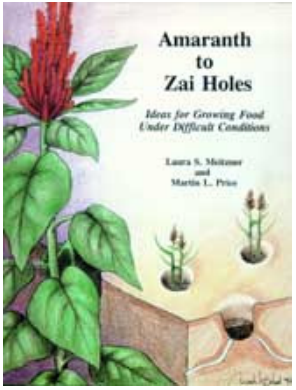


Amaranth to Zai Holes, Ideas for Growing Food under Difficult Conditions (ECHO, 1996, 397 p.)

13: Energy and technologies

Appropriate technologies can reduce tiresome labor and increase the efficiency of the rural family in their work at home and in the fields. There are many simple machines, tools, utensils, pumps, and other items which can make significant improvements in people's lives, but not all are suitable for the living situation. Development workers must be particularly cautious with introducing and promoting new technologies too hastily. It is essential to determine the needs and commitment of the community toward new methods.

There are many excellent organizations and resources with counsel and publications on energy systems, labor-saving devices, construction, and other areas. ECHO does not specialize in appropriate technologies, and people who send us technical questions on these areas are usually referred to the organizations listed here for specialist assistance.

Organizations and resources

APPROPRIATE TECHNOLOGY MICROFICHE LIBRARY. This "library that fits in a shoebox" is one of the most comprehensive resources we have seen! The Library includes the complete text of 1000 of the best books (138,000 pages) on village-level A.T. and sustainable development. It includes many out-of-print materials, classic field resources like Where There Is No Doctor

and the VITA Village Technology Handbook, and extensive sections on agriculture, animal husbandry, health, construction, water systems, and small industries. At $895 it costs about 5% of a similar paper library. This would be a great resource on the field; perhaps you can ask your supporters to sponsor this as a project. The Library includes a copy of the Appropriate Technology Sourcebook, which gives a careful review of every book in the Library. You may order the Sourcebook separately for $23.95 paperback/$29.95 hardcover. (This 800-page annotated guide to appropriate technology literature includes reviews of 1150 of the best books on "village technology" from around the world. The purpose is not to give enough information to get to work, but books and plans are reviewed in sufficient detail to help you decide whether to purchase them. Ordering information is given for each book.) They plan to release this on CD-ROM in mid- 1996. Three microfiche readers are also available, for $250 (office use), $375 (briefcase style), and $625 (prints from the screen). Contact the Appropriate Technology Institute, W110 Engineering Research Center, Colorado State University, Fort Collins, CO 80523, USA; phone 800/648-8043 or 970/491-7189; fax 970/491-2729.

VOLUNTEERS IN TECHNICAL ASSISTANCE (VITA) has an information service which provides technical help to people working in the developing world. Most of you have probably written to VITA from time to time with questions

or requests for plans for appropriate technology items. Their publications on a wide variety of topics are clearly written and the plans are easy to follow. Ask them about their free services in support of development workers. For general information and technical service, write to 1600 Wilson Blvd., Suite 500, Arlington, VA 22209; phone 703/276-1800; fax 703/243-1865. Address publications orders and inquiries to P.O. Box 605, Herndon, VA 22070, USA.

INTERMEDIATE TECHNOLOGY'S TECHNICAL ENQUIRY UNIT can answer specific, detailed questions on a wide range of technical matters, offering information, referrals, and advisory services. They are an excellent contact if you are seeking some particular equipment. Direct your questions to Technical Enquiry Unit at ITDG, Myson House, Railway Terrace, Rugby CV21 3HT, UK; fax +44 -1788 540270; e-mail itdg@gn.apc.org. IT also has country offices in Sri Lanka, Zimbabwe, Bangladesh, Peru, Kenya, and Sudan.

FAKT ASSOCIATION FOR APPROPRIATE TECHNOLOGY can answer questions about technological problems. There is no charge for this service. FAKT consultants assist other organizations in finding socially and environmentally compatible solutions to challenges. They also identify and promote local consultancy structures in-country. FAKT can serve as a resource on the

technologies of mini-hydropower, renewable energies, water supply and sanitation, food science/technology, and hospital technology. Their consultancy (with fees) includes planning technical projects, participatory project management, vocational training and craft promotion, evaluations and studies, and training programs and seminars. Contact FAKT Association for Appropriate Technology, Gansheidestr. 43, D-70184 Stuttgart, GERMANY; phone (0711) 21095-0; fax (0711) 21095-55.

SIFAT (Servants In Faith And Technology/Southern Institute For Appropriate Technology) offers practicums in appropriate technologies in Alabama and a few sites in South America. When people contact ECHO who want further training or information on technologies designed for developing countries, we often refer them to SIFAT. They have year-long internships, short courses, Learn & Serve teams, and cross-cultural seminars for short-term mission. Eight-week sessions include principles of community development, cross-cultural communication, and appropriate technologies for basic human needs (1996 cost: US$1200, or $150/week, including room, tuition, food, building materials, and books). Students learn water management, sustainable agriculture, alternate energy, and health and sanitation. Special hands-on projects are arranged depending on the interests of the student.

Write for a brochure. SIFAT will consider requests for financial aid to cover

tuition, room, and board while at SIFAT, though these arrangements must always be made well before you leave home. In no case will they cover travel expenses. The government will not grant education visas to attend SIFAT because they are not a degree- granting institution, so citizens from other countries should apply for a tourist visa. They are located on a 180-acre farm approximately halfway between Atlanta, Georgia, and Birmingham, Alabama. Rt. 1 Box D-14, Lineville, AL 36266 USA; phone 205/396-2015; fax 205/396-2501.

THE APPROPRIATE TECHNOLOGY INSTITUTE: see information in Chapter 11 on Human Health (p.283).

APPROPRIATE TECHNOLOGY MAGAZINE FROM IT PUBLICATIONS is an excellent resource on a wide variety of AT topics. Each issue features some topic in depth and includes many case studies and practical ideas from around the world. This quarterly publication is £15/$28 for private individuals via surface mail; airmail postage is £6/$12 additional. You may write for a free index, and many back issues are still available. Write IT Publications, 103-105 Southampton Row, London WC1B 4HH, UK.

AN APPROPRIATE TECHNOLOGY NEWSLETTER. Rus Alit (inventor of the Rus pump; see below) has started an Appropriate Technology Newsletter. We

asked how to subscribe. "The receiver will be asked to subscribe after the first three issues. We will give free issues [Ed: write to Rus, not to ECHO] to those who are contributing articles. It will be a quarterly newsletter, costing US$10 per year. Each issue will focus on one particular innovation and will include case study, implications of change, technical details, reference to other AT innovations, and resources available in World Vision Australia department." Write Rus Alit, 7 Bonython St, Rochedale Queensland 4123, Brisbane, AUSTRALIA; phone/fax (07) 341-2371.

MENNONITE HARDWARE STORE IS UNIQUE. When we parked in front of Lehman's Hardware store in Kidron, Ohio, we had to pick a spot between the horse-drawn carriages common in this Amish/Mennonite community. Reflecting the local tradition of continuing with older ways, Lehman's sells items I have not seen in any other store. There were several makes of wood-burning cookstoves, which I had not seen since I was a small child, complete with all kinds of accessories. I saw washboards, hand-powered washing machines, all types of wood working tools, kerosene, gas and gasoline lamps and accessories, sausage stuffers, bottle cappers, fruit peelers and pitters, large copper kettles, many kinds of cast iron cookware, hand-operated grain mills, many types of wood-heating stoves, a gas or kerosene refrigerator and a gas freezer, hydraulic rams and other hand pumps, cream separators, home pasteurizers, etc.

Mr. Lehman took a ten-year leave of absence to serve as a missionary with the Mennonite Central Committee in Zaire. "Soon after my return we decided to print a mail order catalog.... Partly in recognition of the loyal, volume buying of the larger missions and partly as our small contribution to the efforts of missionaries we developed special discounted prices on many of the items commonly used in the 'bush'." They will send the $2 catalog free if you write on letterhead of your mission board. HOWEVER, if you want it sent airmail please send $3 for postage. If you are a missionary, it is IMPORTANT to also ask for the special missionary "non-electric" price list. To call for quotes or advice on replacement parts, phone 216/857-5757. Write to Lehman's, One Lehman Circle, P.O. Box 41, Kidron, OH 44636-0041, USA.

CECOCO "GUIDE BOOK FOR RURAL COTTAGE AND SMALL & MEDIUM SCALE INDUSTRIES AND PADDY RICE CULTIVATION" is a catalog of a great variety of agricultural, food processing, and small industry equipment (for making ropes, looms, paper bags and boxes, wire, bamboo products, and more). It is very unique with products that are difficult to find elsewhere. Send a description of the equipment you are looking for or ask for a list of products from CECOCO, P.O. Box 8, Ibaraki City, Osaka 567, JAPAN.

INFORMATION AND ADVICE AVAILABLE ON BUILDING IN THE TROPICS.

When Dr. Reuben Sperling visited with us to discuss structural aspects of roof top gardens, he mentioned that he used to work with the overseas division of the Building Research Establishment in England. After seeing the practical literature they have published I am convinced that many of our readers should know about this group. I quote from their literature:

"One of the Division's most important publications is the series of Overseas Building Notes, distributed to readers in over 80 countries. The Notes are published approximately six times a year and recent titles have included 'Preservation of timber for tropical buildings', Stabilized soil blocks for building', Roofs in hot dry climates' and 'The management of resources on construction sites.'" Many papers are written by experts from third world institutions. "Several hundred inquiries are answered each year. Similarly many research workers, builders, architects, housing managers and students from all over the world visit the Division each year ... [to discuss] building research or building techniques in use elsewhere."

I have copies of some of their publications. Although this is far removed from my expertise, they seem to be very practical and understandable. You can obtain copies for a small charge (or perhaps free if you explain what you are doing). Here are some selected titles: Small buildings in earthquake areas; Termites and tropical building; Brickmaking in developing countries;

Health aspects of latrine construction; Timber in tropical building; Bitumen coverings for flat roofs; Low cost housing in urban and peri-urban areas; Rice husk ash cement; Building for comfort; and Disease reduction by improved house construction. Address your requests to BRE Bookshop, Building Research Establishment, Garston, Watford, WD2 7JR, UK.

ENGINEERING MINISTRIES INTERNATIONAL (EMI) PROVIDES FREE HELP TO CHRISTIAN MINISTRIES. Engineering Ministries International (EMI) is a group of evangelical professional architects and engineers who volunteer their services "to proclaim the love of Jesus Christ through the work of Christian relief projects." They have experience in such fields as structural engineering, architectural planning, hydraulics (including hydrogeology and water supply), electrical and mechanical engineering, and surveying. EMI's Director, Michael Orsillo, has years of education and experience in civil engineering, and he is also an ordained minister.

Many mission buildings and churches are built with little or no professional design work. EMI is able to provide competent design assistance at a fraction of the cost of professional consulting services. Often the cost of assistance is off-set by a savings in material costs, time over-runs or future maintenance problems. They are presently working with plans for an orphanage in Honduras, a low-budget church in India, a water system for an Ethiopian

women's hospital, and a youth camp in Indonesia.

In order to be eligible for this technical assistance from EMI, projects must minister to the needs of the poor, directly proclaim the gospel of Christ, and have realistic possibilities for funding the building of the project once the design is completed. EMI's design services are provided free of charge. They do not fund the cost of construction. For more information, contact Mr. Michael Orsillo, Engineering Ministries International, 110 S. Weber, Suite 104, Colorado Springs, CO 80903, USA; phone 719/633-2078; fax 719/633-2970.

MICRO-HYDROPOWER SOURCEBOOK. This book deals with a topic beyond my expertise. However, I can tell that it would be "must reading" if I were trying to decide whether to begin a project to harness waterpower, and even more so if I decided to go ahead with the project! ("Micro-hydropower" refers to plants that generate less than 100 kilowatts of electricity.)

This 285-page book is exceptionally well-illustrated with 200 photos of case examples of facilities in the third world and about as many drawings. It has a variety of designs, approaches and case studies. It provides the theory as well as practical guidelines required to plan, design, and implement micro-hydropower schemes. Chapter topics include measuring head and discharge,

streamflow, site selection and layout, construction of the facility, turbines, electrical vs. mechanical power, governing, electrical aspects, and case studies.

I wrote the author, Allen Inversin, asking whether most of our readers would not find electrical generation more technical than they could handle. He replied, "I should note that the Sourcebook focuses not only on electricity generation, but possibly more importantly on the generation of mechanical power to directly drive agro-processing equipment. As it turns out, the most successful microhydropower projects are those which provide mechanical power to mill grain, hull rice and expel oil from oil seed. The success of such programs in Nepal is due wholly to the fact that the focus ... is on productive, income-generating end uses. ...the generation of electricity is a secondary benefit, which is generally realized only after the plants have already generated the income to cover their costs."

The books may not be available after mid-1996. The cost is $22 plus shipping. Individuals working in a volunteer capacity overseas qualify for a special price of $18 plus shipping. Shipping costs $6 for surface mail. For airmail add $10 in Latin America, $15 in Europe and Africa and $20 in Asia. Order from NRECA International Foundation; Attn: Sourcebook; 1800 Massachusetts Avenue, N.W.; Washington, D. C. 20036-1883; USA; phone

202/857-9622; e-mail 74720.551@compuserve.com.

In response to this review in EDN, John and Caryl Busman wrote of their experience in Tamil Nadu State in southern India. "Although power was provided erratically and at widely varying voltages, farmers did everything possible to connect their irrigation pumps to the 'grid.' Attractive electrical rates and low maintenance costs compared to bullocks or diesel made the decision to switch an easy one. That one state ended up with a million electric pumps on small irrigation wells.

"The question is, Who fixes things when they break? The informal sharing of knowledge has created a whole new group of technicians. Little villages would have 4-5 people who knew the business of rewinding motors. You would see motors hauled to town on ox carts for service, with quick turn around time for repair. What is most interesting is that this has all happened within 20 years."

HYDRONET is an international newsletter for the dissemination of information on micro-hydro power techniques and experiences. It is published in English, Spanish, and Indonesian three times a year. Contact Intermediate Technology, 15B Alfred Place, Colombo 3, SRI LANKA; phone 577455/6/7; fax 577458; e-mail itsrilan@sri.lanka.net.

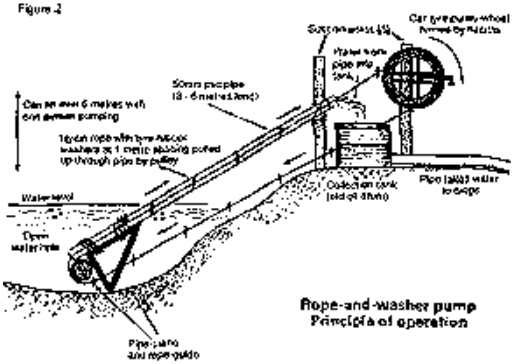
NEW DESIGNS FOR RURAL ELECTRIFICATION (80 pp.) describes the technical and organizational innovations which enabled a power company in Nepal to reduce costs and maximize benefits of supplying electricity to rural subsistence communities. Topics such as the cost of grid extension, utility poles which can be easily carried to remote areas, housewiring alternatives, low-wattage electric cookers, users' organizations to coordinate the villagers and the electric utility company, and community motivators are included. Many pictures are included. Cost is $20 including airmail postage. Order from NRECA International Foundation, Attn: New Designs for RE, 1800 Massachusetts Avenue, N.W., Washington, D.C. 20036-1883, USA; phone 202/857-9622; e-mail 74720.551@compuserve.com.

MAKING WHEELS: A TECHNICAL MANUAL ON WHEEL MANUFACTURE (153 pp.) is a well-illustrated and detailed book on this low-cost technology based on a hand-operated bending device. Rims can be made for bicycles, carts, and cars. An assembly jig ensures that wheels are constructed to a consistent high quality. Readers should have good metal-working skills. Available for $28.95 plus postage from Women, Ink., 777 UN Plaza, New York, NY 10017, USA; phone 212/687-8633; fax 212/661-2704; or £14.95 from Intermediate Technology Publications, 103/105 Southampton Row, London WC1B 4HH, UK; fax 44 171 436 2013; e-mail itpubs@gn.apc.org. Ask for their catalog and a list of distributors in developing countries.

Technologies

"HOW TO MAKE A ROPE AND WASHER PUMP." Robert Lambert wrote this 32-page booklet for the Intermediate Technology Development Group. The manual shows how to make a simple, cheap pump suitable for smallholding and garden use (see illustration from the book). The pump, which can raise water up to 6 meters (18 feet) from a stream, pond or well, has been field-tested in Tanzania and Zimbabwe. An output of 1 liter per second at 5 meters can be sustained, enough to irrigate 1/4 hectare if pumped 20 hours a week.

It is designed especially for irrigation of small plots. Providing "supplementary irrigation to crops at critical periods of growth can greatly increase the yield ... [or even] make the difference between a good crop and total failure." It is "particularly valuable for vegetable production in the dry season when vegetables may be grown only through the use of irrigation. [And prices received will be higher.]"



rope and washer pump

"The rope and washer pump is ... capable of lifting relatively large volumes of water from a water hole or well to its own height [but no higher]." "A rope is pulled up through a pipe by means of a pulley wheel [an old tire]. Fixed to the rope are flexible rubber washers [cut from a tire] whose diameter is slightly less than the internal diameter of the pipe." As the washers are pulled up through the pipe "water is drawn up and discharged at the top. The rope and washers pass around the pulley wheel and return to the bottom of the pipe."

Every moving part is out in the open and can be hand made with simple tools. The cost of materials in Zimbabwe in 1989 was US$30. A video tape is also available. I cannot review the one I purchased because I forgot that

England uses a different video system than we do. However, the booklet is so profusely and well illustrated that I see little need for a video. Order from Intermediate Technology Publications, 103/105 Southampton Row, London WC1B 4HH, UK; fax 44 171 436 2013; e-mail itpubs@gn.apc.org. The price is £5.95 (about $11.50) plus 20% surface postage, 40% airmail. In the USA, order IT Publications from Women, Ink., 777 UN Plaza, New York, NY 10017. They also have distributors in 15 other countries; write or e-mail for one of their excellent catalogs or addresses of local sources near you.

THE RUS PUMP.

Diagram: Design for the Rus pump, courtesy of World Vision Australia and Rus Alit.

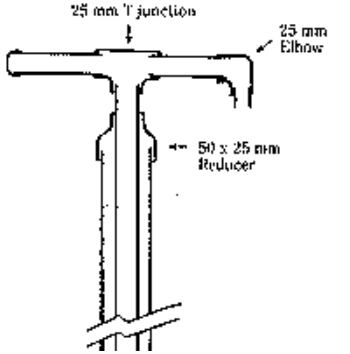
INTRODUCTION

The Rus Pump has gained wide acceptance in South East Asia and the Pacific because it works well, is cheap and is easy to build. The main component needed to make the pump are PVC pipes, hard wood and scrap of car tyre. The valves must be hard wood so they will last. The rubber flap are made from old car tyre. The flaps are about 0.5 mm thick and attached to the valve seat with nails.

