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Edited by Martin Price
and Dawn Berkelaar

ECHO is a Christian non-profit organization whose vision is to bring glory to God and a blessing to mankind by using science and technology to help the poor.

Issue Highlights

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How Can NGOs Make Full Use of the CGIAR Network of Agricultural Research Centers?

By Martin Price, Ph.D.

Did you know that there is a network of agricultural research centers, each specializing in just a few areas of tropical or subtropical agriculture? The network has an awkward name, CGIAR (Consultative Group on International Agricultural Research). Most of the network's members also have long names and awkward acronyms, like ICRISAT, ICRAF, and ILRI. These centers have a wealth of knowledge, genetic resources and research capability that should make them a valuable resource for organizations working with farmers.

Last November I flew to Nairobi, Kenya, to attend an international conference of leaders of the CGIAR system and their "partners." My goal was to better understand how NGOs could benefit from what they have to offer. To what extent are they interested in helping or even working with members of ECHO's network? Is this help available to both large and small organizations? How does the size or nature of your organization affect the ways the centers may be willing to work with you? What is the nature of the "treasures" that must be stored in their minds, publications and seedbanks? How can ECHO help you "mine these treasures"?

I was pleasantly surprised to find that there has been a change at the highest levels that has potential to benefit many in our network. I still have many questions and will be working to learn more.

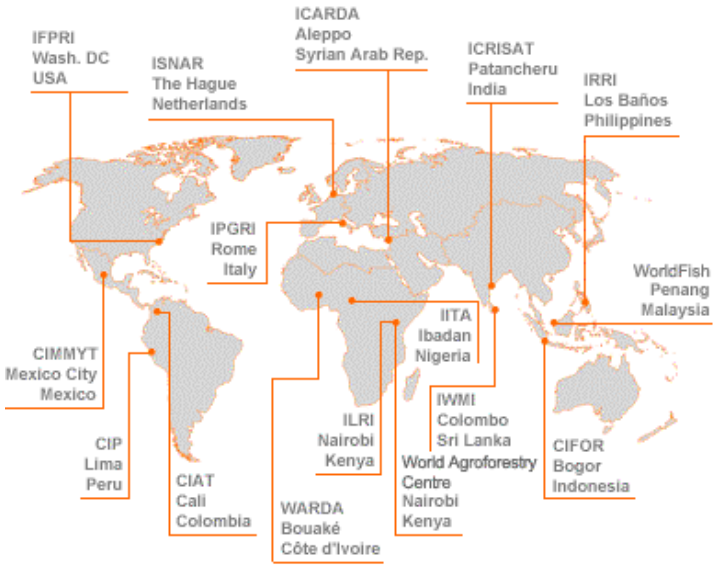
I have been familiar with the CGIAR system for almost three decades. When I was doing post-doctoral research on nutritional problems of bird-resistant grain sorghum at Purdue University in the late 1970's, one of the career options I considered (before the opportunity opened with ECHO) was to be a researcher at one of these centers.

Until a few years ago, the mode of operation of the CGIAR centers was something like the following. They would develop new varieties of crops and evaluate agricultural practices. The results would go to research stations in developing nations that were operated by national governments. Varieties and techniques that proved suited to a country would then be disseminated by the nation's own extension service. Often NGOs were able to obtain seeds and information too, but they were not to my knowledge an integral part of the plan.

In some countries this method worked well. In others, the national experiment stations were few and poorly funded. Often the national extension services did not have resources to carry results to remote parts of the country. When the system broke down it was understandably frustrating to everyone involved, including farmers (those few who even knew about it), scientists, managers of the CGIAR centers, and donor agencies that fund these centers.

The impression I got in listening to presentations at the conference is that many donor agencies have insisted on a revised approach. Speakers talked clearly of meeting needs of the poor as their bottom line. They spoke often (and gave examples) of partnerships not only with governments but also with local and national NGO's and organizations—some very large and

Figure 1: List of CGIAR Centers, with map showing their locations. Links can be found at www.cgiar.org; E-mail: cgiar@cgiar.org.



