Hossner, and Anthony S. R. Juo of the Texas A&M University. A copy of this report may be obtained by writing to the authors or to the Management Entity.

Hurricane Georges Leaves Permanent Reminders

Hurricane Mitch was not the only "visitor" to Latin America and the Caribbean during the past hurricane season. The permanently altered landscape of both Haiti and the Dominican Republic is testament to the severity of Hurricane Georges. Lives and livelihood were lost in both countries. SM CRSP scientists from Auburn University have research sites in Haiti where they've reported the improved resilience of sloping lands used for agriculture through use of leguminous hedgerows. In collaboration with the USAID/Haiti Productive Land Use System (PLUS) project, use of such hedgerows have been emphasized to local farmers. The impact of catastrophic natural events as Hurricanes Georges and Mitch will serve as constant reminders to survivors of the necessity of implementing sustainable soil conservation measures on susceptible lands throughout the region.

D. Shannon

Soil Management C♦R♦S♦P

University of Hawaii
2500 Dole Street, Krauss 22
Honolulu, Hawaii 96822, U.S.A