THE UPPER VALVE/PLUNGER

This Plunger must slide up and down freely

THE PUMP WHEN ASSEMBLED

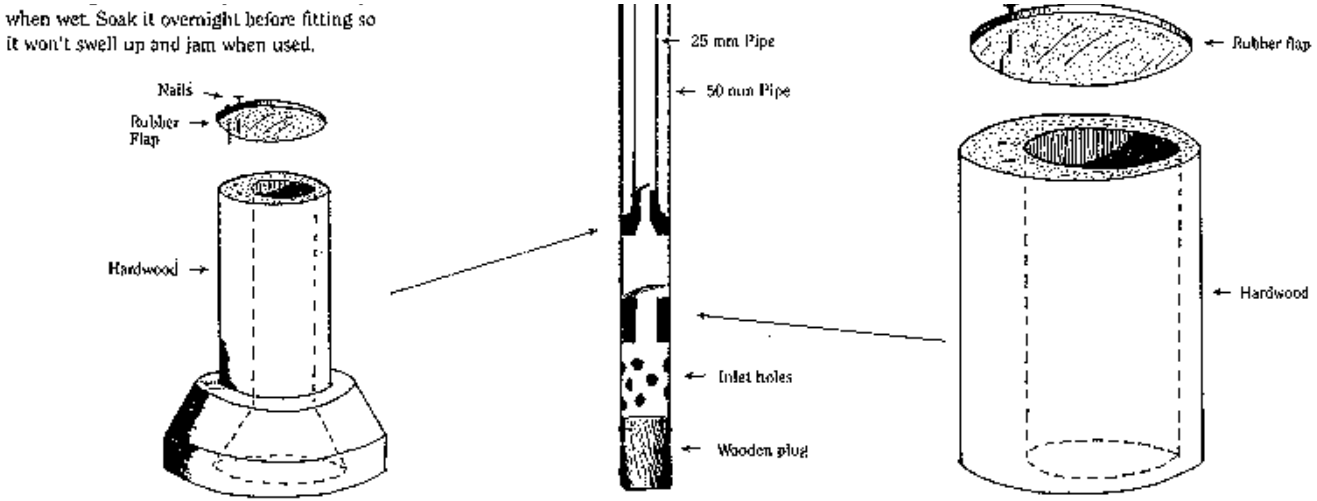


HOW THE PUMP WORKS

On the upstroke, water is sucked into the space between the two valves. On the down stroke, this water is forced up the center pipe.

THE FOOR VALVE

This hardwood valve seat must be a good tight fit in the pipe. Warm the end of the pipe (20 cm long) over the fire. When the pipe is soft, slide the valve in.



Rus pump design

Wayne DeYoung in Haiti writes about a pump that he is sure will interest our network. It was used in a water well project by Dan Cook and others in Haiti. Wayne believes that it has phenomenal value for many gardening situations along rivers or ponds or where a hand dug well is available. "Dan is doing a gardening project where water is the main limitation. They dug a 45 foot deep well at 50 a foot, only to find that pumps were outrageously priced, especially now with the United Nations embargo. Then he heard that the

Reeves in Gonaive had made a pump from PVC pipe. He bought about 50 feet each of 1¼ and 3/4 inch pipe for US $50." Wayne then describes how homemade foot valves were attached to the bottom of each string of pipe and the 3/4 inch string fitted inside the larger one. [Ed: A "string of pipe" refers to a series of pieces of pipe connected to make a long section.] "By pumping the 3/4 inch pipe up and down it pumps water beautifully, at least 5 gallon a minute."

World Vision Australia forwarded a package of brochures for our review (see below to order). The brochures were "developed by our appropriate technologist, Rus Alit, who has traveled extensively introducing the technologies to developing countries." When I saw the size of the brochures I wondered how enough could be included to be useful-each is a single 8½ x 11-inch sheet of paper. But they are clever, to-the-point, and very well illustrated. The brochure on the Rus pump describes how it "has gained wide acceptance in South East Asia and the Pacific because it works well, is cheap and is easy to build." The main components are PVC pipes, a piece of hard wood and a tiny scrap cut from a discarded tire. It can pull water from a well up to 6 meters (18 feet). [The rope and washer pump mentioned above is also made from readily available materials. The model we recently built at ECHO quickly became a hit on our educational tours. It is especially useful for higher volume irrigation where water is pumped a modest height, e.g. up

the bank of a stream into the field. It would not work in a narrow tube well.]

Our own appreciation for the Rus pump was heightened when Merrill Esch, who was studying at ECHO in preparation for work in Honduras, built a Rus pump for ECHO from the Australian design. It is unbelievably simple to build. The only part that might be difficult for some would be making the hardwood valve. Merrill even simplified that by using a 2-inch long piece of bamboo. Note that if the inside pipe is extra long, water can be lifted quite a distance. The bottom section of the Rus pump lifts water by suction, perhaps 6 meters (18 feet), then pushes it the rest of the way.

Diagram: Design for the Rus pump, courtesy of World Vision Australia and Rus Alit.

Notes from ECHO's experience with the Rus pump built by Merrill: (1) Selecting a piece of bamboo of the appropriate diameter is easier than making a hollow hardwood cylinder. (2) Rubber flaps made from innertubes are not thick enough. Cut them from tires as the bulletin says. (3) PVC pipe often comes with one end enlarged so that the next piece will fit into it. Merrill found that using this enlarged end for the upper valve made just the right fit inside the larger pipe. He just forced the bamboo into the end and did not need to make any special fittings. Note, however, that we have not

used the pump under field conditions.

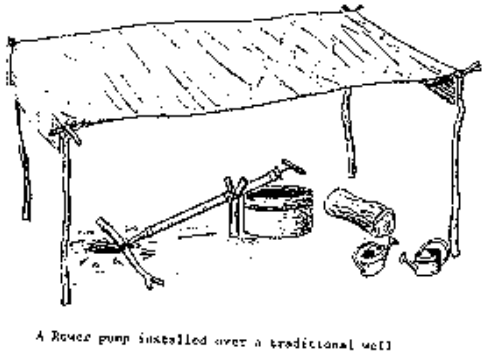
The complete series of 14 brochures (Rus Pump, Making a Hydraulic Ram, Digging a Tube Well, Making Ferro Cement Water Tanks, Making a Water Filter, Water Sealed Toilet, Stoves, A-Frame, Mud Bricks, and others) is available from to World Vision of Australia for A$10.50 (about US$8) plus about A$5 postage. If you work with any technologies, it is well worth having the whole set. Videos are also available; ask for ordering information. Write Bookstore, World Vision Australia, G.P.O. Box 399C, Melbourne, Vic 3001, AUSTRALIA; phone (03) 287-2233; fax (03) 287-2427. Contact World Vision in your country for more information on the technologies.

THE ROWER PUMP, WEST AFRICAN VERSION. Timothy Volk with the Mennonite Central Committee in Nigeria was prompted by the note on the Rus pump to write about the rower pump that MCC is successfully introducing in Nigeria. "The rower pump is rapidly gaining acceptance here, especially for dry season gardening. The [1994] price for the pump is 500 Naira (US$12.50), compared to 10,000 Naira for a gas powered pump."

The name "rower" comes from its mode of operation. A person sits on a log and "rows" back and forth to pump the water. "It is feasible to pump 60

liters per minute over long periods of time." Water can be lifted up to 6 meters.

The rower pump concept was developed in Bangladesh, where they are today mass-produced and used primarily in irrigation. The West African version made design changes to lower its cost and simplify its construction. For example, in the Bengali version the piston and foot valve are made from machined aluminum and injection-molded polyethylene, while the corresponding parts in the West African pump are handmade from PVC plastic.



A Rower pump installed over a traditional well

a Rower pump

A detailed and well-written 36-page book, MCC West African Rower Pump, is

published by the Africa desk of the MCC. They donated a few copies for ECHO to distribute to interested members of our network. If you want it sent via airmail enclose postage ($2 in the Americas, $4 elsewhere). The rower pump appears to be more difficult to make than the Rus pump, but not too much of a challenge for a mechanically-oriented person. In return for the extra work, the advantage is a higher volume of water and less effort.

HOMEMADE WATER REPELLENT FOR WOOD. Don Bernd wrote to ask what we would recommend to counter molding of "leather, books, accordion, and wood furniture" in extreme humidity in his part of Colombia. The U.S. Forest Service bulletin, "Wood Finishing: Water Repellents and Water-Repellent Preservatives," describes a method for treating wood that is exposed to weathering (but above ground). It is not clear from the publication what effect it would have on indoor wood exposed to extreme humidity, but it is worth a try. They treated experimental wood window sash and frames with the preservative whose formula is detailed below. The window units are in good condition after 20 years' exposure even though all the original paint has weathered away. Untreated painted window units decayed severely and fell off the test fence after only 6 years' exposure.

Extreme caution should be exercised in preparing the water repellent because the organic materials, especially the hot paraffin, are quite

flammable. It is best to prepare it outside. Do not use a direct flame or heat near a flame such as the pilot light on a stove. To make one gallon of repellent, melt 1 oz. of paraffin wax in the top unit of a double boiler. Pour this into enough solvent to make a final volume of one gallon, stirring vigorously. The solvent should be at room temperature and can be either turpentine, mineral spirits or paint thinner. After these two are mixed, add 1.5 cups of boiled linseed oil. Exterior-grade varnish can be used in place of boiled linseed oil, but twice the volume (three cups) should be used. The preservative can be applied by brushing or dipping. The wood can be painted after it is dried if desired.

Even more protection can be obtained by including 1.75 cups of pentachlorophenol concentrate 10:1 (40%). The solution is then called a water-repellent preservative. Because this substance is poisonous it should be limited to outside use. Remember that it may be toxic to animals and plants. For (a little) additional information and a good list of product suppliers, request the free publication FPL-0124 from Information Services, U.S. Department of Agriculture, Forest Products Laboratory, Forest Service, 1 Gifford Pinchot Dr., Madison, WI 53705-2398, USA; fax 608/231-9592. (They offer their recent publications on wood utilization research to provide technical information on wood processing, timber economics, tropical woods, wood protection, and related topics.)

PRESERVING WOODEN BEE HIVES It is possible that the water repellent just described would be especially helpful for treating wood that is to be used in constructing bee hives. But be careful if you add toxic chemicals to turn it into a water-repellent preservative. Professor G.F. Townsend at the University of Guelph in Ontario, Canada wrote the following: "In tropical countries it is necessary to either use wood that is resistant to termites and ants, or to treat the wooden parts of the hive. If you wish to stay away from any of the wood preservatives, the equipment may be dipped in a very hot solution of paraffin wax (about 158 C) for a two-minute period. Sometimes up to 50% rosin or some beeswax may be added to this mixture. This procedure is dangerous unless special equipment is devised for the dipping and heating. The only wood preservative which is relatively non- toxic to bees is copper naphthanate. ...If only paint is used, it should be an oil-base paint containing aluminum."

"WICK" SUGGESTED TO PRESERVE UNTREATED POLES. (Taken from Living Off the Land, April 1982.) Joy Horton in Loja, Ecuador wraps posts and poles to several inches above the expected ground level with burlap or newspaper soaked with a mixture of used motor oil and creosote. The wrapped post is then placed in a hole and more of the mixture poured onto the wick. Further treatments are applied twice yearly to the part of the wick that remains above ground. She does not recommend this method for garden stakes or

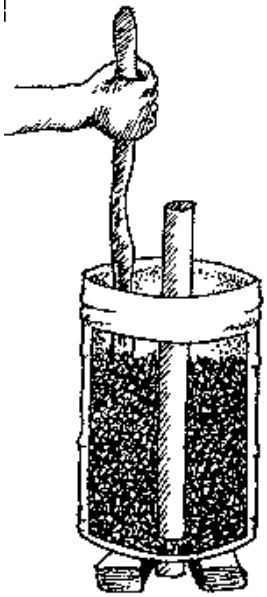
trellises, as the mixture is toxic to plants. (Each issue of Living Off the Land is a "subtropic newsletter" which features one plant, usually a fruit, including recipes. It is oriented primarily to Florida readers. A one year subscription of 5 issues is $15 overseas airmail from Geraventure Corp., P.O. Box 2131, Melbourne, FL 32902-2131, USA. The editor, Marian Van Atta, also has a number of books available; write for a listing.)

PEDAL-POWERED VEHICLES. Ken Hargesheimer wrote, "There is nothing that costs so little that does so much for a third world family as a bicycle trailer. Mine is a chassis on which various units (e.g. pickup for hauling children, animals, tools or a tanker) can be mounted. It requires no welding. I can send all kinds of information and plans to anyone interested." He also sent us a list of other designers, makers, etc. of pedal-powered vehicles and equipment, including people in many other US states, Canada, Kenya, and India. The products include a bicycle ambulance, weeder/harvesters, mowers, a grain reaper, and more. In the US send a self-addressed stamped envelope and $1 for copies; overseas send two International Postal Reply Coupons. His address is P.O. Box 1901, Lubbock, TX 79408, USA; phone/fax 806/744-8517.

SAWDUST USED TO FILL OLD TRACTOR TIRES. CERES, the magazine of the Food and Agriculture Organization, reported a method for using old

puncture-prone tractor tires in making ox carts (September/October 1984 issue). Farmers would not accept metal wheels and could not afford new tires. Engineers settled on using old tires filled with sawdust. They are not susceptible to puncture and provide almost the same ride as air-filled tires. The cart carries 500 kg.

SIMPLE SAWDUST COOKERS. Dale Fritz, a volunteer appropriate technologist who came to ECHO after years of experience in Afghanistan, built some simple stoves to heat our greenhouses with sawdust on a few cold nights this winter. They were modeled after "sawdust cookers" which run on dry sawdust, wood shavings, rice hulls, or similar materials, producing a moderate heat for an extended time.



simple stoves to heat our greenhouses with sawdust

A simple stove can be made from a gallon tin can with the top removed and a 1.5-inch (3.8 cm) hole cut in the middle of the bottom. Insert a metal or PVC pipe or wooden pole vertically in the hole, and add dry sawdust in layers, packing it down firmly before adding more. Fine, highly compressed sawdust burns longer than coarse or loose material. When the can is full, carefully remove the pipe or pole straight out of the sawdust to form a flue.

Twist it slowly as you pull to keep from knocking particles loose. Place the can on two bricks which touch on one corner. Air will enter the bottom hole and be drawn up the flue by the flame. Light some paper and put it under the flue to ignite the sawdust. The sawdust will burn from the red-hot central core outward with an almost invisible flame.

Place two metal pieces across the top of the can on which to set the pot, while holding it high enough to maintain a draft for the flame. Dale found that the smoke could be reduced by cutting a 1.5-inch hole in the removed top and replacing it on the stove after packing in the sawdust. To nearly eliminate smoke, cover the outside edges of the top with a small amount of soil or sand. This lid sinks down as the sawdust is consumed.

To make the stove burn longer, increase the stove's diameter. Test stoves at ECHO 6 inches in diameter and 8 inches high (15 and 20 cm) burned for three hours, although toward the end the heat was not intense. A stove 16 inches in diameter and 20 inches high (41 and 51 cm) burned for over 8 hours. To make the stove hotter, use a taller container or join two cans together.

Regulate the rate of burning by opening or closing the base bricks to modify air flow. It is possible to extinguish the stove by cutting off the air flow on

the top or bottom and relight the unused sawdust later, although rice hulls continue to smolder and cannot be reused. Other suitable fuels include chaff, coffee bean hulls, straw, or mixes of these materials. With some materials, ash will collapse inward and it may be necessary to gently clean out the bottom vent hole to maintain air flow.

Charlie Forst says that he used these cookers much of his four years in Zaire. "I saw them in use years ago by sawmill cooks in West Virginia. I often cooked breakfast in Zaire using rice hulls or coffee hulls. As long as the material is dry, it can be packed in a few minutes and the fire lit. After breakfast I would put rice or beans on the stove and let it burn out.

"Usually you do not even see smoke, just an almost invisible blue flame. But a gummy black layer does appear on the bottom of your pan. I made my stove about 8 inches (20 cm) diameter and 16 (40 cm) inches high. When visiting in one of the poorer sections of Kinshasa, Zaire, I saw quite a few people using variations on the stove, using waste from casket makers or other carpenters."

It is also possible to construct a similar stove out of bricks, with vertical and horizontal flues. Depending on the pots and other conditions, it may be more fuel-efficient to place the support bars for the pot lower in the stove so the

pot can be sunk into the stove, making better use of the heat.

HOW CAN I SIMULATE LONG DAYS TO MAKE PLANTS BLOOM? Many plants respond to the length of days. For example, most winged beans will bloom only when days are short; most onions will only form bulbs when days are long, etc. In some cases (including the above examples) varieties are available that do not have these day-length restrictions. But what can you do when such varieties are not available?

It turns out that what daylength-sensitive plants are actually measuring is the length of the night. For example, a temperate plant that blooms and produces seed when the days are long is actually responding to the short nights of summer. If you live in the tropics where nights are never as short as they are during the summer in temperate regions, you might still be able to get it to produce seed by interrupting the night with a period of artificial light. The plant will respond as though it had experienced two short nights- or one long day!

For another example, suppose you want to make cuttings of a temperate plant that in its native climate grows all summer (short nights) and blooms in the fall (nights about the same as are found all year in the tropics). There is a good chance it will bloom continually in the tropics, which makes it

difficult to make cuttings. You can probably make it stop blooming by artificially shortening the nights.

Alan Ferguson in Bangladesh recently wrote us for information on how much darkness or light has to be provided to induce flowering, and how this could be measured without equipment. I passed the letter on to Carl Scharfenberg, a member of ECHO's Board of Directors. Carl is also vice-president for research at Yoder Brothers Nursery, one of the largest commercial nurseries in the States. They make frequent use of techniques for altering day lengths in their business, both artificial darkness when they need long nights and lighting when they need shorter nights.

Carl said the norm is to use 10 foot candles of light for the four hours between 10 P.M. and 2 A.M. A good rule of thumb is that if you divide the total watts of your lights by the area covered you should have 1 watt per square foot. If you use florescent lighting instead of incandescent, the number should be 0.6 watts per square foot.

Here is a neat trick they use to reduce the amount of electricity (which could be even more important if you must generate your own). They have found that they can divide the area into two parts. The lights in one area are left on for 5 minutes, then they are shut off and lights in the other area are left

on 5 minutes. This is repeated 5 minutes on and 5 minutes off in each area for the four hours. This works just as well as four continuous hours of illumination, but uses half the electricity.

What about the opposite need: darkness to make longer nights for short day plants? This requires "nights" with less than 1 foot candle of illumination for about 13 hours. Carl uses a rule of thumb that it must be so dark that you cannot read a newspaper. A black polyethylene plastic cover works well.

CASSETTE PLAYER AND RADIO NEED NO BATTERIES. A few of you are in places where batteries are hard to come by and short-lived. We purchased a new cassette-tape player with a built-in generator and crank. By turning the crank at a rather moderate rate, the cassette operates just as though it had batteries. It plays at a uniform rate even if the cranking rate is irregular. It has a fast forward, rewind, and volume control, but does not record. It also runs on 4 flashlight batteries, 110 volts, 220 volts and either 6 or 12 volt car batteries. You must provide the adaptor for use in a car. They are available only to persons in the third world for use in their Christian work. Language Recordings International sells "The Messenger" for US$27 plus postage; contact them at P.O. Box 40181, Pasadena, CA 91114, USA; phone 213/250-0207.

Spore (Feb. 1996) featured the wind-up radio "Freeplay," with 20 seconds of winding producing 40 minutes of listening time. The radio will play for 7,000-20,000 hours. It can be used anywhere to receive VHF-FM, MW- AM, and Short Wave frequencies. Cost: US$35-45 plus shipping. Write Baygen Agency, 6 White Horse Dr., Epsom, Surrey KT18 7LY, UK.

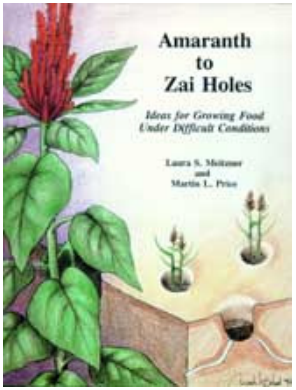
SERRATED HAND HOE. I-Tech (P.O. Box 413, Veneta, OR 97487, USA) is an organization specializing in appropriate technologies. Public disclosures are made of all innovations so that they are in the public domain. They have developed plans for many improved labor-saving devices, including rice and wheat hullers, weeding spades from masonry trowels, a bean thresher using a manual lawn mower, and more. The serrated hand hoe is a useful tool: note the metal blade hand hoe with grooves.

The hoe normally uses a straight edge to cut plant roots and stems. This can be improved by grinding slanted grooves or notches on its cutting edge. The grooves give a serrated edge to the hoe and keep the plant from sliding out of the cutting edge as it is being cut. Grooves are slanted at a slight angle, those on the right side slanting one direction and those on the left in the other.

It also requires less force to hoe with a serrated edge, for two reasons. First,

the serrated edge has less surface area for initial contact with the plant. The result is that the entire momentum of the swinging hoe is transferred to a smaller area of the plant, giving a deeper cut. Second, the grooves also tear as well as cut. The tearing action is enhanced by slanting the grooves.