CIAT – Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture)
CIFOR – Center for International Forestry Research
CIMMYT – Centro Internacional de Mejoramiento de Maiz y Trigo
CIP – Centro Internacional de la Papa
ICARDA – International Center for Agricultural Research in the Dry Areas
ICRISAT – International Crops Research Institute for the Semi-Arid Tropics
IFPRI – International Food Policy Research Institute
IITA – International Institute of Tropical Agriculture
ILRI – International Livestock Research Institute
IPGRI – International Plant Genetic Resources Institute
IRRI – International Rice Research Institute
ISNAR – International Service for National Agricultural Research
IWMI – International Water Management Institute
WARDA – West Africa Rice Development Association
World Agroforestry Centre (formerly ICRAF)
World Fish Center

some surprisingly small. As an example of partnering with a large NGO, World Vision used its community network in Zambia to organize farmers to participate in large-scale evaluation of a system called "Improved Fallows." The World Agroforestry Center (the new name of ICRAF, the CGIAR Center that specializes in agroforestry) oversaw design and analysis of results—both crop yields and opinions of farmers. Local NGOs and government groups also participated. We hope to share some of the results of that work in the future.

An important area of emphasis among the CGIAR centers, an area that I had not heard about before, is helping countries recover after war or natural disaster. This especially involves restoring seed of original varieties and/or bringing in improved varieties that are suited to the region. For example, CIP has established a tissue culture facility for potato in Afghanistan. CIAT corn is yielding three times more than the local varieties in East Timor, the world's newest country. CIAT has a program called "Seeds for Hope in Rwanda." ICARDA has 1003 crop accessions from Iraq and also stores Iraq's own master collection for them. They half-seriously refer to this program as "weapons of mass restoration."

How might members of ECHO's network benefit from the CGIAR research centers?

I was encouraged a year or so ago when the International Center for Improvement of Maize and Wheat (CIMMYT) took the initiative to suggest that organizations in ECHO's network in SE Africa might like to participate in evaluating some new non-hybrid corn varieties (see *EDN* 80). If any of you took advantage of that offer, please write and tell me what your experience was like.

I am still trying to understand how best to advise ECHO's own network. Beyond a doubt there are plant varieties, reports, and knowledge in these centers that could help you as you assist farmers who struggle under difficult conditions. The centers are able to offer us new ideas for development projects, seeds for improved crops (introduction of most of these would need to be preceded by your own experiments to determine whether they are adapted to your particular situation, how they compare in yield and taste to local varieties, etc.), and experts who can answer questions when they are beyond ECHO's expertise.

The bottom line is that I believe there are people in many of the CGIAR centers that are willing to help, but the way has not been found for ECHO to pull together some of CGIAR's treasures into a form that you can easily use. It is not in the CGIAR centers' mandate to maintain a user-friendly shopping list of good ideas for NGOs, large and small, to consider (a list of techniques, technologies, improved seeds, etc.). I believe that is what many of you are looking for from ECHO. But short of that, there are some ways your work can be strengthened by knowing about the centers. Here are some suggestions.

1. When you write to one of the centers, write a couple paragraphs telling about your organization. What does it do? Is it a local farmers group, an NGO, a mission? If you are an agriculturalist by training with experience in doing variety trials and statistical analysis, let them know that. If you are a medical professional or a teacher wanting some seed packets of local crop species to try on a small scale in hopes of finding something that can resist a problem disease or better handle too much or too little rain, tell them that. In what way will sending you seed or information help the community? The more information they have about your goals and setting, the better they can decide what to send you.

2. If you have a really good idea to help local farmers and would like to collaborate in research with help from CGIAR scientists, write to the center that seems to have expertise related to the opportunity. Explain your idea and your capability and credentials to collaborate with them in research.

3. Get to know the centers that may be working in your country, regardless of where their home base might be (see Figure 1). Their web sites are a good place to start—links are available at www.cgiar.org. If you do not have access to the web, ECHO can send you a list of addresses for the centers by postal mail or e-mail.

Collaborative Research/Development Projects

The best news is that the CGIAR centers are at times actively seeking NGO and farmer participation. It will help you understand the kind of collaborations that occur if I describe a contest in Africa in which "civil society organizations were invited by CGIAR to submit examples of …collaborative work on adoption or adaptation of research conducted by [national research centers] supported by CGIAR." A $15,000 top prize was awarded at the meeting I attended in Kenya. The rest of this article is devoted to summaries of approximately half of the programs that were considered.