The modification can be done with a hand-held electric grinder in a few minutes. Grooves are approximately 0.8 mm (1/32 inch) deep by 16 mm (5/8 inch) long, spaced 13 mm (1/2 inch) apart. They are ground on the flat side of the hoe that faces the worker. Grooves ground on the flat side of the hoe will not wear out as quickly as those ground on the beveled side facing the earth, away from the worker. Grooves are also retained when the blade is sharpened on the beveled side. As the hoe wears, the sharp edges of the grooves are exposed.

Amaranth to Zai Holes, Ideas for Growing Food under Difficult Conditions (ECHO, 1996, 397 p.)

14: From farm to market

Farmers everywhere want to make money from their produce. But they may find that if there is considerable money to be made on a particular crop, so many farmers will grow it that the market is soon flooded. Consequently, development groups are often looking for ways to grow a popular crop out of season, to convert it to a new form, to preserve it for later marketing, or to find a new crop or niche market. Over the years, we have come across some ideas and perspectives which are reported in this chapter.

Be aware, however, that projects requiring the cooperation of many people, demanding a high level of quality control, or depending entirely on marketing abroad are risky and are probably beyond the scope of what most NGOs will want to do. ECHO, and most people in our network, specialize in microdevelopment, "one family at a time." We hope that reading about these ideas leads you to consider what to look for in developing a small business. We also mention some ways you can use the expertise you gain in the field.

Small businesses

OUT-OF-SEASON VEGETABLE PRODUCTION AND BANYAN LEAF POTS IN BANGLADESH. We have enjoyed our visits from Joshua Tsujimoto. Joshua retired early from a career as a commercial vegetable grower in New York to become an agricultural advisor in Bangladesh. Though he could think of some things that might increase yields, he faced a serious dilemma. Crops are planted near the end of the rains in the fall. Consequently, all growers come to market at the same time in the spring, causing a large surplus and forcing prices to unprofitable levels. If he helped them increase yields it would only cause an even greater oversupply.

His solution was to develop techniques to grow vegetables outside their normal season. Farmers who could come to market even a few weeks before

or after the normal season would get premium prices and provide much-needed vegetables when they were not available to the population.

Joshua begins by making very high raised beds (about 1 foot or 30 cm) just before the rains begin. This ensures plenty of oxygen for the roots even during heavy rainfall. He mixes compost and organic material into the beds. Sloping drainage canals help carry water out of the fields. Then he constructs a "rain umbrella" or mini- greenhouse. This is a shelter made from 1.25 cm (0.5 inch) thick bamboo hoops placed one meter apart on top of the bed and covered with a one meter wide sheet of clear polyethylene plastic. This protects the soil from puddling and erosion in the monsoon rains. The leaves of plants are also less susceptible to disease because they are not wet so much of the time. The mini-greenhouse allows farmers to grow their own seedlings, since the erosion and heavy pounding of the rains usually make it difficult to start seedlings.

The same structure also serves as a "sun umbrella" unless the plants get too large. "As tomato vines became too large under the plastic shelter, we began to train them to grow outside on top of the umbrella. Where the row was under a banyan tree the growth was still normal, but in the full sun the growing tips were stunted, with leaves curled and puckered and showing symptoms which everyone had assumed were caused by viral diseases. We

now believe it is caused by the intense direct sunlight. We are planting leucaena trees 3 meters apart in both directions to provide shade. Until the leucaena trees are large enough to provide light shade, the plastic structures can be redesigned to handle larger plants." When they are new it may be necessary to make them more opaque by painting the underside with muddy water, but soon the intense sun will make the plastic itself sufficiently cloudy. Joshua has also grown Sesbanias (tolerant of waterlogged soils) in the drainage canals as green manures for the raised beds.

Growing Vegetables in Fiji by Kirk Dahlgren (available from ECHO) has a chapter on growing vegetables under plastic. The main work there has been with tomatoes, but there are many possibilities. "A wide variety of vegetables can be grown in the off-season. Heat-tolerant varieties of cauliflower form tight curds when protected from rain and direct sunlight. Heat-tolerant cabbage forms good heads under plastic. Lettuce forms large and relatively tight heads with no bitterness. French beans also grow well." Joshua also makes seedling starting pots from banyan leaves. Root damage in transplanting can set plants back considerably, especially in the intense tropical sun. The leaf seedling pots avoid disturbing the roots, and Joshua says that this one simple trick gives farmers a harvest about two weeks early. He uses a leaf from a banyan tree and curls it into the shape of an ice

cream cone (see drawing). If you do not have banyan trees, you can find some local leaf that will give the same shape, per- haps after cutting with scissors. The outer flap is pinned into place with a short bamboo toothpick. The new pots should be nested into each other as they dry to remain perfectly round. (With a little practice a person can make 100 an hour. Sometimes people come to Joshua with financial needs that he wants to help, and he finds it convenient to pay them for making a few hundred of these pots.) When needed the pots are nearly filled with moist soil, leaving space to hold enough water to soak the soil when watering. The whole pot can be planted in the field. Be sure that the leaf is entirely covered with soil or it might act as a wick and pull moisture from the soil.

MUSHROOM CULTIVATION IN THE TROPICS. Nigel Florida with CUSO in the Gambia wrote, "I see no reference in EDN to mushrooms. Is anyone in the ECHO network having success with mushroom cultivation on a small scale, village-based industry?"

Dr. Jason Yapp, Agricultural Services & Development Manager, Rural Development Corporation, in Malaysia wrote, "I would like to reply to Nigel Florida's inquiry. Our organization has been successful in introducing the cultivation of shiitake mushrooms to our target poor farmers (income less than M$500 [about US$200] per month). The elevation is 700-1500 m and

night/day temperatures are 15 /30 C. We have a central factory to pack, sterilize, and inoculate spawn. Currently we have over 250 contract farmers involved and are expanding to produce 10,000 bags per day. Our current efficiency is only 0.18 kg mushroom per 1.2 kg bag. Main problems are high contamination of the bags, high temperature and low humidity leading to small thin mushrooms (grade C). Trials are in progress to produce other lowland mushrooms." He sent us a 1-page leaflet on the production of shiitake mushrooms. If you want to correspond with Dr. Yapp, his address is Korporasi Pembangunan Desa, Beg Berkunci 86, 88998 Kota Kinabalu, Sabah, MALAYSIA.

We can heartily recommend the book Technical Guidelines for Mushroom Growing in the Tropics (155 pp.). This color-illustrated guide is a must for anyone contemplating such a project. (Overseas readers can order from the FAO, Distribution and Sales Section, Via delle Terme di Caracalla, 00100, Rome, ITALY, or through the FAO sales agent in your country. U.S. and Canadian readers can order for $20 plus postage from Unipub, 4611-F Assembly Drive, Lanham, MD 20706-4391, USA; phone 800/274-4888; fax 800/865-3450; e-mail query@kraus.com.)

Nutritionally, mushrooms contain more protein than leafy and root vegetables and fruits and rank high for vitamin content. Although devoid of

vitamin A, mushrooms make up for this with their high riboflavin, thiamine and nicotinic acids. "Their content of the anti-pellagra vitamin, niacin, is nearly equal to levels found in pork or beef." They are also good sources of essential minerals such as calcium and phosphorous. Low in cholesterol and calories, mushrooms are often referred to as "slimming foods."

Mushrooms can be grown almost anywhere as long as the conditions for their growth and cultivation are provided. "Mushroom cultivation, however, is not a simple business. It involves a number of operations that must be coordinated. These include selection of a suitable ... culture of the mushroom, preparation of spawn and substrate, inoculation of the substrate, crop care, harvesting, preservation of the mushroom, and marketing. Introduction of a mushroom technology does not take place in a vacuum." In many successful mushroom growing regions, higher technology operations of preparing spawn and substrate are done by a central business with the specialized technology. This is then distributed to individual farmers.

The book covers the following topics: introductory considerations, biology of the mushroom (life cycle, identification, poisonous mushrooms, genetics and breeding, food value), equipment of a mushroom laboratory, culture and media preparation, culture of the fungus, preservation of mycelium, growing techniques, environmental factors, cultural problems and solutions, major

contaminants of mushroom culture, pest prevention, mushroom preservation and processing, and utilization of spent mushroom compost.

The type of substrate [growing medium] depends upon the species of mushroom. For example, the shiitake mushroom fruits on logs or sawdust; the straw mushroom on rice straw, banana leaves and other materials, whether composted or not; the button mushroom fruits only on composted substrates.

While mushroom growing may be possible and profitable in your location, it is going to take a lot of attention to detail to develop the techniques. People who have tried growing mushrooms at ECHO have had both complete failures and moderate successes. It does take some determination.

You may be fortunate enough to have someone in the community who already has perfected the techniques. Hopefully someone also sells spawn and perhaps medium. In that case, you would only need to pay attention to detail and do what you were taught. For example, those working in or near the Philippines can attend one of the workshops offered by one of the book's authors, Dr. Quimio, whose Quality Control and Training Center has offered training courses on mushroom farming specific to the type of mushroom and the technology desired. To inquire about the course (not to order the book)

you may write to her at the Dept. of Plant Pathology, University of the Philippines at Los Banos College, Laguna, PHILIPPINES. (We were unable to contact her during 1995 at this address.)

The Ghana Export Promotion Council is attempting to make Ghana a major exporter of mushrooms. They are involved in production of pure spawn for mushroom growers and run three-week training courses for commercial growers. Write them at P.O. Box M146, Accra, GHANA. (Condensed from Spore, December 1992.)

A U.S. company with a free color brochure and an 80-page catalog ($3 plus $2.50 international postage) for mushroom growers worldwide is Fungi Perfecti, P.O. Box 7634, Olympia, WA 98507, USA; phone 800/780- 9126; fax 206/426-9377; e-mail mycomedia@aol.com; http://www.halcyon.com/mycomed/fppage.html. They are "a complete resource for equipment, cultures, and technologies for growing mushrooms." Another source offering books, teaching videos, information, and supplies is Mushroompeople, Box 220, Summertown, TN 38483-4495; phone 800/386-4495 (also fax) or 615/964-2200.

BEFORE YOU GET EXCITED ABOUT SPICE PRODUCTION, CONSIDER THIS. (Condensed from Spore, December 1992.) Perhaps growing up on a small

farm in Ohio made me a cynic, but it seems that any farm product that is at all profitable will be overproduced within a few years. It is happening to spices.

Three years ago black pepper sold for US$2,428 per ton. By mid-1992 it had fallen to $1,000. The price of cloves dropped from $5 per pound a decade ago to 80 (because Indonesia, which imported vast quantities to flavor cigarettes, now produces its own). In Madagascar, clove trees are being cut for firewood. Vanilla pods dropped from $74 per kg to $50. Madagascar had vanilla stocks at the end of 1990 equal to 2-3 years' total world consumption!

Are there any [temporary] bright spots? Markets for chili and paprika peppers remain strong and there is some room for growth. The market for cassia and cinnamon is steady because of their use in cola drinks. Allspice is in short supply and prices have risen. The use of spices which are used as a natural coloring (e.g. paprika and turmeric) may increase. Some spices, e.g. black pepper and vanilla, can be successfully intercropped. Black pepper grows well using coconut tree trunks as part of its support. "It is quite clear that 'Will it grow?' is not the first question to be asked. 'Will it sell?' is a better starting point."

COMMENTS FROM DR. TONY LAMB ON SPICES (AND OTHER TOPICS). Dr. Lamb of the Tenom Agriculture Experiment Station shared these interesting insights during a tour of Malaysia.

(1) The standard ground cover mix used in rubber plantations is centrosema and pueraria. The latter does not produce seed in Malaysia, so must be imported.

(2) Fruit consumption per person in Malaysia is going up a lot as people become more health-conscious. The result is a large increase in imports of temperate fruit. They are trying to improve the quality and diversity of locally grown fruit.

(3) In choosing trees to provide shade crops, he prefers Leucaena leucocephala or L. diversifolia to Gliricidia sepium (sometimes called mother of cacao). L. diversifolia produces a lighter shade than gliricidia. A drawback to L. leucocephala is that it produces too many seedlings, but a sterile cross with L. diversifolia produces no seeds. However, it must be propagated asexually.

(4) Cloves bear in 6 years in Malaysia and bring a good price. Indonesia planted 200,000 hectares, now it is being wiped out by disease!

(5) Cinnamon prices are very poor ($2 per kg), making this labor intensive crop economically feasible only where labor is exceptionally cheap.

(6) Branch bores are a terrible problem with mangos. Even 3 inch branches fall off the tree.

(7) We are interested in backyard fruit to reduce imports, e. g. using the jaboticaba tree as a substitute for grapes. [ECHO's jaboticaba tree is producing a bumper crop. We can send a few seeds to overseas readers. Trees take about 9 years to bear, and there are no short cuts. They must have plenty of moisture and acidity, so only order if this fits your situation.]

(8) According to a USDA publication, a fruit is considered to have been introduced when 20% of the population recognizes the fruit.

(9) Farmers make $2,000-$2,400 per acre per year from mandarins, but must destroy the trees after about 6 years due to disease buildup. Each orange brings 20 cents.

(10) Nutmeg trees are hard to start in a dry climate, but then they do well. All of his are female. Be cautious if you are thinking of starting a big nutmeg project. A single 300-acre farm could supply the entire world market.

A NEW REARING METHOD FOR COCHINEAL INSECTS. The red dye, carmine, comes from the bodies of female cochineal insects, Dactylopius coccus. In Peru and the Canary Islands, these have for centuries been reared on prickly pear cactus plants, Opuntia ficus-indica. The insect can only survive on varieties of this plant. With use of synthetic dyes for human consumption coming under increasing criticism, the demand for natural dyes is increasing.

In parts of southern Africa there are large, aggressive wild stands of prickly pear, but rainfall patterns and intensity make it impossible to grow the insects on plants in the open. Any rainfall washes insects from the plants and they do not survive. A new rearing method allows them to make use of the vast supply of healthy plants, according to Economic Botany (vol 4, pp. 154-162, 1993). "Healthy, fully mature terminal [pads] are suspended from hooks inside large sheds (90 m2) after they have been seeded with crawlers (immature stages of the insect)." After three months in the summer to five months in winter, the mature females are harvested by placing the pad over a container and blowing compressed air over them. Some females are allowed to reproduce. All females are eventually dried at 60 C for 2 days before exportation.

"Preliminary estimates are that annual production of dried cochineal insects for a rearing unit of 90 m2 will be 75 kg. Based on a world price of US$40

per kg, this represents a gross income of US$3,000." They estimate that 3-4 rearing units could be maintained for every densely populated hectare of cactus."

This work was done by Dr. H. G. Zimmermann, director of the Plant Protection Research Institute in South Africa (Agricultural Research Council, Private Bag X134 Pretoria 0001, Republic of South Africa). He told ECHO that his research had to be stopped for lack of funding. The original research paper he sent us lists the following problems that still need to be solved. (1) 80% or more of immature crawlers are lost. (2) Optimum temperatures are not known. Also conditions leading to periodic excessive decay of pads are unknown. (3) Contamination of the insect population by D. opuntiae can be a problem. (This insect was brought into South Africa as a biological control of prickly pear cactus.)

PASSION FRUIT PROJECT IS ESPECIALLY SUCCESSFUL IN PUERTO RICO. George Gaskins initiated a cooperative venture among small farmers in the mountains south of San Juan in the late 1970s. They purchased used processing equipment from Hawaii and began selling passion fruit juice. One key to their success was careful advance marketing work. Another key was crosses they made between local passion fruit varieties and varieties from Hawaii and South America. Farmers are now earning $3,000 per year per

acre of steeply sloped mountain land! When I visited I asked whether he could help small farmers around the Caribbean by purchasing fruit from them. He writes, "I have been pondering that issue for some time. I may suggest that we can buy and process tamarind. This fruit is probably abundantly wild in most of the Caribbean and can ship well.... We would be able to buy this 'pulp' in quantities. ...This may work out for other fruits and/or products as well."

The Wall Street Journal did a story on this project in 1985. "Starting from nothing in 1976, Puerto Rico now produces more than 3,000 tons of passion fruit a year. Two dozen new juices and drinks have come out using the juice. The industry's annual sales are estimated at $10 million and rising."

A SMALL CANNING BUSINESS SEALING IN METAL CANS. Don Mansfield in Mali wrote that he knew of household businesses among Eskimos in Alaska in which fish were canned in tin cans. It is of course simpler to preserve food in glass jars. This is fine for home use where the jars can be recycled, but may make competition in the marketplace impossible. Don mentioned the Wisconsin Aluminum Foundry Co. as the source of the equipment so we contacted them. You may have a local source for such equipment, but we provide this information for those who do not. If you wish to follow up on this discussion, you can write Attn: Philip Jacobs, P.O. Box 246, Manitowoc,

Wisconsin 54221, USA; phone 414/682-8627; fax -4090.

Mr. Philip Jacobs responded with helpful literature, but no details of small-scale operations in the third world. When asked, he said he knew that they were used that way, but would not disclose any specifics. Although they do not actively court such business, he will be happy to quote prices to any of our readers. They are willing to sell in units as small as one, but be sure to specify how many you are interested in purchasing to receive the quantity price. He will then send a pro-forma invoice. The Master Can Sealers cost US$299-1295; Senior Can Sealers (with Fly Wheel, pictured) are $895-1995.

Hand operated can sealers indeed cost less than I would have expected. Their "Automatic Master Sealer" ($299) is equipped to seal can sizes 1,2,2 1/2, and 3 (half pint, pint, 30-ounce and quart). (The price includes equipment only for #2. It is not clear what that equipment is, but hopefully it is a rather inexpensive adaptor.) Their "Senior Automatic Sealer" ($895) will seal sizes 10 and 12 (4 and 5 quarts) as well as the smaller ones if you have the right equipment (adaptor?). They also have other models, some with motors. The company also has a line of aluminum pressure cookers with large capacity that appear to be heavy-duty equipment. They use a metal-to-metal seal, so you would not have problems replacing gaskets. Ask

about those too, when you write.

Another source of hand-operated can sealers is Ives-Way Products, 2030 North Nicole, Round Lake Beach, IL 60073, USA; phone 847/740-0658. Prices look very reasonable: $115-495. They sent us some very helpful information and a catalog illustrating their models which "offer many choices in can sizes for fruit, vegetable, meat, poultry, and fish canning. The same basic sealer is used for all models. The required chucks, spacers, and extensions are furnished with each model to adapt the basic sealer to the can sizes shown. The durability...has been proven by over forty years of consumer use. Complete operating instructions and recipes are included with each sealer." They explained the standard naming of can sizes: "Each dimension is expressed as a three-digit number. The first digit gives the number of whole inches, while the next two give the additional fraction of the dimension expressed as sixteenths of an inch. The first number given in the size of each can is the diameter, and the second number is the height. For example, the 303x406 can is 3-3/16" diameter x 4-6/16" high." Dimensions are "overall," including the entire seams. Ives-Way does not carry pressure canners, gauges, or other canning equipment.

Mr. Jacobs mentioned two free mimeographed bulletins that are exceptionally practical and thorough. "Home Preservation of Fishery

Products" (22 pp.) and "Home Canning of Fishery Products" (44 pp.) are both available from the U.S. Dept. of the Interior, U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries, Washington, D.C. 20240, USA. The former discusses preservation methods other than canning: corning, brine salting, dry salting, drying, smoking, pickling. The latter discusses canning with detailed discussions for specific fish and shellfish. For example, the author points out that if tin cans are to be used with fish or shellfish, the cans should be lined with "C" enamel, unless vinegar is added. The reason is that fish and shellfish liberate sulfide compounds when heated to high temperatures. This causes a discoloration of the inside of plain tin cans than can be transferred to the food. Because of thinner walls and greater ability to conduct heat, tin cans require a shorter cooking time than glass, and cool more rapidly. You might also wish to obtain "Home Canning of Meat and Poultry", Home and Garden Bulletin #106, free from the Office of Govt. and Public Affairs, USDA, Washington, DC 20250, USA. By the way, the latter says that plain tin cans should be used for canning meats, rather than C-enamel, R-enamel and sanitary-enamel. Fat in meat or poultry causes the enamel to peel off inside the can, making it appear unappetizing (though not harmful).

If you have had experience with small-scale commercial canneries I would appreciate hearing as many details as you have time to write. It is a subject

of interest to many. I am interested in both technical details and a perspective on the potential of canning for small businesses based on your own experience.

CECOCO SELLS EQUIPMENT FOR COTTAGE INDUSTRIES. There is great potential for small scale industries in the third world, both to generate employment and to reduce the need for imports. The CECOCO company in Japan has a fascinating array of machinery for rural cottage and small and medium scale industries. When you write for information you are sent a few sheets of prices and short descriptions. To really understand what is available and, especially, to make decisions about purchase you should see their 160-page catalog (we got it in 1985 for US$20). I have not personally seen any of their equipment, but it sounds great. To give you an idea, let me share some items as I leaf through the catalog. Their address is CECOCO, P.O. Box 8, Ibaraki City, Osaka 567, JAPAN.

With their equipment you could make any of these products: tooth picks, wooden ice cream spoons, paper clips, hair pins, safety pins, snap buttons, wire, barbed wire, window screen, nails, screws, nuts, bolts, springs, chains, zippers, chalk, paper boxes, tapioca and potato starch, rope and straw mats. The section on rice begins with hand and foot operated equipment (thresher, winnower, two-man hand huller, paddy separator, and polisher) followed by

quite a variety of power machinery. Other food processing sections include flour milling, noodle machine, oil expeller, bakery equipment, coffee pulping, roasting and milling equipment, power and hand sugar cane squeezers, all kinds of equipment to handle fish for food or fish meal. Then there is cotton processing machinery, a wide variety of pumps, all kinds of mills for feeds, egg incubators, peanut roaster, peanut butter machine, rice straw softener, small and medium scale saw mills, equipment for tilling fields, printing presses, basic manpower units to drive other machines, many coconut husk processing machines, pulverizers and grinders, and cane processing machines. Happy shopping!

THE WOOD-MIZER COMPANY HELPS CHRISTIAN MISSIONS AND SCHOOLS WITH PORTABLE SAWMILLS. In some parts of the world lumber is most expensive where trees are most abundant-in remote forested sites. Since these remote locations do not have processing equipment, logs are hauled away and lumber is hauled back.

For twelve years the Wood-Mizer Sawmill Company has helped missionaries and organized local Christian ministries who need wood for building schools and churches by donating half of the cost of a portable sawmill. They also like to see the local people reap more of the benefits from their own trees. One example is Pacific Island Ministries in Papua New Guinea (PNG). This

mission, which has a school in a remote area, intends to establish a sawmill in each nearby village so they can produce their own lumber. These small sawmills can produce 500-800 board feet per day. The mission will buy some lumber from them for school construction, and the communities will market the rest.

The project began when the mission learned that Japanese businessmen had met with the community leaders. The missionary realized that if each community had a sawmill, it could easily make 10 times what the foreign companies were offering. And since the local people cherish their forest, they want to cut on a selected basis rather than clear-cut.

In another PNG community, Beechwood Ltd. bought logs as cheaply as 5 per board foot for sale within the country. They still went out of business because of the high cost of transporting logs out of the remote area. With a portable sawmill, people do not move the sawdust, water and slabs, but only dried lumber. Wood has two kinds of water, free and bound. Free water between the wood cells is 80-90% removed by a week or two of air drying. (A typical rain forest tree is 60-80% water, but the water content of air-dried boards is about 20%.) Bound or intracellular water is harder to remove, but this extra drying step, accomplished with solar kilns or other methods, can significantly increase the value of the lumber.

"Value added" is the key concept. The sawmills enable people to sell boards rather than rough logs, and well- dried boards bring an even better price. For this reason, solar kilns are also part of Wood-Mizer's donations program where appropriate (two 1500-board-ft kilns may be needed with each sawmill). For example, the cheapest sawn lumber might be worth 80-$1 per (air-dried) board foot when sold in country. Exotic species roughly sawn (not dried) might only bring 25, but may sell for at least $2-4 per board foot after solar kiln drying. At these prices, solar kiln-dried exotic species could even be profitably flown out of the area for export.

There are other situations where a lumber project could fit the goals of a development organization. Darryl Mortensen in Mexico wrote us this summer that a field survey by AMEXTRA, a Mexican development organization, turned up some incredible statistics. He writes, "200,000 trees have been ordered for the reforestation program in Chiapas. Many trees have been cut down ... to clear land for planting. A recent survey showed that there is salable lumber in logs that are just lying on farmland which farmers want to clear for crops. AMEXTRA is looking into ways to market this lumber rather than burning it, as there is sometimes more than $500 worth of lumber on a single farm which would be more income for the farmer than 2-3 years of planting corn." A portable sawmill may be used in this situation.

Envision the following scene. Fell a tall tree. After removing the branches, cut the tree into logs of the desired length, so the cut logs remain end-to-end. Carry the sawmill to the site and set up beside the first log. This 10-minute set-up involves fastening the mill to skids 10-12 feet (3-3.6 meters) long to give it stability. Two to three people roll the first log onto the mill with cant hooks. As soon as this log is sawn into lumber, slide the mill along the length of the tree to the second log. Repeat the process until the entire tree is sawn. If the log is on a hillside, place blocks under the mill to make it level before sawing. Stack the boards criss-crossed (X) against a strong tree for 10-12 days to air-dry before carrying them out of the area, perhaps to the site of the solar kiln.

How portable is the sawmill? Wood-Mizer makes many models of portable sawmills, any of which can be transported where there is a road. For really difficult sites, they recommend the LT20 (see photo), a model that is no longer produced, but which the company occasionally takes in on trades. It can be dismantled and put in the back of a truck in 10 minutes. The heaviest piece is 67 pounds. Twelve people can carry the sawmill and accessories into off-road sites; some have been carried as far as 15 miles.

"One of our questions before giving a sawmill is whether they know the local Forestry Department people. We require that recipients replant trees at a

ratio of 100:1. Any Wood-Mizer sawmill and future parts and supplies are available at a 50% discount. Any non-profit organization actively involved in meeting human need may apply. Christian missions in developing countries are given priority. Decisive factors are the organization's goals and prospects for long-term use." The first step is to write Wood-Mizer to explain your program and how the sawmill would fit into it. If this meets the company's criteria, you will be sent a formal application. It could be three months to four years before you get the mill, depending on the waiting list. Even if you do not meet their donation criteria, any licensed, accredited educational institution can receive a 25% discount.

Glen Munro is the coordinator of the sawmill donations. You can write him at Wood-Mizer, 8180 West Tenth Street, Indianapolis, IN 46214-2400, USA; phone 800/553-0182 or 317/271-1542; fax 317/273-1011.

EDEN VALLEY INSTITUTE OFFERS TRAINING IN ORGANIC FARMING AND MARKETING. We enjoyed getting to know farm director Joel Meyer when he spent some days using ECHO's library. The school farm specializes in small farm operation for schools, missions and family-based market gardening. They offer a course "designed especially for small farm management, with emphasis on food production for schools and market gardening through an apprenticeship experience for one full growing season. Classroom instruction

and field application are blended together. The course trains individuals in the science of biological gardening so they are prepared to instruct others." The program is run by and for Seventh-Day Adventists, but is open to all Christians interested in agricultural missions (US or overseas). The main focus is commercial-scale, hands-on organic and vegetarian market gardening.

The course outline includes: A philosophy of agriculture and medical missionary work; Biblical principles in nature and agriculture; practical Christianity; biological crop management; food preservation and storage; agriculture equipment and maintenance; energy efficient greenhouse design and operation; fruit culture; methods of crop marketing. This course usually runs mid- January through mid-October and costs about $1850, including room and board.

In December they offer an intensive seminar "for the serious gardener or commercial producer" on various topics, which in the past have included participatory food production and balancing soil fertility. (The 5-day course costs $325 including room and board.) Contact Steve Meyer or Paul Kidney for more information at 6263 North County Road 29, Loveland, CO 80538-9598, USA; phone 303/667-9225.

HAS ANYONE TRIED MAKING AND SELLING...? We always appreciate letters from our network which give details of how people in your community have found ways to process and market their products in new ways. ECHO sometimes receives requests for help evaluating the market potential of some crop, product, or industry in an area. While we cannot address that from our office, you should know that several publishers have many case studies on marketing and microenterprise which may be of interest to you. Consult the NRI, IT, IIRR, and GTZ catalogs reviewed in this book for a wide selection of resources. (Some in our library include: Traditional Candlemaking and Making Wheels from IT; Microenterprise Development in the Philippines from IIRR; and one in Spanish on small garbage collection businesses, sponsored by GTZ.) The catalogs of FAO (Viale delle Terme di Caracalla, 00100 Rome, ITALY) and UNIPUB (4611-F Assembly Drive, Lanham, MD 20706; phone 800/274- 4888; fax 800/865-3450; e-mail query@kraus.com) have many economic development resources.

Employment ideas

INTENT NETWORKS PROFESSIONALS. Intent (formerly called U.S. Association of Tentmakers) is a membership organization of professionals who work (or are seeking opportunities to work) within their profession in other countries. They are motivated to live and minister overseas by their

Christian faith. Write P.O. Box 35, Cascade, CO 80809-0035, USA; phone 800/781-8728 or 719/471-6600; fax 800/829-8728 or 719/684-9391; e-mail 74203.1311@compuserve.com.

ECONOMIC DEVELOPMENT PROGRAMS AT EASTERN COLLEGE. Eastern is a Christian college which offers graduate M.S. and M.B.A. programs in economic development; students choose a "global" or "urban" focus. Degrees can be combined with an M.Div. from Eastern Baptist Theological Seminary. We have met many satisfied students of this course, and the faculty is excellent. Contact the Graduate Admissions Office, Eastern College, 10 Fairview Drive, St. Davids, PA 19087-3696, USA; phone 610/341-5972; fax 610/341-1466.

CONSULTING AS A CAREER OPTION. Many in ECHO's network have unique combinations of specialized training, work experience, and language proficiency. If you find yourself between jobs, consulting can be an attractive option. Some have even made careers as consultants, using their expertise as professional advisors.

Many firms in the Washington, D.C. area specialize in putting together proposals in response to formal "Requests for Proposals" (called RFPs) by government agencies. Most of these positions are not filled by their own

technical staff. Rather, they each have large computerized databases with names and qualifications of potential consultants with the right combination of skills needed for various projects. I posed the following questions to Walter Price in Washington, D.C., who at one time worked as projects coordinator for one of the major contractors.

Q) Explain how this system works.
A) Let's say that an RFP calls for a team that includes someone with an expertise in sweet potatoes and knowledge of Swahili. The project coordinator would contact those people whom the computer identified as having those skills. If you were that person, he would describe the assignment and ask whether you might be available for a certain time period. If you are interested, your resume will be included with the proposal. You are under no obligation to hold that time open, however, because the grant may not be awarded.

Q) If your work is in a remote overseas location, how is he to get in touch with you?
A) That can be a problem. If he cannot find you quickly, he usually has 10 or 50 other qualified people he can call. If you are in a hard-to-get-to place overseas, have someone in the States take telephone calls/fax for you and have him tell the consulting firm that you will get back to them right away.

Q) This can clearly be a good way to get some interesting assignments. How is the pay?
A) The pay can be very good indeed. However, the government usually has restrictions that do not let your pay exceed your previous salary by more than a modest amount. This can result in some awkward situations for people who have worked sacrificially at very low wages with a non-profit organization. The good news is that with each job you can notch the salary up a bit and eventually catch up.

Q) What about extreme cases? Surely a Peace Corps volunteer or missionary with valuable experience in agroforestry and a master's degree who earned less than US$1000 a month would not be expected to continue working for so little?

A) There is room to negotiate. But if you really want a consulting job, don't scare them off by stating too rigidly your salary expectations. You are far better off to get them interested in you, then talk salary. Do not say you won't work for less than $150 per day unless you really mean it-they probably won't call you. Sell them on your qualifications; later argue that you should not be penalized too severely for your volunteer spirit.

Q) It would seem to be difficult to make a career of such assignments

because there can be a lot of "down time" between successful proposals that include you. Also, if you are in a remote overseas assignment it may be more difficult to get included in proposals. Is this correct?

A) There can be a lot of down time, but a lot of consultants get hired again and again by the same place(s). For example, I once went to work for the World Bank on a three-month contract and left four years later. Actually the kind of contract you have discussed so far is Chapter One of a two-chapter story. One can sometimes obtain a position quickly through organizations that have won Indefinite Quantity Contracts (IQCs).

Q) What is an IQC?
A) Many government agencies working in development issue "Indefinite Quantity Contracts" for consulting in fields such as agriculture, rural development, urban development, housing, business & accounting, health, education, etc. Their purpose is to enable the government to hire consultants for needs that come up unexpectedly and require a response too quickly to follow all the channels of making a request for proposal, etc. Also it would not be cost-effective for the government to do all that paperwork for every small project that came up.

When AID, for example, put out an RFP for an IQC, I had to demonstrate

that our firm had the ability to handle the contracts. By the time the contract was awarded, very few of the original experts whose resumes were used would still be available. In effect, they were used to show that we had the capability of fielding such a team of experts. The IQC obligated us to give service to AID, but neither we nor they knew for sure how much demand there would be for services. The contract assures at least a minimal level of funding (let's say $500,000) and a ceiling (perhaps $2,000,000). So we were on-call, usually with very short notice.

Herein lies the key for those who make a successful career of consulting. If you know which firms have current IQC contracts you don't need to waste your time writing to those who have no money. You need to spend time on the street "marketing" yourself, but it should be to agencies with IQCs who at any moment may receive a call asking them to field a team of experts. Don't limit yourself to IQCs in agriculture. IQCs in other fields such as rural development or training and education may need an agriculturalist too. Q) How can someone ever learn which companies have these IQCs? A) The freedom of information law makes this public information (free). Request "a list of contractors with AID IQC contracts," by writing AID, MS/OP/PS/SUP, Rm 1472, SA 14, Washington, D.C. 20523-1418, USA or phone 703/875-1047 (the Office of Procurement).

This next information is less useful, but there may be times when you want to know every agency with an AID contract in your country. The "Yellow Book" is a phone book-sized global listing of all contracts and subcontracts made by AID. Probably the AID office in your country would have a copy.

Q) What are the specialties with IQCs?
A) The latest 17-page listing has the following: accounting and financial management, agriculture, rural development, data processing, development evaluations, development management, energy, foreign language training, health, water supply and sanitation, housing and urban development, macroeconomic analysis, nutrition, and remote sensing.

Q) Is AID the primary source of contract work for agricultural development?
A) Many consider that assignments with the World Bank, International Development Bank, United Nations, International Fund for Agricultural Development are tops in prestige and pay. However, AID is the real "bread and butter" source.

Q) Without naming names, can you give some examples of people who have made a successful career as contractors?

A) I've worked on three assignments with an agronomist from California who

is very successful at getting repeat assignments for the World Bank. Several things stand out about him.

1. He is very specialized, i.e. does not claim to be all things to all people.

2. He is extremely productive. Consultants are paid by the day. He makes sure the boss gets his money's worth and that the boss knows that.

3. He does not mix pleasure with work. In the field he is no-nonsense: sociable and friendly, but mainly he talks and thinks business.

4. He never loses sight of the fact that the Bank is primarily interested in the final product. His work is always done exactly like the Bank wants it and always ahead of time.

5. He avoids controversy. He will discuss anything important to his work, but avoids getting sucked into needless controversies about a project or program and offending colleagues.

6. He is genuinely interested in people. The next time you see him he will ask about your family-by name-and will remember everything you have told him.

7. He stays in contact. He doesn't make a nuisance of himself, but finds ways to let you know he is around and available.

8. He does every assignment like it is his first (i.e. does not get too comfortable and disregard quality).

9. He dresses like agency colleagues; when in doubt he overdresses.

10. He never makes snide comments about the contracting agency (he leaves that to insiders).

Another example is a Peruvian economist who has worked for 20 years with all the "best" agencies. How does he do it? I have observed him over 10 years. He is a clone of the agronomist.

Q) Can only US citizens work under IQC contracts?
A) I have checked with both AID and a contractor. Both say that work done under an IQC in another country can use people who are not U.S. citizens.

Q) Do you have any final comments?
A) You'll have something set up and it may be suddenly cancelled, so don't put all your eggs in one basket.

VOLUNTEERS IN COOPERATIVE ASSISTANCE (VOCA) is a nonprofit organization which recruits volunteer consultants (farmers, executives, and specialists who are US citizens with at least 10 years' field experience) for short-term assignments in developing countries and emerging democracies. Volunteers share technical assistance and business/agricultural expertise. Projects usually last 2-12 weeks. VOCA does not pay a consulting fee, but all project-related expenses are covered, including travel. Examples of assignments span from resource conservation to poultry production to tofu processing to expertise with tropical fruits. If you are interested in using your field experience as a volunteer consultant, contact Samuel Driggers, Jr., VOCA, Pacific Regional Office, 1008 "S" Street, Suite B, Sacramento, CA 95814, USA; phone 800/556-1620; fax 916/556-1630; e-mail VOCA-CALIFORNIA@voca.org. If you are in the field and believe that a short-term VOCA consultant could assist you in your work, contact the VOCA Headquarters directly at 50 F Street, N.W., Suite 1075, Washington, D.C. 20001; phone 202/383-4961. Most requests for volunteers come from foreign national host organizations.

For your economic interest

SUPPLEMENTAL CURRENCY. Currency serves two uses in a community. It buys goods and services from outside the community. Until then, it

recirculates within the community making economic activity possible. A common lament heard throughout much of our overseas network is, "It just makes no sense. Willing labor goes unused and local produce and goods unsold because no one in the community has money. This remote area has so little to 'export' out of the region that very little money comes in to it."

A missionary once told me, "Even if our projects had no effect themselves, the ripple effects of the money we spend recirculating in the community is in itself an enormous value." In my less restrained thinking, I have pondered, "If all this productive potential sits unused for lack of currency, then why not create a local currency, valueless except for goods and services in that community?" The idea seemed intriguing, far out and probably illegal.

You can imagine my surprise to read in the September 1993 issue of Mother Earth News that two years ago a group in the community around Ithaca, New York (the location of Cornell University) created a supplemental currency called HOURS. A one HOUR note is worth one hour of labor, or its equivalent in "barter" for other goods and services. It is accepted by an increasing number of people (laborers, farmers market vendors, baby sitters, hair dressers), and businesses such as restaurants. One credit union even accepts HOURS for deposits, though not with any equivalency with dollars.

Supplemental currency may well be illegal in the country where you work, and it is still a "far out" idea. But it is sure a fascinating article. You can order a Hometown Money Starter Kit, including forms, laws, barter articles, past and future issues of their newsletter, sample currency for about $25 (in US dollars!) from the group that started the Ithaca project: Ithaca Money, Box 6578, Ithaca, NY 14851, USA. MARKETS SATURATED WITH FREE GRAIN. A questionnaire that ECHO sent to its "network" asked, "What are your most frustrating problems?" A missionary in Africa replied, "Free food distribution that puts the local farmers out of business." Where drought or war has resulted in famine such relief is important. However, we need to be very careful before handing out free commodities on a large scale. [The following example is excerpted from Rurcon News by Peter Batchelor, 4 Churchfield, Wincanton, Somerset BA9 9AJ, England.] "All too frequently one hears of well-meaning aid agencies getting grain to needy areas so late that the free gifts coincide with the harvest from local farmers. In 1984 farmers in Chad only produced 58% of the country's grain requirements, so tons of food aid were needed. In 1985 about 114% of needed food was produced in-country, but food aid continued. In March 1986, 1000 tons of grain were released by FAO in Bongor. Grain prices dropped from about 50 pence a kilo to 5 pence. Farmers thus have no incentive to grow more than their families require and there could well be another famine on the way. An alternative to dumping grain is to store it. Good grain silos at family,

community and regional levels should be a priority." If you are a Christian missionary in Africa you should ask to receive Peter's newsletter; write RURCON, Nigeria Bible Translation Centre, Old Airport Road, P.O. Box 6617, Jos, NIGERIA. Much of his time is spent in personally visiting missionaries. I believe his special expertise is in ways to work with small third world farmers. He might even show up at your door some day!
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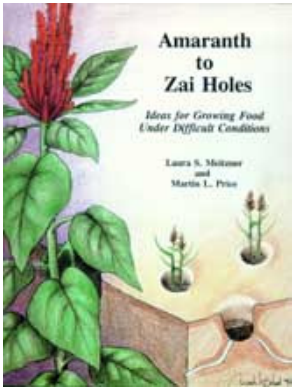


Amaranth to Zai Holes, Ideas for Growing Food under Difficult Conditions (ECHO, 1996, 397 p.)