Vegetables grown in urban areas are sometimes avoided for fear that they may have been grown with sewer water or industrial effluent or may contain heavy metals. IPGRI went into partnership with Family Concern in Kenya with the object of matching rural and periurban [i.e. not far outside the city itself] farmers' production of African leafy vegetables with the market requirements and demands. To correct the negative attitude among city dwellers they introduced a brand name and farmers must adhere to certain quality standards and regulations.

In Ethiopia, a dairy products marketing association consisting of small farmers joined with ILRI to improve productivity and quality of products. The goal was to transform subsistence production into a market-oriented system and strengthen rural-urban linkages.

Primary schools in rural Tanzania are becoming development nodes. With support from the government, the Diocese of Central Tanganyika, the Christian Council of Tanzania, and ICRISAT, the schools are producing and selling inexpensive, high-quality seed to smallholder farmers.

In war-torn northern Uganda, about a million people are internally displaced and live in protected camps. They face destruction of crops by rebels and have limited time to work. Through a partnership between a foundation, the International Potato Center (CIP) and two organizations that we presume are NGOs (PRAPACE and NARO), a vitamin-rich sweet potato is being introduced that requires little care and produces in 3-4 months.

In East Africa, the Catholic Relief Services, KARI (the Kenya Agricultural Research Institute) and CIMMYT jointly involve farmers in extensive on-farm evaluation of experimental varieties, and help rural communities establish seed production businesses and distribution strategies.

In Uganda, traditional medicine accounts for 80% of Ugandans' primary health care. However, practitioners find it increasingly difficult to locate many of the medicinal woody plant products. A partnership between an NGO (RPWRD), ICRAF and herbalists has inventoried the medicinal species they use and targeted priority species for domestication (i.e. find whether and how the plants can be grown on small farms). Cultivation on smallholder farms increases supply and reduces pressure on wild populations.

CIAT is working with farmer research groups at plot sites in Malawi and Uganda. The desired outputs are farmers that are self-confident and capable of identifying and evaluating new market opportunities and technologies; "baskets" of technology options for crop production and soil management; and diverse new agro enterprises. Partners with CIAT and the farmers were an African highlands initiative promoting agricultural research in the region, and the NGOs Africare Uganda, Catholic Relief Services, and Traditional Irrigation and Environmental Development Organization of Tanzania.

ICRISAT partnered with Catholic Relief Services, Sasakawa Global 2000, TechnoServe and Kenya Agricultural Commodity Exchange to increase crop productivity and grain quality with new varieties and integrated pest management. They also worked on marketing to traders and processors. Returns to farmers have increased by up to 30% the first year and 3,000 farmers are involved in Kenya, Tanzania and Uganda.

Space does not permit us to summarize all of the projects described. Here are a few more with only brief descriptions of joint NGO and CGIAR projects and the lead CGIAR center. (We can send a little more information on any particular project mentioned in this article if it would be helpful.) IITA is helping to improve agro processing technologies and packaging and helping to developing agrobusiness in Africa. ICRAF is working with indigenous fruit tree domestication projects and marketing of the fruit. CARE and CIMMYT are involved in *Striga* control in Kenya. The World Fish Centre partners with NGOs to mobilize communities, enable fingerling production, and work on marketing strategies for production and distribution of fingerlings.

On-Farm Seed Priming

By Dawn Berkelaar

Poor crop establishment is common in developing countries. However, plants can be given a head start if they are able to germinate and emerge quickly. One way to minimize the time that seeds spend absorbing water from the soil is to soak the seeds in water before sowing them. This kind of seed soaking, also called seed priming, has been done in many countries and for many generations, but is only regularly done during poor growing conditions to help seeds "catch up." Until a few years

ago, seed priming was not done on a regular basis, and the duration of soaking varied.

Experiments with on-farm seed priming were done by researchers from the Centre for Arid Zone Studies (CAZS) with funding from the Plant Sciences Research Programme of the United Kingdom Department for International Development (DFID). Safe limits were calculated for the length of time that seeds could be soaked without germinating prematurely. Then on-farm trials were done to compare the performance of primed seed with non-primed seed.

A booklet by David Harris that describes on-farm seed priming (details also available online at www.seedpriming.org) summarized the trials as follows: "The results were remarkable. Farmers reported that primed crops emerged faster and grew more vigorously. This alone is reason enough to adopt seed priming. In many cases, however, crops also matured earlier and gave higher yields. They also flowered earlier – very important in drought-prone areas. In some cases – in chickpea and upland rice for example – less disease was reported. Priming has become very popular with the collaborating farmers, along with their friends and neighbors, because it is simple and cheap yet extremely effective." Figure 2 shows the difference that priming seed can make for emergence of maize seedlings. The plants on the left are from primed seed and the plants on the right are from non-primed seed.

Figure 2: Maize emerges faster and more completely when seed is primed overnight, as shown in this farmer's field in India. The maize plants on the left are from primed seed. Maize plants on the right are from non-primed seed. Photo by David Harris.

Table 1 summarizes crops for which yield benefits of on-farm priming have been demonstrated. Crops listed in category A have been extensively tested; those in category B have shown promise and are being tested further. The table also lists the soaking time (in hours) that has been found to be effective. In general, overnight soaking is safe and effective, but rice and maize show better results if seed is soaked for 18 hours.

On a few occasions priming has not been found to increase yield. However, Harris wrote, "no cases were reported where priming was worse than not priming. This is significant because, since priming has essentially zero cost, the practice can be considered as reliable 'insurance' for farmers."

Farmers in many countries tested, developed and adapted seed priming, and feedback from them has been very positive. For example, a group of 23 farmers in India were asked for feedback about the effects of seed priming on wheat. All of the farmers felt that the primed seeds germinated earlier, resulted in a better stand of wheat, and matured earlier. 83% saw more vigorous growth and harvested higher yields. 78% saw larger panicles filled with more grain. 65% claimed that plants had more tillers. All of the farmers declared that they planned to soak their seed the following year. This kind of response was typical from farmers in many different countries.

Seed priming activities are now being done in more than 25 countries in Asia, Southern and Central Africa, West Africa, and Latin America. Effects of on-farm seed priming have been independent of the crop variety used.

Crop	Soaking time (hours)	Countries	Largest yield benefits consistently observed to date (%)
A. Crops in which benefits have been repeatedly confirmed.			
Wheat	12	India, Nepal Pakistan	37
Barley	12	Pakistan	40
Upland rice	12 - 18	India, Nigeria, Sierra Leone, Gambia, Cameroon	70
Maize	12 - 18	India, Nepal, Pakistan, Zimbabwe	22
Sorghum	10	Pakistan, Zimbabwe	31
Pearl millet	10	Pakistan	56
Chickpea	8	Bangladesh, India, Nepal, Pakistan	50
Mungbean	8	Pakistan	206
B. Crops in which preliminary research has shown benefits.			
Finger millet	8	India	
Cowpea	8	Zimbabwe	
Bambara groundnut	8	Zimbabwe	
Linseed	8	Bangladesh	
Pigeonpea	8	India	
Groundnut	8	India, Vietnam	

Table 1. *Summary of crops responding positively to on-farm seed priming. Table used with permission; from www.seedpriming.org.*

In standard methods of seed priming (often done for temperate horticultural and agricultural crops), seed is soaked, then dried back to its original water content. This is both energy- and technology-intensive, and results in biochemical changes in the seed. In marginal tropical environments where water is often lacking, the main purpose of seed priming should be pre-hydration of seeds (though it may also result in some biochemical advantages). Properly primed seed still needs additional moisture from the soil in order to germinate. Farmers can prime their own seed if they know the safe limits

for soaking (i.e. so that germination will not continue once seeds are removed from water). It can be disastrous to sow pre-germinated seed under dry land conditions!

Seed can be primed overnight, surface-dried and sown the same day (but if necessary, surface-dried primed seed can be kept for several days before sowing, if it is kept dry). The fast germination and emergence of primed seed can lead to fast development of seedling root systems while soil conditions in the surface layers are still relatively favorable.

For more information about seed priming, contact Dr. Dave Harris at DFID Plant Sciences Research Programme; Centre for Arid Zone Studies; University of Wales; Bangor; Gwynedd LL57 2UW; United Kingdom; Tel: 0044-1248-382922; Fax: 0044-1248-371533; E-mail: D.Harris@Bangor.ac.uk.