15: Training and missionary resources

ECHO provides technical assistance to help you find practical, sustainable ways to address world hunger. We are motivated out of a Christian concern for obedience to Christ and love for our neighbors. This chapter lists many training opportunities and resources for working in development and groups that assist missionaries in their service.

Training and learning resources

INTERACTIVE VIDEOS ON DEVELOPMENT FROM WORLD VISION AUSTRALIA. Two excellent video workshops have been produced by Dr. John Steward and the staff of World Vision Australia. The Gift That Releases: First Steps in People-Centered Development is a tool to assist groups beginning to think about the factors which affect marginalized peoples, and it challenges the participants to evaluate their response to the poor. Mike Fennema reported that this video was extremely helpful in training farmer-extensionists in Cambodia. He found that these "first steps" encouraged the facilitator staff to examine their own attitudes toward and expectations of the farmers with whom they worked, and to consider how they could relate to them in the most beneficial way. The videos give input from experienced people around the world and promote discussion among the workshop participants, so people are motivated to apply the lessons to their own situation.

Biblical Holism: Where God, People, and Deeds Connect traces the Bible's teaching on holistic ministry to integrate development and evangelism. Our world views make a practical difference in why and how we work. The workshop fosters personal reflection, applied in life. Both series include the following materials: a 170- minute video tape, audio tapes for review or where video is not available, and workbook/study guides. Each video workshop is US$149.95 plus postage; workbooks alone are US$24.95. (Before buying the workshops, you may request a free introductory video

from WV in Australia, Zimbabwe, or the UK or MARC in the USA.) Order from MARC Publications, 121 E. Huntington Dr., Monrovia, CA 91016-3400, USA; phone 800/777-7752; fax 818/301-7786; e-mail MARCpubs@wvi.org. They are also available for A$99 plus $7 postage from World Vision Australia Bookstore at GPO Box 399C, Melbourne, Vic 3001; phone 613 9287-2297; fax -2427; e-mail AUSTRALIA_BOOKSHOPO@wvi.org.

WORLD VISION AUSTRALIA PUBLICATIONS. The Bridge invites readers along on individual's journeys and insights into working with the poor. It is published by WV's Development Services Department, which educates about people-change and community development in the two-thirds world. The Department provides advice and service to students and missionaries who are considering involvement in cross-cultural rural development, with a focus on sustainability and empowerment.

Each issue (about A$8 plus postage) chronicles the experiences and reflections of different people in various roles in development. The issues include: 1) Christian Missionaries in Community Work; 2) Environmental Implications of Development Assistance; 3) A Journey in Development (on Michael Duncan's incarnational approach to serving the poor in Manila's slums); 4) Book Reviews: Christian Transformation; 5) Not Relief-But Release: Learning Among Poor Partners (holistic ministry); 6) Starting

Small, Slow, and Sure: Hope Grows in Cambodia; 7) Who Holds the Stick? Hope Grows in Cambodia; 8) Sidetracked!-For the Kingdom (Rus Alit's ministry through appropriate technologies); 9) Discipleship, Development, and Pain (an extension of #3 above, highly recommended for those wrestling with theology and response amidst poverty); 10) Elephants, Water Pumps...and Other Signs of Transformation; 11) The Provincial Development Approach in Cebu. Order from WVA Bookstore (above).

The Global Issues Bulletin (6/year) provides abstracts and access to photocopied articles on topics related to the two-thirds world. You can quickly scan the summaries and book reviews, then conveniently order the items you want from World Vision. The editors screen over a hundred international journals for relevant articles. Summaries are given on the topics of aging, agriculture, aid agencies, children and war, debt, development, economics, environment, families, human rights, landmines, tourism, women, World Bank, and much more. New books are also reviewed and are available from the WV Bookshop. Subscriptions are A$35 in Australia/A$45 Pacific/A$55 elsewhere (airmail). Contact World Vision Australia Information Centre at GPO Box 399C, Melbourne, Vic 3001; phone 613 9287-2294; fax -2427; e-mail infoserv@wva.org.au.

TOGETHER MAGAZINE PUBLISHED BY WORLD VISION INTERNATIONAL.

Many people have suggested to ECHO over the years that in addition to the technical notes in ECHO Development Notes, we should include articles and case studies on working with communities and discussion of issues in the broad field of development. One reason we do not do this is that we have so little expertise in this area. The other reason is that Together and other publications are already doing the job. "Together is published quarterly as a service to those who minister to the poor and needy of the world in the name of Jesus Christ. It is intended to bring them encouragement and stimulus as they offer God's wholeness in a broken world."

Here are some articles that appeared in recent issues. "Transformational development," "Loan associations as bridges to social development," "The poor and the affluent: theological issues," "Through the valley of the shadow [of war]," "Mines still plague Cambodia," "The aftermath of violence," "Communities that heal," "Social justice is nothing new for evangelicals," "Is your evaluation unit effective?," "Communities respond to AIDS," "To do or to be...Is that the question?," "Forgiveness and reconciliation: a foundation for development," "Prayer in evaluation," and more. Each issue features different perspectives on a theme. Together is sent free of charge to those engaged in Christian ministry in the third world; others and those in developed countries may subscribe for US$15. Particular back issues can be sent as long as they are in stock. Write to Together, World Vision

International, 121 East Huntington Drive, Monrovia, CA 91016-3400, USA; phone 818/303-8811; fax 818/301-7786.

FOOTSTEPS, A QUARTERLY NEWSLETTER FOR CHRISTIANS IN RURAL DEVELOPMENT. This is one of the essential publications for people working in community health and development. "The idea is to encourage Christians world-wide who are working to promote rural development, many of whom may feel isolated-whether through physical isolation, spiritual isolation, lack of resources or simply through frustrating work situations. We hope it provides a stimulus of new ideas and enthusiasm." Each issue follows a particular theme; past ones have featured vision problems, credit schemes, women's health, home gardens, training, literacy, small livestock, and sanitation.

The theme of the 16-page December 1995 issue is fish farming. The lead article discusses the basic considerations in raising fish: water, oxygen, food, and safety. Simple, clear guidelines are given for determining whether a pond site can hold water, adding organic fertilizers, and signs and remedies for oxygen shortage. Other articles give details on sealing and building fish ponds, raising fingerlings, and using fish in rice paddies. Illustrations are excellent. Readers' letters, resources, a Bible study on Jesus' breakfast of fish based on John 21, notes on neem, a Thai raised bed gardening system,

and agroforestry in the Dominican Republic are also included.

An issue on water gives two case studies, a success and a failure, and suggestions on working with community water projects. Another article gives two teaching aids to convince mothers of the need to prevent dehydration. One illustration shows a healthy baby drawn on a plastic bag filled with water. After a small hole is made, and water drains out, the baby begins looking wrinkled and ill. When one of the mothers pours water into the bag faster than it is going out, the baby becomes normal again. Two well-illustrated pages give instructions for making ferro-cement water tanks to catch rainwater. The description of an innovative radio program on Radio Rurale in Chad could give you some helpful ideas for a radio outreach. Hints on growing vegetables when there is little water, a Bible study based on the theme of water, and other articles also appear.

Footsteps is free to individuals working to promote health and development. It is available in English, French, Portuguese, and Spanish. Readers are invited to contribute views, articles, letters, and photos. To be placed on the mailing list, give brief details of your work and your language preference to Footsteps Mailing List, Tear Fund, 100 Church Road, Teddington, Middlesex, TW11 8QE, UK; phone (0) 181 977 9144.

HEART MISSIONARY TRAINING INSTITUTE prepares missionaries to live in third world settings through practical training in a simulated village. Students learn appropriate technologies, primary health, nutrition, cross-cultural communication and development, small animal husbandry, and intensive gardening. Training sessions are 1-15 weeks or can be tailored for groups. HEART is 2 hours from ECHO. Contact HEART Institute, 5301 U.S. Hwy. 27 South, Lake Wales, FL 33853, USA; phone 941/638-1188; fax 941/638-1472.

AGRICULTUAL CHRISTIAN FELLOWSHIP NEWSLETTER serves as an "encouragement for Australians in overseas development, challenging to mission, informing for prayer, and a technical resource service." This is a networking group which enables members to get in touch with others doing similar work and share experiences from the field (much like EDN for Australia). People write with updates and stories from their mission work. Courses and conferences, many recent publications, news on upcoming initiatives, and technical information are also included in the newsletter's sixteen pages. Membership is a biennial donation of A$20; free to missionaries. Write Agricultural Christian Fellowship, c/o GPO, Box 399C, Melbourne, Victoria 3001, AUSTRALIA.

HORT IDEAS IS AN INTERESTING AND HELPFUL NEWSLETTER. Occasionally

people write us that they read EDN as soon as it arrives. Hort Ideas is in that category for myself. Gregory and Patricia Williams, the authors of this 12-page monthly newsletter, scan the horticultural literature and other newsletters, attend the most important horticultural conferences, look over advertisements, and correspond with a large base of sub- scribers to select the most relevant information for condensing into a paragraph or two. They scan both technical and popular sources. Addresses are always provided to get a copy of the full article, place an order, or write for further information. I put at least one article from most issues in my file to share with EDN readers. Here are excerpts of several examples.

Not all composts are created equal... at least with respect to their abilities to suppress damping-off (a fungus disease which kills seedlings soon after they emerge). Composted hardwood bark, composted sewage sludge and certain other organic materials have disease-suppressing effects. Recent research at the Ohio Agricultural Research and Development Center has shown that organic materials composted at high temperatures (above 140 F) can actually be conducive to damping-off due to Pythium ultimum. Only materials composted at lower temperatures are suppressive, apparently because higher temperatures kill the microorganisms that are antagonistic to Pythium. The bottom line is to get compost from the cool edge of the pile, rather than the hot center, if you want to control damping off of seedlings.

High temperature composting kills pathogenic microorganisms, but it can kill some beneficial ones too.

Curved cucumbers? Here's why. Experiments in Japan show clearly that curvature is an abnormal condition due to shading or too few leaves per fruit. Cucumbers curve when they aren't getting enough food! Straight cucumbers result from early thinning to make sure the leaf area per fruit is large, and by trellising to minimize shading of the leaves.

Aluminum sulfate for slugs. Most molluscicides are based on methiocarb or metaldehyde. [Many gardeners are reluctant to use these poisonous chemicals.] Experiments at the Long Ashton Research Station in Great Britain suggest that aluminum sulfate works as well as, or even better than, these more toxic chemicals. It also costs less and is easy to apply. All commercial molluscicides were found to protect Chinese cabbage seedlings during the first four days following application, then damage increased. So frequent applications may be needed. This makes a less toxic treatment even more important. Some results suggest that aluminum sulfate acts mainly as a repellent, not as a poison, which would lead to a slower buildup of resistance. Adding aluminum sulfate at a rate of 5 pounds per 1000 square feet won't lower the soil pH very much; 10 times that rate is needed to lower the pH from 7.5 to 6.5.

Because items for Hort Ideas are selected for its primary clientele of readers in the USA, many will, of course, not be directly relevant to tropical small farms. Also, the field of horticulture includes landscaping and ornamentals, which may or may not be important where you work. If you are heavily involved in horticulture, though, I think you will become an avid subscriber. Subscriptions are US$20 in US; $26 Canada/Mexico; Overseas: $30 surface, $35 air mail. Write Hort Ideas, 460 Black Lick Rd., Gravel Switch, KY 40328, USA.

HONEY BEE, A NEWSLETTER ABOUT FARMER'S INNOVATIONS. Honey Bee is a newsletter specializing in reporting indigenous knowledge and grassroots creativity. The focus is on documenting farmers' innovations and experimentation in sustainable technologies. Hundreds of innovations have been summarized to date. Some examples follow.

Volume 3(2) mentions how farmers in the Tungbhadra area of India control leaf miner damage on groundnuts by flooding the fields overnight. Volume 2(1) mentions that tribal farmers in the Bharuch district control rats in wheat fields by intercropping with sunflowers. It is believed this provides sturdy support for the owls that kill and eat the rats at night. The same issue tells about controlling termites with castor cake, castor oil, kerosene, rotation with castor bean, or irrigation.

It is important to remember that reports of indigenous knowledge document what people do. This does not prove that they either are or are not effective. You might look at each issue as providing numerous ideas for experimentation.

Honey Bee is a publication of SRISTI (Society for Research and Initiatives for Sustainable Technologies and Institutions). This group would like to be in touch with other members of ECHO's network interested in sharing "local knowledge." Write Prof. Anil K. Gupta, Editor, Indian Institute of Management, Vastrapur, Ahmedabad 380 015, INDIA. Honey Bee is published in 7 Indian languages, and they are interested in translations and adaptations for other parts of the world. Subscriptions can be paid in US dollars to "SRISTI Innovations": $5 for small farmers, $15 for development workers, and $30 for professionals. Write for other arrangements if unable to afford a subscription.

THIRD WORLD RESOURCE GUIDE is a review of 425 organizations, 95 periodicals, and 275 other references useful for those involved in sustainable agriculture, forestry, and development worldwide. The index by country helps you locate other groups in your area with similar concerns, as well as identify organizations which give assistance in particular fields. The Guide includes many small groups not found in other lists, though it was

printed in May 1993 and some of the information is outdated. Order for US$6 in US/$8 airmail overseas. One copy is sent free of charge to small organizations in developing countries. (There is also a service called TERN-Traveler's Earth Repair Network-which links travelers with host organizations working in over 100 countries; ask about becoming a TERN traveler or host.) Contact Friends of the Trees, P.O. Box 4469, Bellingham, WA 98227, USA; phone/fax 360/738-4972; e-mail trees@pacificrim.net.

AUDIO-FORUM SPECIALIZES IN AUDIO FOREIGN LANGUAGE SELF-STUDY COURSES. Audio- Forum, "The Language Source" offers 264 courses in 91 languages. They retail selected materials produced by others, including the Foreign Service Institute series in those languages where this is available. (The FSI series in Spanish was extremely helpful to me some years ago.) The catalog also contains a variety of language-learning aids, such as ethnic music, travel guides, foreign-language films, and books on language learning.

In addition to the most commonly studied languages (Spanish, French, German, Italian, Japanese, and Russian), they have courses in Afrikaans, Albanian, Amharic, Arabic, Armenian, Azerbaijani, Bulgarian, Burmese, Cantonese, Cajun, Catalan, Cherokee, Chickasaw, Chinese, Chinyanja, Choctaw, Czech, Danish, Dutch, Esperanto, Estonian, Finnish, Fula, Gaelic

Scots, Georgian, Greek, Haitian Creole, Hausa, Hawaiian, Hebrew, Hindi, Hungarian, Icelandic, Igbo, Indonesian, Irish, Kazakh, Khmer, Kiowa, Kirundi, Korean, Lakota, Latin, Latvian, Lenape, Lithuanian, Malay, Mandarin, Mohawk, Mongolian, More, Navajo, Northern and Southern Sotho, Norwegian, Persian, Polish, Portuguese, Romanian, Salish, Sanskrit, Serbo-Croatian, Shona, Sinhalese, Slovak, Swahili, Swedish, Tagalog, Telugu, Thai, Tibetan, Tlingit, Tswana, Turkish, Twi, Ukranian, Urdu, Uzbek, Vietnamese, Welsh, Xhosa, Yiddish, Yoruba, and Zulu. A free catalog is available by writing Audio-Forum, 96 Broad St., Guilford, CT 06437, USA. There is also a London office, but we have no address for it.

SPANISH IN THE FIELD. The AgAccess Company released this set consisting of a 248-page illustrated book, 4 cassette tapes and a pocket farm and agribusiness dictionary. If you or your employees work with Spanish-speaking farmers and are not fluent in Spanish, this is a great investment. It is designed to teach the unique agricultural and mechanical terms that few Spanish courses cover.

Chapters in the book are: pay, hiring and firing; time, weather and calendar; directions and measures; tools, containers and materials; soil preparation; irrigation; machinery and parts, safety in the field and shop, how to drive; health problems, accidents; chemical spraying; grapes; cotton;

trees; row crops, produce; grains and cereals.

The book is primarily vocabulary, sentences that one might want to say while working on the subject of the chapter, and drawings with parts named. The tapes primarily consist of sentences followed by the Spanish translation. Although I have a good general knowledge of Spanish, I have never heard much of the daily hands-on agricultural vocabulary. I am finding it helpful to listen to the tapes over breakfast or while driving. The price is $59.95 plus shipping. Order from AgAccess, P.O. Box 2008, Davis, CA 95617, USA; phone 916/756-7177; fax 916/756-7188. They have a very wide selection of agricultural books. You might want to ask for their catalog.

THE DEVELOPING COUNTRIES FARM RADIO NETWORK (DCFRN) PRODUCES INFORMATIVE SCRIPTS FOR THIRD WORLD FARMERS. They produce packages of twelve scripts which are meant to be read directly to the small farmer via radio segments lasting a few minutes per topic. (ECHO's publications, on the other hand, are directed to development agents and assume at least a high school education.) The radio scripts have simple, low-cost techniques of benefit to the small farmer with limited resources and difficult conditions. The practical information can help the farm family increase their food supplies and improve health and nutrition. The ideas in the DCFRN scripts can be used in community education for many years.

Often the detailed script, which is available in English, Spanish or French, is translated into the local language and read by a local announcer. But its use is not limited to radio. Many have found that they can use the script (which is supplemented with diagrams and drawings) to prepare materials for their own person-to-person agricultural extension work. There is no charge to receive the scripts. The units are sent quarterly and recipients are asked to fill out an evaluation and report back on how they used the material. Write to: Developing Countries Farm Radio Network, 40 Dundas Street West, Box 12, Suite 227B, Toronto, Ontario, CANADA M5G 2C2; phone/fax 416/593-3752; e-mail dcfrn@web.apc.org. For East and Southern Africa, write to the Network partner: Livai Matarirano, Programme Manager, Farm Radio Network, P.O. Box 308, Harare, ZIMBABWE; phone/fax 263-4- 495317; e-mail africare@mango.zw.

THE INTERNATIONAL INSTITUTE OF RURAL RECONSTRUCTION offers short courses for rural development professionals. IIRR trains leaders in participatory, people-centered, sustainable approaches to solving the problems of the world's poor. The courses are repeated annually, but you should allow plenty of time for registration as they tend to fill quickly. They run 2-4 weeks at their campus in the Philippines. Participants must be proficient in English, willing and able to participate in intensive training, and have rural development experience (3 years or more) related to the course

of interest. Fees range from US$1300-2500.

Topics include (dates given are for 1997): Development Communication (2/24-3/21), Environmental Management: Integrated conservation and development (3/10-28), Rural Development Management (4/7-5/2 and 8/4-29), Gender Analysis in agriculture, forestry and natural resources (5/5-23), Systems in Community-Managed Health (6/2-27), Training of Trainers on sustainable agriculture (7/7-25), Regenerative Agriculture (9/1-26), Applying Indigenous knowledge in development (9/29-10/17), Development Approaches in the Third World (10/13-24), and Household Food Security through Home Gardening (11/24-12/12). For more information and an application, contact: Mila Resma, Training Division, International Institute of Rural Reconstruction, Silang, Cavite 4118, Philippines; phone 63-96-402-0891; fax 63-2- 522-2494; e-mail iirr@phil.gn.apc.org. Completed applications should be received no later than 2-3 months prior to the start of the course.