Filtering Water with Old Clothes to Prevent Cholera

By Dawn Berkelaar

Filtering water through old clothes can effectively remove many of the copepods (a type of zooplankton) that carry cholera-causing bacteria. Researchers from the University of Maryland, College Park, did a study in Bangladesh comparing the effectiveness of old saris and nylon filters for filtering pond and river water. The study was written up in the *Proceedings of the National Academy of Sciences*. The following information was obtained from a summary by CBC News online staff (http://www.cbc.ca/stories/2003/01/14/sci-tech/cholera031314).

Bacteria called *Vibrio cholera* cause cholera. The bacteria live in standing water and enter the human body attached to copepods. The bacteria grow in the human gut, releasing a toxin that causes extreme diarrhea leading to severe dehydration. In Bangladesh, where much of the well water is contaminated with arsenic, people end up drinking surface water contaminated with cholera.

Researchers did a study with 44,000 people in different villages; people in some villages filtered water with folded cloth from old saris, people in other villages used nylon filters supplied by the WHO (World Health Organization), and still others gathered water traditionally using no filter. After 18 months, the rate of cholera in villages that used sari filters was 0.65 per 1,000 people per year. The rate for villages that used nylon filters was 0.79 cases per 1,000 people per year. The rate in control villages (where people did not filter water) was 1.16 cases per 1,000 people per year.

Saris filtered best when four layers of cloth were used. Any finely woven fabric could be used instead. Old clothes seemed to be most effective at filtering. The fibers of the cloth unraveled slightly, making the holes smaller and more effective at trapping fine particles.

Domestication of Australian Trees Project

By Dawn Berkelaar

While responding to a technical request a few years ago, former intern Denise McKinney contacted the Australian Tree Seed Center, run by the Australian government. She shared with us, "This is an organization that we have had contact with in the past; however, they have a great deal to offer our network that I don't think we have shared. They carry over 1000 species of mostly agroforestry trees. Each seed lot they carry is mapped, thus they know a great deal about the climate in which each lot of a species is growing.

"In addition, they currently have a project called "Domestication of Australian Trees" (DAT), which provides seeds free of charge to researchers in developing countries. It sounds as if many people in our network would qualify for free seeds, as ECHO was able to receive free seeds through this program. This program is funded by the Australian Center for International Agricultural Research."

Many species are available under the DAT project. Maurice McDonald, Denise's contact for the information she shared, wrote, "Most of these species are sources of fast growing firewood or land rehabilitation species. We currently stock seed of over 1000 species, which are often represented by seedlots collected from throughout their natural distributions (for assessment of provenance variation)." DAT provides high-quality seed, and also shares up-to-date information about selection, improvement, silviculture and management of Australian tree species.

If you are interested in learning more, check out their web site at http://www.ffp.csiro.au/tigr/atscmain/. You could also write a letter describing site conditions where you work, and send it to: Officer-in-Charge; Australian Tree Seed Centre; CSIRO Forestry and Forest Products; PO Box E4008 Kingston; Canberra ACT 2604; AUSTRALIA; Tel: +61 2 6281 8211; Fax: +61 2 6281 8266; E-mail: atsc@ffp.csiro.au.

Terra Preta: the Secret of Rich, Dark Soil in the Amazon

By Dawn Berkelaar

An article in the August 9, 2002 issue (Volume 297) of *Science* magazine ("The Real Dirt on Rainforest Fertility") describes an exciting discovery in Amazonia in Brazil. Researchers have discovered a rich dark soil that they refer to as "terra preta do Indio" (Indian dark earth), or terra preta for short. Terra preta is very productive soil with long-lasting fertility—unusual in the tropics, where most soils are very weathered, highly acidic, and low in organic matter and essential nutrients.

One estimate suggests that terra preta might cover 10% of Amazonia. Precontact Amerindians seem to have actually improved the soil rather than degrading it. The oldest deposits

of terra preta seem to date back 2000 years, and by AD 500 to 1000 they seem to have been present in almost every part of the Amazon basin. Deposits of terra preta are usually 1 to 5 hectares in size, 40 to 60 cm deep. However, plots are up to 300 hectares, and the soil in some places is 2 m deep. The plots are almost always full of broken ceramics. Locals sell the soil as potting soil.

Terra preta has been found to have more organic matter and more bioavailable phosphorus, calcium, sulfur and nitrogen than surrounding soils. The key to its long-term fertility seems to be charcoal; terra preta contains up to 70 times as much charcoal as nearby oxisols. Bruno Glaser, a chemist at the University of Bayreuth in Germany, said, "The charcoal prevents organic matter from being rapidly mineralized [Ed: broken down to basic minerals]. Over time, it partly oxidizes, which keeps providing sites for nutrients to bind to." Charcoal contains few nutrients, so high nutrient inputs are also needed (e.g. manure and turtle, fish and animal bones). Special soil microorganisms also likely play an important role.

Several researchers believe that terra preta was created by "slash-and-char" agriculture, in which charcoal was created by incomplete burning of organic matter, then was stirred into the soil. In addition to the benefits to the soil, this process seems to release less carbon into the air.

A few researchers have actually tried to make terra preta out of highly weathered soil, using treatments of charcoal and fertilizer. They planted rice and sorghum for three years. After the first year, there was little difference between treatments (but almost nothing grew in the control plots). In the second year, plots treated with charcoal alone grew little, those with fertilizer grew, but those treated with both charcoal and fertilizer yielded up to 880% more than fertilizer alone.

Early inhabitants of the Amazon also seem to have practiced a type of agroforestry. At one archeological site, the wood from 30 species of useful trees was found in addition to annual crops.

One major problem with terra preta plots is that weeds grow very quickly and can overwhelm crops. People who farm on ancient terra preta sites move their fields from time to timefor this reason.

For your Interest Only

Plant Communication

By Edward Berkelaar, Ph.D.

Plants calling for help? Researchers have discovered that under certain conditions, plants may communicate with insects or other plants.

Plant leaves emit into the air organic compounds called green leaf volatiles, or GLVs. Researchers Douglas Whitman and Fred Eller have made two interesting discoveries. First, damaged plants emit more GLVs than undamaged plants. In their study, damage was caused either artificially or by caterpillars eating leaves. Secondly, they demonstrated that certain wasps that feed on caterpillars will fly toward the source of GLVs. Together, these pieces of information suggest that plants under attack from caterpillars emit chemical signals that guide enemies of the caterpillars to sites where they have caused damage.

In another research project, Edward Farmer and Clarence Ryan demonstrated that plants might be communicating with one another. They showed that internal plant defense mechanisms are activated when plants are exposed to a chemical called methyl jasmonate. Methyl jasmonate is released into the air when leaves of a plant are damaged by herbivores. This may warn neighboring plants that herbivores are in the area, enabling them to chemically defend themselves from attack in advance.

ECHOES FROM OUR NETWORK

Smoked Rice Hull and Pottery

Padma Rajagopal with the organization SEED Trust in India wrote to us about smoked rice hulls as a planting medium for seedlings (EDN 69-5). She wrote, "I can add a hint about making the carbonized rice husk in another way, which would allow you to get something more out of the energy it's burning. If there are local potters producing terracotta (low temperature unglazed pottery), they can make beads for jewelry, small decorative pieces, etc., and put them into a large fired pot alternating with thick layers of rice husk. This pot would be closed with a fitting lid and sealed with clay, then fired with other ware in the terracotta kiln until all the pottery in the kiln reaches red heat. As a result, the other pottery would be fired red, while that in the pot containing rice husk would fire deep matt black, sometimes with silvery effects from the husk as well—a process called reduction firing. If you burnish the pieces before firing, you'll get a shiny deep black. The husk in the pot would be carbonized and can be used as per the instructions in EDN for raising seedlings."

BOOKS, WEB SITES & OTHER RESOURCES

CTA Website

Reviewed by Dan Sonke

In our book *Amaranth to Zai Holes: ideas for growing food under difficult conditions*, we mentioned the Technical Centre for Agricultural and Rural Cooperation (CTA) and their excellent publication *Spore*. CTA is a Netherlands-based agriculture development research organization working for development of African, Caribbean, and Pacific (ACP) nations. *Spore*, a bi-monthly newsletter published in English, French, and

Portuguese, is highly recommended to EDN readers. *Spore* always contains articles about development, news of research in international agriculture, reviews of new books and other publications such as newsletters or rural radio scripts (some of the most useful of these publications are published by CTA) as well as notices of upcoming conferences, courses, and seminars. It is on ECHO's "must read" list.