ROLAND BUNCH IS A DEVELOPMENT ADVISER with the training organization COSECHA, whose purpose is to spread knowledge and use of the "people-centered development" process, as described in his book Two Ears of Corn. COSECHA's address is Apartado 3586, Tegucigalpa, HONDURAS; phone (504) 76-6140, ext. 2132; fax (504) 76-6241. Roland Bunch is also the

Head of the Department of Rural Development at the Panamerican Agricultural School in Honduras.

THE UNIVERSITY OF FLORIDA SPONSORS SHORT COURSES (1-3 weeks) in international development and technical assistance. Some of the courses offered in 1995 include: "Agroforestry Systems: Design and Management," "Vegetable Production and Management for International Markets," "Embryo Transfer in Cattle," "Post-Harvest Technology for Horticultural Crops," and a series on "Farming Systems Research and Extension." Course fees are $1450-2500. Contact the University of Florida, International Programs/FANR, Training Unit, P.O. Box 110329, Gainesville, FL 32611-0329, USA; phone 904/392-1965; fax 904/392-7127; e-mail itd@gnv.ifas.ufl.edu.

NATURAL RESOURCES INSTITUTE, part of the British overseas aid program, offers many practically-based training courses: "Grain Storage Management," "Post-harvest Horticulture," "Pesticide Residue Analysis," "Handling and Quality of Fish in the Tropics," "Mycotoxins," "Basic Food Microbiology," and "Microbial Insecticides." Courses range from 12-15 weeks and cost £7000-10000, plus fares and accomodation. Candidates from countries eligible for British Government Aid may be able to obtain financial support. Individual training programs are also available in Resource

Assessment and Farming Systems Development, Integrated Pest Management, and Food Science and Crop Utilization. For more information, contact Training Contracts Officer, NRI, Central Avenue, Chatham Maritime, Kent ME4 4TB, UNITED KINGDOM; phone 44 1634 880088; fax 44 1634 880066/77; e-mail NRI@UKC.AC.UK. (NRI also publishes many technical booklets on land resources, forestry, and the processing, storing, and marketing tropical products. See below for details.)

CORRESPONDENCE STUDY OR DISTANCE LEARNING IN AGRICULTURE AND DEVELOPMENT. ECHO is often asked where people can do college-level agricultural study by correspondence (through the mail rather than living at a university). Distance learning is a great alternative for people who want to sharpen their skills or earn a degree while remaining on the field, and with electronic communication it is more popular and easier than ever. The following programs offer individual courses or entire degrees by distance education. We asked people in our network to send us information on their programs. Please continue to let us know about new offerings you find, and we will keep updating our list at ECHO.

Pennsylvania State University, Independent Learning Program, 207 Mitchell Building, University Park, PA 16802-3601, USA; phone 800/252-3592 or 814/865-5403. Penn State has over 300 credit and noncredit courses which

can be applied toward a degree or taken individually. Of most interest to ECHO's network might be the noncredit courses, which look interesting and are very inexpensive (average about US$20). Some of these titles include: Farm management for part-time and small farmers, soil and water conservation, soil fertility and management, sheep husbandry, stock feeding, animal breeding, Beef production, Breeds of dairy cattle, Silos and silage, Beekeeping, Dressing and curing meat, Ice cream manufacture, Plant propagation, Small fruits, Production of market turkeys, Rabbit production, Small woodlot forestry, Microbiology, Campground development, and more.

Pacific Christian College, Graduate Studies, 2500 E. Nutwood Ave., Fullerton, CA 92631, USA; phone 800/762-1294 ext. 641; fax 714/738-4564; e-mail AlanR@xc.org. Among several other graduate programs, PCC has an MBA, MS, and Certificate in International Development with a field-based, task-oriented component in collaboration with Food for the Hungry International. The program provides training in disaster relief and community development for enrolled workers in developing countries. This is a new opportunity for Christian workers to continue graduate studies while in the field.

SACRED Africa (Sustainable Agricultural Centre for Research and Development in Africa), P.O. Box 2275, Bungoma, KENYA; phone 254-0337-

30293, writes: "We offer a 3-month training course for extensionists, researchers, development workers, and policy makers on sustainable agriculture. We have a set of theory and practical courses which participants take in their own place of work. The topics covered include compost making; soil-improving legumes; adaptive research; seed selection, preservation, and banking; botanical pesticides; community development; soil fertility management; etc. The course costs US$1000 per participant."

University of East Anglia, School of Development Studies, Norwich NR4 7TJ, UK; phone +44-(0)603-592331; fax -505262. UEA offers diplomas, Masters, and Doctoral programs in various fields related to development. Some members of ECHO's network have been able to stay on the field while completing Ph.D. degrees in the school's "overseas-based research program," in which the university supervisor visits the student's site.

University of Guelph, Independent Study, OAC ACCESS, Guelph, Ontario N1G 2W1, CANADA; email to request a catalog and calendar is handbook@access.uoguelph.ca. Guelph offers complete diplomas, (shorter) certificates, and individual courses in horticulture and agriculture via independent learning. These are oriented for temperate climates. Some course titles include: Principles and practices of soil science, Livestock production systems, Business management, Weed control, Advanced

beekeeping (includes tropical), Soil conservation, Energy on the farm, Forages, Field machinery, Animal diseases and parasites, Dairy goat production, Meat technology, Managing small rural enterprise, Urban tree management, Safe pesticide handling and storage, and others. Many of the horticultural courses are related to landscaping. Fees range from C$70 to C$275 per course, and average about C$200 (about US$140).

University of London, The External Programme, Wye College, Ashford, Kent TN25 5AH, UK; phone 01233 812401; fax 01233 812138; e-mail ep@wye.ac.uk. Wye College offers M.Sc. and postgraduate diplomas by distance education in agricultural development, environmental management, agricultural economics, food industry management and marketing, and more. The program began in 1988, and we have heard many good reports from its students who are in ECHO's network. We recently received these comments from Andrew Betts, who studied agricultural development: "The course was well organized and of a high academic standard. It was largely economics-based and is likely to appeal to those in higher level positions...and there are new courses that would have more appeal to grassroots development workers. As with all distance learning courses, prospective students should not underestimate the discipline required to undertake the course. It was definitely worth the effort. The course has already proven useful in my current job, and I believe in securing and

carrying out my next one too. The courses are not cheap-but it should be possible to obtain grants towards taking them, as I did."

University of Zimbabwe, Centre for Distance Education, P.O. Box MP 167, Mount Pleasant, Harare, ZIMBABWE. John Mautsa wrote that the university will be opening a B.Sc. Agriculture degree by distance learning in 1997.

Wheaton College, Extension and Continuing Education, Wheaton, IL 60187, USA; phone 800/325-8718 or 708/752-5944; fax 708/752-5935. Wheaton offers graduate credit and non-credit courses in theology, Bible, Chinese ministry, and evangelism.

PUBLICATIONS CATALOG OF THE NATURAL RESOURCES INSTITUTE (NRI). This is a superb resource. How does one review a 60-page catalog of books in a few paragraphs? For starters, NRI is part of the British overseas aid program. Their goal is to alleviate poverty in developing countries by increasing the productivity of renewable natural resources. They work in resource assessment and farming systems, integrated pest management, food storage, processing, packaging, transport and marketing.

Among their titles are the most useful books in our library. Single copies of their several hundred titles are available at no charge to organizations

working in countries that are eligible for British aid. I will list JUST A VERY FEW titles under each category in their book catalog to give a "feel" for the range of subjects. Some are large books; many others are booklets. Many are relevant to community-level development; others are oriented more toward research or country-wide development. To order a catalog, write NRI, Central Avenue, Chatham Maritime, Kent, ME4 4TB, UK; phone +44 1634 880088. (Most titles published since 1980 are available on microfiche; contact Chadwyck-Healey Ltd., The Quorum, Barnwell Road, Cambridge CB5 8SW, UK; phone +44 1223 215512.) A partial listing follows:

Land Resources: Revised Classification of the Soils of Belize; Development Prospects of the Southern Rift Valley in Ethiopia; A Soil Survey of Seychelles; Development of the Water Resources of Bali. Forestry: Pulping Characteristics of Hardwood Species Growing in Plantations in Fiji [there are many studies of pulping characteristics of specific trees]; Field Guide to Forest Trees of Ghana; Charcoal Production Handbook. Crop Production: Onions in Tropical Regions; Root Crops; Food Legumes.

Processing of Non-Food Crops: Processing of Oil Palm Fruit and its Products [most of the rest relate to dye products]. Processing of Food Crops: Processing of Macadamia Nuts; Starch Extraction: Checklist of Commercially Available Machinery. Food Storage: Food Storage Manual; Storage and

Handling of Onions; Evaluation of Structures Suitable for Emergency Storage in Tropical Countries. Grain After Harvest: Training in Grain Post-harvest Technology for Developing Countries; Fumigation Technology for Developing Countries.

Pests: Constraints on Adoption of IPM in Developing Countries; Pest Control in ... [several titles: Groundnuts; Tropical Legumes; Tropical Onions; Tropical Root Crops; Tropical Tomatoes]; Locust and Grasshopper Agricultural Manual; The Desert Locust Pocket Book [a great many locust titles, most very technical]. Post Harvest Technology: Guidelines for Management of Insect Pests and their Natural Enemies in Wetland Rice; Use of Plants and Minerals as Traditional Protectants of Stored Products.

Animal Feeds and Products: Production of Protein Foods and Concentrates from Oilseeds; Small-Scale Manufacture of Compound Animal Feed; Manufacture of Leather Uppers; Rabbit as a Producer of Meat and Skins in Developing Countries. Fish: An Illustrated Guide to Fish Preparation; Fish Handling, Preservation and Processing in the Tropics; Comparative Study of Solar and Sun Drying of Fish in Ecuador.

Producer Gas: Wood and Agricultural Residue Combustion Systems: Survey of Commercially Available Equipment; Producer Gas: Its Potential and

Application in Developing Countries; Anaerobic Digesters for Small- scale Vegetable Processing Plants. Rural Technologies: Pedal-Powered Grain Mill; Charcoal Production using a Transportable Metal Kiln; Heat Production from Sawdust. Industrial Economics: Manufacture of Dry-cell Batteries; Industrial Profile of Breadmaking; Economic Aspects of Small-scale Fish Freezing; Tanning of Hides and Skins; Tomato Paste or Puree: An Industrial Profile; Industrial Profile of Small-scale Expelling of Vegetable Oil; Guide to Economics of Dehydration of Vegetables in Developing Countries.

Marketing: Methodologies for Studying Agricultural Markets in Developing Countries; Selected Markets for Chilies and paprika; Market for Dried Fruit in the United Kingdom, Germany and France. [There are many other highly specific marketing studies.]

FAO PUBLICATIONS CATALOG lists a great variety of titles useful in agricultural development, available from Food and Agriculture Organization of the UN, Viale delle Terme di Caracalla, 00100 Rome, ITALY.

BOSTID REPORTS (Board on Science and Technology for International Development) from the U.S. National Research Council includes many titles EDN readers will recognize. The publications give a basic look at a topic to stimulate interest, serve as a technical reference, and facilitate research

contacts. Although many are out of print, several which are still available include Lost Crops of Africa; various topics on fuel alternatives for developing countries; Agroforestry in the West African Sahel; Conserving Biodiversity: A Research Agenda for Development Agencies; Mangium and Other Fast-Growing Acacias for the Humid Tropics; books on Calliandra, Casuarinas, Leucaena, and Neem; The Water Buffalo; Butterfly Farming in Papua New Guinea; Little-Known Asian Animals; Microlivestock; Saline Agriculture: Salt-Tolerant Plants for Developing Countries; Vetiver Grass; and more. Request a publications catalog listing regional distributors from BOSTID/FO-2060Z, 2101 Constitution Ave. NW, Washington, D.C. 20418, USA.

PEACE CORPS MANUALS are some of the best resources on a wide variety of topics-easy-to-read, practical, and complete. The manuals are in the public domain, so they may be copied. Peace Corps publications are no longer available free from PC offices; they can now be purchased from: National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161, USA; phone 703/487-4650; and ERIC Document Reproduction Service, EDR/CBIS Federal, 7420 Fullerton Rd., Suite 110, Springfield, VA 22153-2852, USA; phone 800/443-3742 or 703/440-1400. We priced a few, about $30-40. Some of the manuals can be found on the internet at http://www.clark.net/pub/peace/PeaceCorps.html.

THE SOCIETY FOR ECONOMIC BOTANY is an international scientific organization which encourages research on the past, present, and future uses of plants. Members from a variety of disciplines are interested in useful plants, plant products, or the relationship of plants and people. The excellent quarterly journal Economic Botany often publishes comprehensive articles about many of the plants in ECHO's seedbank, and it is a very useful resource in our library. Annual membership is US$40; $25 for students. For further information, write Lucille N. Kaplan, Dept. of Anthropology, Univ. of Massachusetts, 100 Morrisey Blvd., Boston, MA 02125- 3393, USA; phone 617/287-6850; fax 617/287-6650.

BOTANICA DE LOS CULTIVOS TROPICALES. This 445-page, Spanish language paperback is written "to give students of agronomy in Latin America basic information about origin, diversity and structure of cultivated plants in the tropics." The abundant detailed line drawings are especially impressive. It is somewhat like the famous Purseglove's "Tropical Crops," with better illustrations design. Order for about US$18 (plus postage which varies by region) from IICA, SEDE Central, Apdo. Postal 55-2200, Coronado, San Jos, COSTA RICA.

A FLORA OF THE ANDES IN SPANISH. Werner Moosbrugger sent us this book from the Corporacin Autnoma Regional de las Cuencas de los Ro Bogot,

GTZ, and Kreditanstalt fur Wiederaufbau. El Manto de La Tierra: Flora de los Andes (332 pp.) is filled with beautiful color photographs of 150 trees or shrubs of economic value growing in the Andes. It is easily carried, measuring 5x8 inches (13x20 cm). Two pages are given to each tree. One page contains two color pictures: a close-up showing leaves, flowers and seed or fruit and one showing the entire plant. The second page shows family, scientific and common names, a code for the major uses and discussions of morphology, geographic distribution, propagation and growth and particular uses. There are indices for leaf type, scientific name, common name and climate (hot, temperate, cold). It is available for about US$11 plus shipping costs (about $5-10 airmail, depending on your location). Please order from Werner Moosbrugger, Apdo. Aereo 100409, Bogota 10, COLOMBIA, South America; fax 235-89-94.

COPYRIGHT-FREE ILLUSTRATIONS FOR USE IN DEVELOPMENT WORK. Illustrations attract interest and help you communicate more effectively, but it can be difficult to find good pictures dealing with agriculture and related topics in developing countries. These are two resources designed for extension communicators who are not artists but need to produce interesting printed materials. You may trace them, enlarge them, scan them into your computer, or whatever you wish. Use them in posters, pamphlets, books, magazines, and transparencies. We used many pictures from both

these resources in producing the book you are reading. The authors of Clip Art for Development contacted a number of artists and communicators and assembled more than 150 pages of copyright-free line drawings which illustrate people, farming practices, livestock and crops in developing countries. We turn here first when we need a clear, simple drawing of common plants and animals. The price is $11 plus shipping ($4 US, $5 surface elsewhere, $12 airmail). Professor Eric Abbott, Dept. of Journalism and Mass Communication, Iowa State University, Ames, IA 50011, USA.

If we need more elaborate drawings or expressive pictures of people, we turn to The Copy Book (110 pp.). A highlight in this book is the wide variety of styles included, from simple line sketches to more complex scenes in ethnic art. This costs £10.95 (about US$21) plus postage from: IT Publications, 103-105 Southampton Row, London WC1B 4HH, UK; fax 44 171 436 2013; e-mail itpubs@gn.apc.org. Ask for distributor catalogs in your country.

MORE INFORMATION SERVICES FOR TECHNICAL QUESTIONS. Here are several more resources which address technical questions. Agromisa, P.O. Box 41, 6700 AA Wageningen, NETHERLANDS; fax (31) 317 419178; e-mail agromisa@tool.nl. Agromisa offers a question-and-answer service about small-scale agriculture and related topics. They also publish low-cost

practical 'Agrodoks' in English, French, Spanish, and Portuguese, available from CTA (below). The services are free to people from most African, Caribbean, and Pacific countries. CTA (Technical Center for Agricultural and Rural Cooperation), Postbus 380, 6700 AJ Wageningen, NETHERLANDS; fax (31) 317 460067; name@cta.nl. CTA publishes the always relevant, informative, and fascinating bulletin Spore (in our must-read category), plus about 50 titles a year on topics in tropical agriculture and rural development. CIRAD (Centre de Coopration Internationale en Recherche Agronomique pour le Dveloppement), B.P. 5035, 34032 Montpellier CEDEX 1, FRANCE; fax (33) 6761 5820; e-mail radigon@ist.cirad.fr. An information center and technical question service on a wide variety of agricultural topics, principally in Africa. IFOAM (International Federation of Organic Agriculture Movements), Okozentrum Imsbach, 66636 Tholey-Theley, GERMANY; fax (49) 6853 30110; e-mail IFOAM-SECRETARY@oln.comlink.apc.org. IFOAM promotes sustainable food production, holds conferences, and exchanges knowledge on organic agriculture.

Missionary services

INTERNATIONAL AID INC. IS A GREAT RESOURCE FOR OVERSEAS MISSIONARIES! Several missionaries have told us what a help this organization has been. International Aid Inc. is a Christian relief

organization that serves missionaries (both Catholic and Protestant) by providing food, clothing, medical supplies, hospital equipment, personal care items, etc. to mission boards and missionary families to be used and distributed among the people they serve.

Over 1900 missionary families visit the Supply and Service Center each year, where they can select from a wide range of products including: small appliances, office and school supplies, baby-care items, vitamins, and over-the- counter medications. They are also assisted in areas such as: furlough housing, travel and transportation, insurance, agriculture, water supply etc. Items can also be mail ordered. "Customers" pay only 10% of the retail value of merchandise as a handling charge. Products are donated by U.S. consumer goods manufacturers and labor is provided by volunteers.

Medical missions should write for their medical supplies catalog. An average of 15 semi-truck loads of supplies are shipped monthly to established missions or churches in third world nations. Items include food, clothing, medical supplies, hospital equipment, tools, seeds, tractors, vitamins. Regular visits to recipients of larger orders monitor use of the goods. An entire warehouse is set aside for medical supplies, including used equipment donated by hospitals who seek the very latest for their own use.

Though the help is given in the name of Christ, they are also glad to assist secular organizations doing relief/development work in the third world. National relief or development programs are also eligible for assistance, not just U.S. missionaries. Anyone visiting the Michigan warehouse to make personal pickups must have a formal letter confirming their employment on official letterhead (unless they already know you). Mail orders are accepted only for USA addresses for missionaries who need materials to take with them overseas. Direct shipments overseas are by shipping container load only. For more information, write or call: International Aid Inc., 17011 W. Hickory, Spring Lake, MI 49456, USA; phone 616/846-7490; fax 616/846-3842.

SERVANTHOOD: THE VOCATION OF THE CHRISTIAN (121 pp.) by Darrow Miller, Food for the Hungry, 1985. Quite likely you began preparing for your present work as you came to realize in your own life that you were called to serve both God and others, rather than live for yourself. It is even likely that you have taught on this subject, seeking for your students a vision-expanding, life-changing encounter with the Scriptures.

Servanthood is not like most books. Each chapter begins with a half-page of three segments which he calls "review," "preview" (what the chapter will help you understand) and "know and do" (what personal change should

result from this understanding). The rest of each chapter is an interesting mix of comments, quotes from other authors, Scripture to study, and questions to think about (with space in which to write your answers).

You can use Servanthood in several ways. The place to start is to use it yourself as a personal study guide. It then lends itself exceptionally well as the basis for a course on servanthood, perhaps in your church or for a series of talks for a visiting work team. He wrote it to encourage a group of Christian high school students from the States as they prepared for a work project in the Dominican Republic. Food for the Hungry uses it in training new staff members. They go through it as a group, but he asks students not to fill in any of the blanks. Then after they have been overseas for a few months and culture shock has begun to set in, they go through it again, this time carefully responding to all the questions. "Consistently over five years students later list the servanthood course as the single thing from their training that helped them most."