CTA has a website at www.cta.nl. From the site you can read issues of *Spore* from December 1997 to the present (either html or pdf files), search a publications catalog for titles available from CTA, and locate agriculture centers in ACP countries where CTA cooperates with research. If you work in rural radio, you can even download rural radio audio files to be played over the air. You can also subscribe to an e-mail edition of *Spore* at http://spore.cta.int.

If you are not able to browse the Internet but would like to contact CTA about their research or publications, contact CTA at Postbus 380, 6700 AJ Wageningen, The Netherlands. Tel. +31 317 467100, Fax. +31 317 460067. E-mail: cta@cta.int.

Overstory Online

Reviewed by ECHO Staff

In *EDN* 55, we told readers about AgroForester, an agroforestry-promoting organization in Hawaii that carried a wide range of seed of tropical tree species as well as inoculants for leguminous tropical tree species. In order to give more time to educational programs, AgroForester closed its seed business in January 2004 and ECHO bought their seeds. They are now referring their customers to ECHO. They are still selling the inoculants, but many of the tree species that were supplied by Agroforester are now available for purchase in bulk through ECHO.

Since 1998 AgroForester has been publishing *Overstory Online*, a free newsletter e-mailed to subscribers twice a month. A practical, informative newsletter, *Overstory Online* focuses on designing, developing and learning more about tropical agroforestry systems (systems that incorporate trees and other perennial plants). Issues include project development strategies, brief book recommendations, species highlights, Internet links to helpful related information, and much more. Past issues are available for reading on their website at www.agroforestry.net.

The first three years of the *Overstory Online* have now been published and are available as a book or on CD. The information is organized by topic, illustrated and fully indexed. Chapters are cross-referenced to related chapters. The paperback book is 430 pages. It costs US$39.95 plus shipping.

Topics covered by past issues have included sheet mulching, bamboo in agroforestry, animals in agroforestry, live fences, bees and agroforestry, mushrooms in agroforestry, tree domestication, etc.

To subscribe to *Overstory Online*, simply send an email to overstory@agroforestry.net with 1) your name, 2) email address, 3) organization (or project name or description), and 4) your location (country, state). Unsubscribing is equally simple, and instructions are included in every issue. Also, AgroForester promises never to reveal your name and address to anyone. To read past issues on the web, go to http://www.agroforestry.net/overstory/osprev.html. Other contact information for AgroForester is: P.O. Box 428, Holualoa Hawaii 96725, USA; Tel: 808-324-4427, Fax: 808-324-4129; E-mail: email@agroforestry.net; website: www.agroforestry.net.

FROM ECHO'S SEEDBANK

Rice Bean -*Vigna umbellata*: Another amazing green manure/cover crop

By Grace C. Ju, PhD
ECHO Seed Bank Manager

Rice bean (*Vigna umbellata)* is one of the top five most commonly grown green manure/cover crops in the world. Rice bean comes highly recommended by Roland Bunch (author of *Two Ears of Corn* and frequent speaker at ECHO's annual agricultural missions conference). In a recent article about green manure/cover crops, he ranked rice bean high in its ability to grow in poor soil, resistance to drought, and resistance to shade. He ranked it average among other legumes in nitrogen fixation at about 80 kg/ha (compared to 130 kg/ha for lablab) and average in controlling weeds. He ranked it very high in taste. Among the most important cover crops in SE Asia, rice bean is versatile, easy to grow, quick maturing and heavy producing. It has tremendous potential to improve nutrition for humans and animals and to improve the fertility of the soil. Today it is primarily cultivated in India, Burma, Malaysia, China, Fiji, Mauritius and the Philippines. It is also known as *Phaseolus calcaratus* and *Azukia umbellate.*

This versatile green manure/cover crop is used by farmers for maintaining or improving soil fertility, controlling weeds and providing nutritious food for humans and animals. It is a practical nitrogen-fixing green manure crop that improves the soil. Stems can be cut and used as animal feed or mulch. Vines can be cut for hay when pods are half grown. Leaves can be fed to chickens. It is valuable as an erosion control when planted on slopes, and smothers weeds easily.