A few quotes give you a flavor for the book. "The revolutionary thing about this teaching is that these people [in a New Testament passage addressing slaves] to whom first-century culture affords no choice at all, are addressed as free moral agents. Paul gave personal moral responsibility to those who had no legal or moral status in their culture. He made decision-makers of

people who were forbidden to make decisions."

[When confronted with the problem of hunger and poverty, people say, "What could I do?"] "The trouble is with the question. 'What could I do?' is the wrong thing to ask. Before we ask what we, as individuals, could do, we need to ask the personal question of commitment-'Am I willing to serve?' A person can be shown a thousand needs and be given ten thousand opportunities for service; but if there is no commitment to serve, the question will always be 'What could I do?' If a person has a commitment to act and to serve, then God will indicate the appropriate service."

You may order for $10 (includes shipping to anywhere in the world) from Food for the Hungry, 7729 E. Greenway Rd., Scottsdale, AZ 85260, USA. (Make the check out to "Food for the Hungry," but please write "Attn: Darrow Miller" on your order.)

A BOOK TO HELP YOU WRITE MORE INTERESTING LETTERS TO YOUR SUPPORTERS. Many in ECHO's network periodically write newsletters to those individuals and churches who support them with prayer and finances. A publication that can add life and effectiveness to those letters is Bored Readers Don't Pray Much by Carrie Sydnor Coffman. Many times I have heard my wife Bonnie exclaim about how unusually interesting Carrie's

latest newsletter was, so I was not too surprised to learn that she published a book on the subject.

One of the strikingly unique things about Carrie's letters is that no matter how much might have happened since the last letter, she only tells about one thing. "The problem with most missionaries' prayer letters is the attempt to share an abundance of data. ...As a result there is not sufficient space to include enough interesting details about anything to capture the reader's interest." Several pages of the book are devoted to how to select one good idea. Each is illustrated with a good example of that approach from an actual letter she has seen.

About half of the book is devoted to very helpful suggestions on how to take (black and white) photos for the newsletter (of course, complete with pictures). Many would be equally applicable to taking slides for the talks you give back home.

I found the section on taking pictures of people with black skin especially helpful. Carrie points out that faces of Africans often turn out almost totally black with almost no detail. To solve this, take the camera off automatic and hold it so that a black person's face almost entirely fills the frame while you set the light meter. If you take the photo at this setting, the black face will

look more like the shade of an Asian's face. To correct for this, alter your aperture one half stop smaller. For example, if the reading was f 5.6, move it half of the way to f 8.0 (there will probably be a click at the half-way point). If your friend is standing by a white person, the latter will look white as a ghost. But this is not a problem. A custom lab can fix that easily. If there are several whites and blacks, options are fewer. People must either be grouped by race so the lab can darken the section where the whites are [this will probably look like your group practices segregation!], or the black faces will be obscure or the white faces pasty white. She illustrates the latter with a photo of a large mixed group that she took to illustrate that African leadership was trained and taking over from missionaries. The perfectly exposed smiling black faces stand out, the white faces are visible but almost fading away. It is a striking picture that was reproduced widely. The book sells for $15 plus postage (surface mail $2 in North America and $3 overseas; airmail $10) from Apples of Gold, 242-B Muldrow Court, Norman, OK 73069-5253, USA; phone 405/321-5332; fax 405/329-7063.

SERVANTS' MISSIONARY SERVICE. Kristin Kroll (Food for the Hungry, Kenya) writes that the periodic letters she sends to her supporters around the world are handled by this unique organization. Their primary purpose is to publish and mail prayer letters of over 300 Christian missionaries. To encourage supporters to write notes to you, they place at the bottom of each

letter a "ShortNote." This can be returned to them in the envelope provided and they send it air mail to you. Kristin says, "They do a nice job, really quickly, it does not cost much, and a lot of people who never would have written send in the ShortNotes."

Founders Ron and Sue Faircloth say your letter can be sent to them by mail, fax, email, or on computer disk. They can scan photos, drawings, signatures, and clip art into the computer. Average turn-around time is 5-7 working days. For a list of prices and policies, write them at Servants' Missionary Service, Inc., PO Box 3488, Columbia, SC 29230-3488; phone 803/754-2929; fax 803/786-8903; e-mail 70413.2445@compuserve.com.

"THE BEACON: MISSIONARY INFORMATION EXCHANGE" is a very handy 8-page collection of information and contacts on many topics of interest to missionaries, including general information, audio-visuals and communication, pest control, medicines and health, and nutrition. There are many useful items on each page, and if you are on the field or furlough, you will want to receive this publication. Robert Hicks has been publishing this bulletin for 30 years. Write to "The Beacon," 23225 Berkley, Oak Park, MI 48237, USA.

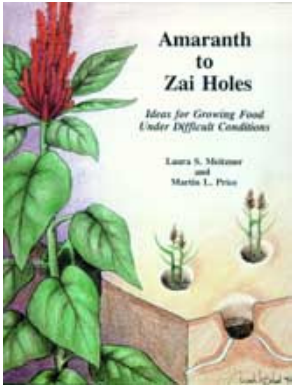
There are about 55 items in the latest issue. Here is just a sampling of the

topics: several books to assist in ministry with various people groups, a service that provides missionaries and church workers with vehicles while in the U.S., a digest of missions news, resources for deaf ministry, Mission Aviation Fellowship Web sites, an international law firm which provides legal advice, a new Nicaraguan Protestant University, missionary health insurance, home insect controls, small business development groups, and more.

BIBLES FOR THE BLIND AND DISABLED are available free on audio cassette in 40 languages. Recipients must send verification of the impairment with their order. Some Bible studies are also available. New Testaments are available in Arabic, Bangala, Cakchiquel, Czech, English, French, German, Haitian Creole, Hausa, Hindi, Hungarian, Indonesian, Italian, Japanese, Kalenjin, Korean, Luba Kaonde, Luganda, Maasai, Mabaan, Malayalam, Mandarin, Ndebele, Nepali, Polish, Portuguese, Romanian, Russian, Slovak, Spanish, Swahili, Tagalog, Telugu, Thai, Tigrinya, Uduk, Ukrainian, Urdu, and Zande. Write the Bible Alliance, P.O. Box 621, Bradenton, FL 34206, USA; phone 941/748-3031; fax 941/748-2625.

MAP-LATIN AMERICA has formed a Christian Transformation Network for mutual encouragement among churches and people interested in the meaning and practice of social transformation in Latin America. Contact the

Red Cristiana de Transformacin Integral, Casilla 17-08-8184, Quito, ECUADOR, South America; e-mail map@map.ecx.ec.



- 3: Staple crops
- 4: Multipurpose trees
- 5: Farming systems and gardening techniques
- 6: Soil health and plant nutrition
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- 9: Domestic animals
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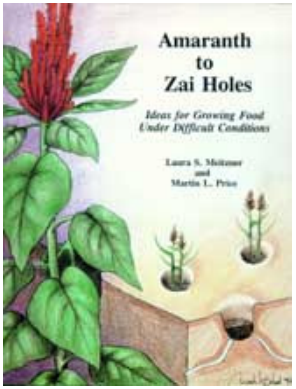
- 18: What is ECHO?
- Additional ECHO publications
- ECHO development notes - issue 52
- ECHO development notes: issue 53
-

- 28 additional technical notes about tropical agriculture
- Principles of agroforestry
- Good nutrition on the small farm

Other ECHO publications

The other ECHO publications are added at the end of the last chapter 18 are:
EDN ECHO DEVELOPMENT NOTES 52
EDN ECHO DEVELOPMENT NOTES 53
TECHNICAL BULLETINS ABOUT TROPICAL AGRICULTURE
PRINCIPLES ABOUT AGROFORESTRY
GOOD NUTRITION IN THE FARM

Amaranth to Zai Holes, Ideas for Growing Food under Difficult Conditions (ECHO, 1996, 397 p.)

16: Oils

Nearly every community uses oil in cooking. In some cases oil is a primary ingredient for flavor and energy, delivering needed calories and fats in a concentrated form (while in North America many people are concerned about limiting oil in their diets). Because processing equipment, oil crops, or both are frequently not available in a particular community, oil must be imported from elsewhere in-country if not from abroad. Development workers often write us with questions about producing oil locally in their

communities. In future issues of EDN we hope to address this subject in more detail; these articles are an introduction to the topic.

Oil crops

BUFFALO GOURD IS ANOTHER CANDIDATE FOR FOOD AND FUEL. ECHO has grown buffalo gourds in our "semi-arid" greenhouse for several years. Until recently I was not overly enthused about it, even though it is one of the National Academy of Sciences "underexploited" plants. It has some impressive traits, but I did not imagine that many in our network would actually use it. My enthusiasm took a quantum leap when Dave Unander told me about the work of Drs. Wayne Bragg and Eugene Schultz and Debra Duke on its use as a cooking fuel.

The buffalo gourd, Cucurbita foetidissima, is a potential source of oil for animals and humans. On barren, arid land it may match the performance of traditional protein and oil sources such as peanuts and sunflower, both of which require more water. It is a vigorous perennial that grows wild on wastelands in Mexico and the southwestern United States. The fruits, 8 cm in diameter, are allowed to dry out and then can be "threshed." One hectare can produce 2.5 tons of seeds, which contain 30-35% protein and 34% oil. The crushed seeds yield a polyunsaturated oil (that is the "good" kind as far

as cholesterol is concerned) and the pulp is fed to cattle. North American Indians used the seed for food and soapy extracts of the fruit pulp and vine for washing clothes and cleaning hides. (This was surely not for a fresh-scented soap though. As the species name implies, the vine has a foul smell!)

Wayne says that within a few years the plant can develop a "colony" that covers an area 35 feet across and roots of the original plant can be nearly as large as a person. By then the roots are too difficult to dig and the "mother plant" soaks up all available water. Consequently he harvests most roots about 3 months after planting, at which time they may be the size of a large carrot. He leaves a few plants because wherever a bit of soil and water is placed over the sprawling vine, roots will develop. In this way a continuing colony is sustained, which can be selectively harvested as needed. He would not let any plant get over three years old or it will absorb too much of the available water.

Wayne and colleagues found that they can harvest more biomass from the roots (11 metric tons per hectare in 3 months) than from limbs of the common dryland firewood tree crop, mesquite (6 metric tons per hectare in 12 months). Roots are cut into thin segments, with some thin slivers, and sun dried. Roots are slower to ignite than wood, which is where the slivers

help. Frequent feeding with small charges of roots is desirable. Size of the grate openings may need to be increased, as the root fuel requires more draft than wood. With enough air they produce no more smoke than wood, but do produce more ash.

Like wood, roots burn with flames until about 80% consumed, then coals burn at a lower rate. Flames are about half as high as wood (charcoal has no flames). Roots burn a third as fast as wood but 3.7 times as fast as charcoal. Because of lower heating value than charcoal they only release heat 1.6 times as fast as charcoal, but water can be heated about twice as fast as on a charcoal fire. The authors attribute this to efficiency of capture of heat from a root fire being about 1.25 times greater than from charcoal.

Cooking tests with women in Mexico, Niger and Senegal have been positive and some communities are now using rootfuel in Mexico. They say the smoke is not irritating. ECHO has seed if you would like to try this plant. do not request the seed if you have a long humid season with plenty of water; other crops are much better. We have never been able to keep a plant alive at ECHO through the summer, even in our semi-arid greenhouse.

CUCURBIT SEEDS AS POSSIBLE OIL AND PROTEIN SOURCES FOR SMALL-SCALE HOUSEHOLD USE IN THE HOT HUMID TROPICS. Dr. Frank Martin

wrote an article on this topic for us. You may have a copy upon request. Here is a summary of the highlights. Oils are necessary in the diet as a source of non-saturated fatty acids. They also are a concentrated source of energy, give flavor to foods and are used as a cooking medium in the kitchen. How can oils be produced at the level of the individual household in the tropics?

On a small scale, animal fats are more easily obtained from small animals than plant fats can be obtained from plants. Animal fats can be stored 1-2 weeks or more without refrigeration, but plant fats are less stable and more readily turn rancid. Most plant fats contain a good proportion of non-saturated fatty acids (palm oils are an exception) and are therefore more useful nutritionally.

Most plant oils are stored in the seeds. It is not necessary to extract the oil to obtain its nutritional value, but this is often desirable for other reasons. It is also often desirable to remove the hulls. A convenient way to use the fats without first extracting them is to prepare a vegetable curd. This is done by grinding the seeds in water, filtering, and precipitating the protein with an appropriate agent, such as lime juice, vinegar or epsom salts. Most of the oil comes out with the protein.

In the tropics there is often a shortage of oil in the diet and/or cooking oil for the kitchen. It is difficult to mature many of the most typical oil crops during the rainy season. A suitable crop for small scale oil production in the tropics should be an annual, or a perennial that produces during the first or second year. The oil producing fruit or seed should be available year round or the seed should be storable for oil production year round. It is also useful if the seeds are also good sources of protein.

The oil palm outproduces all other species. Its oil is principally saturated. The coconut palm is also excellent. The oil can be extracted at the household level. Because of the space and time required, however, they may not be convenient crops for the small household. The soybean, peanut and possibly winged bean are suitable for high quality cooking oil, but are very difficult to extract on a small scale. They are excellent sources of non-saturated fatty acids. Okra seed is another possibility.

Cucurbit seeds as oil sources. Cucurbit seeds [e.g. melons, squashes, pumpkins] contain about 50% oil and up to 35% protein after dehulling. Most of their oil is non-saturated fatty acids, thus of high nutritional value. Conjugated fatty acids of some cucurbit oils make them quite useful as drying oils. The proteins are typically deficient in lysine and sulfur amino acids.

There are many precedents for using cucurbit seeds for oil in the tropics. Two species of Telfaria (oyster nut) are used for their large oily seeds in Africa. Hodgsonia (lard fruit) is a perennial vine with large, fatty seeds that has been domesticated as an oil source in China. In West Africa, seeds of watermelon are used as commercial sources of oil. These and seeds of egusi and bottle gourd are used in melon soups for their oil and protein content. (Seeds of Luffa acutangula and L. cylindrica, the angled and sponge luffa gourds, are bitter and may be poisonous.)

Most cucurbits cannot be grown except when there is a pronounced dry season because of disease problems. The most successful species for the humid tropics, from our experience in Puerto Rico, are Benincasa hispida, the wax gourd, and Cucurbita moschata, the tropical pumpkin. If fruits are carefully protected from excess moisture, Lagenaria siceraria, the bottle gourd, can also be grown.

The wax gourd is perhaps the best of the cucurbits as a source of seed oil for the hot, humid tropics. It can be produced any season of the year. Though the fruits may rot during the rainy season, they can be protected by growing the vines on trellises or by placing thick but porous supports between the fruit and the wet ground. The fruits are very large and very seedy. If the fruits are sound, they can be stored for many months, even a full year, until

used. Or, the seeds can be removed and dried. Per hectare yields of seeds have been estimated in our fields as 500 kg/ha. [Ed: The fruits of some varieties are covered with a white wax that keeps microorganisms from attacking. The white flesh is eaten much as a summer squash, though is somewhat more firm.]

Seeds of cucurbits can usually be readily separated from the pulp. Sometimes a light fermentation of the wet seeds for 1-3 days is useful to clean the pulp from the seeds. Fresh, wet seeds can be chewed without further processing or are toasted. They can be used in soups with or without removing hulls. The naked seeds of the hull-less pumpkin, Cucurbita pepo, are especially desirable because they lack a seed coat. Stored seeds contain most of their nutrient content for years and are convenient for rapid use later. Dried seeds can be ground into a nutritious oily meal.

In our own laboratories we have emphasized the preparation of vegetable curds. All of the cucurbits with the exception of the Luffa species produced a very satisfactory vegetable curd, as good as tofu from soybeans. They were rich in protein and oil and contained only insignificant traces of the seed coat. However, the curds are usually very fine and difficult to separate from the whey by filtration. In the case of wax gourd, vinegar or lime juice gave a more manageable curd. We consider these results preliminary, but very

promising.

Hand presses and solvent based methods of oil extraction may be used. We consider these too advanced for the smallest households, but have not yet found a satisfactory alternative.

ECHO can provide seed for luffa, wax gourd, tropical pumpkin and bottle gourd. We have not yet found lard fruit. We found seeds for oyster nut and planted it at ECHO. One vine TOTALLY covered a tall pine tree from top to the ground; because of its weed potential, we do not distribute seed of this plant.

EGUSI SEEDS ARE HIGH IN OIL AND PROTEIN. Egusi (Citrullus lanatus ssp. colocynthoides) looks like a watermelon while growing. Although the 6-inch diameter round fruits also look like watermelon, the white, bitter flesh is inedible. According to Dr. John Cherry with the USDA, the dehulled seeds contain approximately 50% oil and 30% protein. They are good sources for the essential amino acids arginine, tryptophan and methionine, and vitamins B1, B2, and niacin and S, Ca, Mg, Mn, K, P, Fe and Zn. He believes it has potential as a source of calcium and niacin in low milk consuming regions. It is a very popular food in Nigeria, Zaire, and elsewhere in Africa. For example, over 360,000 hectares were grown in Nigeria during the 1970-

1971 season. One visitor from Africa told me that whenever a group of men were standing around talking their hands were usually busy dehulling egusi. It is ground into a paste and mixed with a variety of condiments to make stews, made into a substance like peanut butter, roasted, cooked in soups etc. After partial removal of the oil seeds may be ground into meal which is used to make patties that serve as a meat substitute or sold as a dry powder that is a base for soups. The Paulsons in Central African Republic tell me that dry dehulled seeds can be placed on a skillet and popped like puffed rice. They add that this is one fruit that monkeys do not bother.

Dr. Ezumah at IITA in Nigeria writes that egusi is traditionally intercropped (92% of the time) in Nigeria. Egusi improves the performance of the associated crops, he says, but its own yields are 50% lower than when planted by itself. Yields of 600-1000 kg/ha have been achieved in sole crop plots. (The Paulsons mention it being interplanted with corn, coffee and cotton.) After 4 weeks of growth the plants completely cover the soil surface, helping in weed control. Flowering occurs about 4-5 weeks after planting and fruits mature at 7-8 weeks after planting. Fruits are softened by beating with a piece of wood and allowed to rot for a week to make the seeds easier to remove. Seeds are washed in a running stream and dried for storage. He is working at crossing egusi and watermelon so both fruit and seed could be used. (Egusi seed is larger than normal watermelon seed.)

I asked Ruth Welch in Zaire to send us some recipes and to find out whether any animal would eat the fruits. We can forward a few recipes from Ruth to you. Local farmers said that no livestock would eat the fruits, though they had seen antelope and elephants eat them. ECHO has seed in our seedbank.

JOJOBA IN PERSPECTIVE. Jojoba (pronounced ho-HO-ba), Simmondsia chinensis, is a hardy shrub which grows wild in the Sonoran desert in northern Mexico and southwest USA. Its seeds contain an oil, which is really a liquid wax, that is very similar in properties to sperm whale oil. This kind of wax is difficult and expensive to synthesize in commercial quantities, so the demand for jojoba or sperm whale oil seems sure to continue. The oil is excellent as a lubricant under high pressures and temperatures. (The Christian Science Monitor says that a few drops of jojoba oil added to transmission fluid has been found to reduce internal temperature 20 F and in turn double the life of the transmission.) It is an excellent agent for controlling foaming in penicillin, requiring only 1/6 the amount of sperm whale oil used for the same purpose. Its main use is in cosmetics.

Years ago, jojoba received a lot of publicity and many areas were planted with great enthusiasm and hopes of great returns. Many countries had interest in trying jojoba, which was hardly surprising: a desert shrub producing acorn-size seeds with 40% oil that sold for $200 per gallon was

interesting indeed! Most plantations were established from seed, which produced plants of varying quality. (Superior plants can be propagated by tissue culture or cuttings.) Plants are either male or female, but the sex cannot be determined until flowering. Jojoba has a life expectancy of at least 100 years (quite a long-term investment!). Native jojoba plantations can be found in areas with less than 12 inches (300 mm) of rain per year, but optimal growth occurs with 15-18 inches (380-450 mm). It can withstand grazing and apparently makes good forage. Plants grow to 3 feet under water and grazing stress, but can be 9 feet tall under ideal conditions.