There are both climbing and bush types of rice bean (see Figure 3). It can be grown as an annual or perennial. The bush can be 30 to 75 cm (12 to 30 inches) tall. Trifoliate leaves grow thick on the stems providing a dense ground cover. Yellow flowers are followed by round pods in heavy producing groups of 5 to 12, about 10 cm (4 inches) long. The

plants are short day plants (i.e. they require short days to flower). Seeds are ready for harvest 90 to 120 days after planting, depending on the time of year it is planted. Seeds come in different colors: yellow, brown, red, violet, ivory, and black. The seeds are about the size of a grain of rice, which may be why it is called “rice” bean. Rice bean has a wide range of environmental habitats, from hot humid to hot arid. It will not do well in waterlogged conditions. It is planted in rice paddies after rice harvest (during the dry season) to add nitrogen and humus to the soil. It can also be grown in rotation with crops like maize and millet.

Figure 3: Picture of a climbing type rice bean plant.

Seeds are easy to harvest from these heavy producing plants, and pop open readily when dry. The pods mature at one time so one harvest is all that is needed. The dry pods tend to shatter, so harvesting should be done in the morning when moisture is higher in the air. The seeds can be stored for long periods and retain high germination. Germination can be enhanced with presoaking. They are very resistant to insect pests. Of special note is that they resist the cowpea curculio even though rice bean is in the same genus as cowpea. We have had problems with wild rabbits at ECHO eating the seedlings. Protecting the young plants by sprinkling blood meal on and around plants has worked.

A great advantage of rice bean as a green manure/cover crop is that it provides a tasty and nutritious human food. Rice bean seeds can be used as a pulse (dried seed), vegetable sprouts or as green bean pods that stay tender on the vine a long time. The young leaves and immature pods can be steamed and eaten (when the plant is 40 to 60 days old). It is often cooked with rice and can also be used instead of rice in stuffing. It can be cooked in soup or stew. Sprouted rice beans are a good source of zinc. Rice bean offers a valuable source of protein for humans and animals. The total protein content is 20-23%; it also has high calcium and carbohydrate content. Nutritionally it is comparable to traditional pulses. The 3.2-4.4% crude fiber helps with the digestibility of the legume.

Rice bean has proven to be a successful plant at ECHO and it possesses characteristics that make it an ideal green manure/cover crop. We are impressed with its quick maturity, heavy production and uniform seed set. Those working in agricultural development in developing countries may request one free sample packet of *Vigna umbellata* (rice bean). All others may purchase seed from ECHO. The overseas price is $3.50/packet (includes shipping), the domestic price (in the USA) is $3.00/packet plus $1.00 for shipping.

Bulk Seed from ECHO’s Seedbank

The following seeds may be purchased from ECHO’s Seedbank in small bulk quantities.

Abelmoschus esculentum 'African Okra’: A high yielding okra which thrives in hot weather and continues to produce large pods even when days are short.

Mucuna pruriens 'Tropical Velvet Bean': An extremely vigorous legume which is somewhat drought tolerant, a good green manure and excellent for weed suppression and animal fodder. Beans are not used for human consumption.

Psophocarpus tetragonolobus 'Day-Neutral Winged Bean': A climbing leguminous vegetable that thrives in hot humid zones. The pods, beans, leaves, tubers, and flowers are all edible, which is why it has earned the name "super market on a vine." This particular variety does not require short days for seed production.

Sorghum bicolor 'Giza 114': A sorghum mentioned in "Lost Crops of Africa" as a promising fuel crop for the future. Stalks burn at very high temperatures so they can be used to fuel cookstoves and brick kilns.

Sorghum bicolor 'Striga-Resistant': Variety from the University of Purdue that is resistant to the parasitic weed "striga" or "witch weed".

Zea mays 'Hawaiian Supersweet #9': A sweet corn from the University of Hawaii that will grow with tropical day-length. Results with Hawaiian Supersweet were disappointing in some of the trial reports we received. However, the Seedbank has had several individuals in the past year order it in bulk because they tried the trial packets and were excited at its success. It seems to be a quality seed that will thrive under the right conditions. We suggest that you request and plant a trial packet of this seed before you order it in bulk.