During this time of heavy publicity, many people were tempted to plant jojoba on a large scale right away, because it takes 3-5 years for plantings to begin production. But many scientists urged caution until more was known, especially about growing jojoba in more tropical latitudes. Dr. Lemoyne Hogan at the University of Arizona knew of five-year-old plants flowering and fruiting at 4 S in Brazil, so long day length is not a requirement to get fruit. Reports based on greenhouse work in Australia had suggested that some cold was needed. He stressed that jojoba is not suited if rainfall is over 30 inches (760 mm) or if soils are poorly drained. He stressed that jojoba does need nutrients. Regarding the temptation to plant widely rather than do trials first, he replied, "They had better do trials! That's what I keep urging people. It is crazy."

In 1995 we wrote David Palzkill at the University of Arizona, USA, for an updated perspective on its potential after the initial years of promotion. Excerpts from his comments follow. "A lot has changed with jojoba during the past 15 years! It is still slowly developing as a new crop; however, many large failures have occurred with attempts to grow it, especially in the warmer developing countries. I think it still has a future, but income will not be anywhere near the amounts which we spoke of in the early 1980s. Interest in jojoba remains high, but few new plantings are being made, and the market has not expanded as quickly as some had hoped-there was no dependable seed supply from year to year.

"Most of the early commercial plantings have failed, for a variety of reasons. Most were started from seed which produced very non-uniform and relatively low-yielding plantings. Many were established in areas where jojoba was not adapted. Also, it cost more to manage than was originally expected, and prices paid for the seed were lower than expected. Early promotional packages were exaggerated, both in terms of the yields and projected selling price of the seed for oil extraction. In the early years of commercial development, jojoba was promoted for many regions of the world in which no test plantings had ever been made. It has since been discovered that many of these regions do not receive sufficient cool temperatures to overcome flower bud dormancy (jojoba has a chilling

requirement, much like peaches)."

Is jojoba still a good cash crop? "It depends! For some people with existing plantings, it is. I do not think that now is a good time for anyone to start major new commercial plantings unless they can afford to lose their investment money. I do think it is still worth doing small test plantings in various regions to learn how to manage the crop, and to identify locally adapted varieties. Jojoba is also a good landscape plant for wind and dust control, and can serve as forage for livestock."

"The size of the market has not grown much in recent years, and the price of the seed has been as low as $0.50 per pound, at which US growers cannot even cover costs. Oil price is now $30-40 per gallon, not the $200 as at one time. Many of the 'potential' uses mentioned in the 1970s and 80s have not yet been realized."

What has been learned from field experiences about growing jojoba and cultural practices in the crop? "Plantation failures have occurred in many places due to insufficient chilling to overcome flower bud dormancy. We even suspect that we have a problem with this in areas of Arizona (where jojoba is native) after warm winters. There are individual plants which do not require chilling, and the amount of chilling required varies with the

variety. Variety tests need to be conducted before establishing plantings in a new area. In the mid-1980s, frost was a severe problem, and much has been learned about management to avoid frost damage. Mechanical harvesters have been developed and are in use; however, improvements are still needed. Superior varieties have been developed by several groups (in Arizona, Australia, Israel, California), but are not yet in wide use. Procedures have been improved for asexual propagation by cuttings or tissue culture, and if interest increases again, it will be possible to propagate desired clonal varieties fairly quickly. Problems with insects, diseases, weeds, salinity, etc. have been encountered."

VERNONIA GALAMENSIS: A POTENTIAL NEW INDUSTRIAL OIL CROP FOR SEMI-ARID AREAS OF THE TROPICS AND SUB-TROPICS. Researchers have been working since 1983 to make vernonia a commercial crop in Zimbabwe. This plant holds potential to bring income to the poorest semi-arid regions of the country; it has grown in areas with less than 600 mm rainfall and thrives in sandy soils. Vernonia is a weedy annual, wild in much of tropical Africa, resembling a thornless thistle. It is grown for its seeds which contain 40% oil, of which 80% is a "naturally" epoxidized vernolic fatty acid. There is a large industrial market for synthetically epoxidized vegetable oils (such as linseed or soybean), but the epoxidation process is expensive. Vernonia oil (VO) is epoxidized already, and may be able to fill some of those market

niches. VO is also much less viscous than the synthetically epoxidized oils. The latter are semi-solids at 50 F (10 C) and can no longer be poured at 32 F (0 C), while VO can be poured even below the freezing point.

Where might the market be? Several possibilities are being researched at universities and industrial laboratories right now. Most have to do with its special physical properties, especially the fact that the "epoxy" structure is highly reactive with certain chemicals, unlike most fatty acids which are not epoxidized. Eastern Michigan University's Coatings Research Institute (CRI) foresees the possibility that one pint (one half liter) of VO could be used in each of the 325 million gallons of alkyd-resin paints produced each year in the U.S.A. alone. The solvents that evaporate from paint have been identified as major contributors to photochemical smog in California and elsewhere. The low viscosity of vernonia oil should make it a good solvent in paint manufacture and the highly reactive epoxy group will cause it to become chemically bound in the dried paint rather than evaporating into the atmosphere. Other potential uses include lubricants, adhesives, plastic formulations, protective coatings, cosmetics, detergents, a raw product for nylons, and much more.

The meal that is left after expelling the oil contains 43% crude protein. No feeding trials have been done (in May 1996), but research on use of the

meal as an animal feed is underway.

A porous, well-drained soil is essential. Vernonia will not grow on heavy clay. There have been no major problems with insects, nematodes, or disease. It tolerates full sun and can also grow in partial shade. It should be suitable for agroforestry, serving as an annual cash crop while trees are getting established. I asked Dr. Robert Perdue, who has worked with vernonia for many years, about its weed potential. "I have never seen it as a weed in farmer's fields. A West African variety does become a weed, but we [are not using] that one."

Collaborative efforts have been focused on the vernonia trials at Africa University in Zimbabwe, where research is centered and a seed oil processing facility has been established. The major problems reported in 1996 were crop loss due to winter frosts and up to 50% seed loss during post-harvest treatments. The primary needs are a better understanding of the agronomic requirements (including optimum fertilization) and a day-neutral cultivar which can grow during the summer months to take advantage of the rains from November through early April. (Vernonia is a short-day plant, flowering only in April in Zimbabwe regardless of its planting date. Currently, irrigation must be used as seeds are sown in February and harvested in August. A daylength-insensitive plant could be

planted earlier to coincide with the rainy season.) There are several promising germplasm lines for early-maturing or day-neutral varieties. There is still much work to be done on market development for vernonia oil, but some progress has been made.

If a market suddenly becomes available, the person who has learned the basics of production and has accumulated some seed will be in a profitable position. (If you want to do a modest trial, write ECHO for some seed for trial.) Those who develop a serious interest should contact Dr. Folahan Ayorinde, Dept. of Chemistry, Howard University, Washington, D.C. 20059, USA; phone 202/806-6908; fax 202/806-5442; e-mail ayorinde@cldc.howard.edu; or Dr. Fanuel Tagwira, School of Agriculture, Africa University, P.O. Box 1320, Mutare, ZIMBABWE; e-mail tagwira@africau.uz.zw.

Oil processing

Back Issues of "Oilseed Press" Available

How Can I Get Palm Oil from Oil Palms? Castor Bean Oil A Few Small-Scale Press Resources and Manufacturers

OIL PROCESSING is one book in the Food Cycle Technology series. See

review in Chapter 10, Food Science.

BACK ISSUES OF "OILSEED PRESS" AVAILABLE from Appropriate Technology International, 1828 L Street NW, Washington, D.C. 20036, USA; phone 202/293-4600; fax 202/293-4598; e-mail atintl@igc.apc.org. "Oilseed Press" has ceased publication, but the journal written to "promote small-scale oilseed processing in Africa" may be replaced by a new one from the Africa offices. ATI also produced a 20-minute video on manufacturing and promoting ram presses called "The Regional OILS Project: A Quiet Revolution," available from USAID or ATI/OILS offices around Africa.

The September 1994 issue had some helpful features excerpted here. The picture shown here is from a ram press poster by artist Salimini Sille printed in this issue. Sunflower seedcake (SFS) is used as an affordable feed for ruminants, pigs, and chickens. SFS is high in protein (25-35%) and phosphorous, which are often lacking in animal diets based on crop residues. Optimize digestion and reduce waste by milling the seedcake particles to smaller sizes before feeding. Combine the seedcake with energy sources such as cereal grains and residues for best results. The following guidelines were given: "Cattle: 2 kg of protein-rich SFS will dramatically increase production if the current diet is high in roughage. Swine: a mix of one part SFS to one part cereal grain or residues represents a good balance of

protein, energy, vitamins, and minerals. Poultry: A mixture of 30% SFS and 70% cereal residue will provide a sufficiently nutritious ration for moderate production."

The same issue addressed the process of introducing oilseed presses into new areas. ATI has found that sending plans or even a prototype machine is simply not effective to begin manufacturing and using ram presses. Some of their observations follow. First of all, a feasibility study should be done to assess the suitability and profitability of oilseeds for growers and small-scale processors before any technologies are introduced. Quality seed, with a high oil content and soft shells which will not damage the oil press, is essential. Individual attempts to improve the ram press have often resulted in heavier, harder to operate, and more expensive designs which do not actually improve performance. Learning to manufacture a press usually requires an intense week of hands-on training; copying from plans is simply not enough. The extension activities for sustainable dissemination are the most complex step, requiring a concerted effort. Contact ATI at the above address for the OILS address near you in Africa. They may be able to help you evaluate the potential of oilseeds in your area.

HOW CAN I GET PALM OIL FROM OIL PALMS? Lennie Clement in Nigeria asked this after our article about using palm oil to control bruchid beetles in

stored beans. The following is summarized from the Liklik Buk.

The oil may be extracted easily at the village level, and used for cooking, or in making soap or oil for lamps. Palm oil is very rich in vitamin A. First, harvest nuts in bunches. A chisel with a long handle might be helpful in cutting the main stem of the bunch. Break nuts off the cluster and wash them. Boil them for 30 minutes in a large can [which I presume contains some water]. Squeeze the boiled nuts in a screw-type press. The juice that comes out is mostly water, but also contains considerable oil. Some small bits of pulp will also be present. When the oil rises to the top, pour it off. Filter the oil by pouring it through a sieve to remove bits of pulp. If oil will be used immediately, no further treatment is needed. If the oil is to be stored for weeks or months, it must be heated briefly to sterilize it. The authors did not know how hot, but recommended it be quite hot but not allowed to burn. It is common in West Africa where a screw press is not available to cook the nuts in a drum and skim off the oil as it rises to the surface. This is less efficient than using the oil press.

Palm kernels can be fed to pigs, which quickly learn to crack the shell. Too many palm kernels causes a very yellow fat, and the high fiber slows growth. The high-yielding oil palms produce well with this process. Other oil palms may or may not contain enough oil to be worthwhile.

CASTOR BEAN OIL was the subject of a question from Laura Raab in Kenya. She inquired about using castor bean oil to treat constipation in the village. While it is used medicinally in some areas, castor bean contains the deadly poison ricin. The CRC Handbook of Alternative Cash Crops says: "The seeds contain 2.8- 3% toxic substances, requiring 2.5-20 seeds to kill a man, [although] chewing a single seed may be fatal to a child." Processed castor oil can be used in foods. How is that done? Oil Processing states that "Only castor oil which has been processed using sophisticated technology can be used for medicinal purposes." Exercise much caution when working with castor oil. (Better treatments for constipation include high-fiber foods like bran or cassava, drinking lots of liquids, eating fruit, or milk of magnesia.)

We came across another use of castor seeds in the 1990 #5 Baobab. People in Cameroon use castor oil as an insecticide spray against a variety of pests. The directions are as follows: "Take 4 glassfuls of seeds with the husks still on them (0.5 kg) or 5 glasses of shelled seeds; crush or grind them. Heat the powder for 10 minutes in 2 liters of water. Then add 2 large spoonfuls of kerosene and a small amount of soap. This mixture is filtered, diluted in 10 liters of water and used immediately."

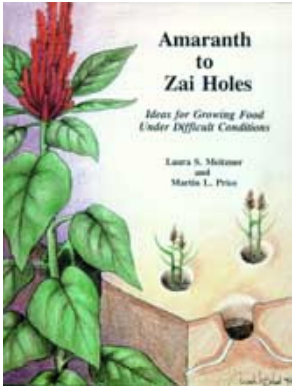
A FEW SMALL-SCALE PRESS RESOURCES AND MANUFACTURERS. Watch future issues of EDN for more on the topic of oil crops and oil processing.

Appropriate Technology Vol. 20, No. 2, September 1993 (pp. 17-18) has an extremely helpful chart on "Principles of Oil Extraction" for seeds/beans, nuts, and fruits. Small-Scale Food Processing (158 pp.) and Tools for Agriculture (238 pp.) help you identify and find the most suitable technology and equipment for your needs-including oil processing. The chapters give insights on the topic and list sources for palm nut crackers and a wide variety of presses and expellers in many countries. [The books are available free from CTA only for nationals of the 70 ACP countries (most of Africa and the Caribbean, and several Pacific Islands); write CTA, Postbus 380, 6700 AJ, Wageningen, Netherlands. Others can order the books from Intermediate Technology Publications, 103-105 Southampton Row, London WC1B 4HH, UK; fax +44 171 436 2013, or in the US from Women, Ink., 777 United Nations Plaza, Third Floor, New York, NY 10017; fax 212/661-2704; each book costs £30 or US$58.50 plus postage.]

There are many manufacturers of oil expellers, and choosing one which is appropriate is an important task requiring good information and careful evaluation. Regular availability of local seed is critical, and the new equipment may carry challenges of their own. You will probably want to consult with both local organizations and IT, CTA, FAKT, or other groups listed in this book who offer specialized assistance on technical subjects. Here we list just a few contacts for those who want to pursue this

independently.

CECOCO has a powered oil expeller; write P.O. Box 8, Ibaraki City, Osaka 567, JAPAN. The Sundhara expeller was developed in Nepal through collaboration with FAKT; contact H. Martin Dietz, Reinhold Metzler, and Carlos Zarate at FAKT, Buro Furtwangen, Stephan Blattman Str. 11, 7743 Furtwangen, GERMANY; fax +49 772 35373. The KOMET spindle-press uses 'cold' pressing (no heating required); contact IBG Monforts GMBH & Co., Postfach 200853, D4050 Monchengladbach 2, GERMANY. The ram press, inexpensive and operated by one person, was developed in Tanzania; contact Appropriate Technology International, 1331 H St NW, Washington, D.C. 20005, USA. For the Tinytech from India, contact Technical Enquiry Unit, Intermediate Technology, Myson House, Rugby CV21 3HT, UK, or Tinytech Plants, Near Mallavia Wadi, Gandal Road, Rajkot - 360 002, INDIA. A variety of table oil expellers are offered by the S.P. Engineering Corporation, P.B. No. 218, 79/7, Latouche Road, Kanpur, INDIA (last contacted ECHO in 1983) or Sheonagar, Bahraich - 271 801, U.P., INDIA. There are many, many more contacts; be sure to check with local organizations first.



Amaranth to Zai Holes, Ideas for Growing Food under Difficult Conditions (ECHO, 1996, 397 p.)

17: Above-ground (urban) gardens

Urban food production is an area which has been too frequently overlooked by development planners, considering global urbanization and the surprisingly large amount of food already produced in cities. Beyond the sites traditionally used by urban gardeners, there is considerable potential to involve millions of urban families, who may not at first thought seem to have a location to garden. This untapped potential is found where there is plenty of sunshine but either no soil or the soil does not lend itself to cultivation. ECHO and others have developed several "above-ground" techniques suited for such sites.

Where might sites for these above-ground gardens be found? For starters, in many cities there are countless hectares of sturdy, flat cement rooftops and many more hectares of tin roofs on insubstantial shanties. There are also steep hillsides, extremely poor soils, yards of rock or cement, spaces around tree roots, and places where land tenure is so unstable that only portable gardens are attractive.

Such areas were a natural challenge for us, since one of ECHO's purposes is to help people grow food under difficult conditions. There are few "soils" worse for gardening than a cement slab, a pile of rocks, a corrugated roof or a mass of tree roots. However, large areas of such unused but potentially prime growing space are often located in cities, near large markets and

numbers of underemployed people. The potential value of creating growing areas in such locations is obvious.

Since 1982, ECHO has been working on methods for gardening in such situations, which are not nearly as difficult a challenge for gardening as one might think. In fact, cement slabs have become one of our favorite gardening spots in Florida, where sandy soils and nematodes make in-ground gardening a challenge. Urban gardening has a reputation of not being very successful. This chapter takes a second look at growing food in the city.

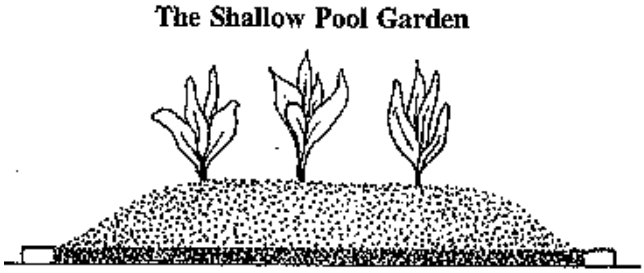
Overview of above-ground gardening

SOME CRITERIA FOR ABOVE-GROUND GARDENS. (1) They must be made from local materials, not from something imported into the country. (2) They must be inexpensive to construct, preferably using recycled materials approaching no cost at all. (3) They must have a very low weight per area of growing space (unless located on the ground). (4) The emphasis should be on obtaining satisfactory production with minimal inputs, rather than maximum possible production with high inputs (which is the usual goal of hydroponics). (5) No instruments or analyses should be needed for routine operation.

A LOOK AT FOUR ABOVE-GROUND GARDENING METHODS. [Please note: One inch (") = 2.54 cm.]

Shallow Bed Garden

The Shallow Bed Garden is a 3-6" bed of compost. To keep weight to a minimum, no soil is used. If compost is not available (a likely situation), plants can be successfully grown in fresh organic matter of many kinds. Such beds are fertilized and covered with at least a thin covering of compost or soil. Almost any vegetable can be grown in shallow beds. Once the beds are established, they are like regular gardens except in their need for more frequent watering.

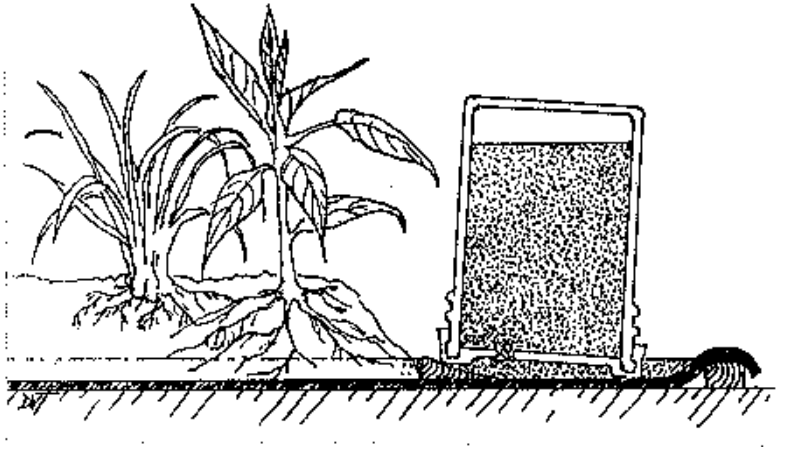


Shallow Pool Garden

The Shallow Pool Garden consists of a shallow pool of water 0.5-3" deep. Usually a sheet of plastic of the desired size is formed into a pool by laying sticks under each of the sides. Shallow beds made of any material that does not tend to become waterlogged are then built in the pool, extending at least 2" above the water line. The length of time between waterings can be extended by making a bucket waterer. [To make a bucket waterer, drill a 3/8" hole into the tight-fitting lid of a 5-gallon plastic bucket, about 1 inch from the edge of the lid. Fill the bucket with water (optionally containing a soluble fertilizer) and place it upside down in a cleared spot in the "pool."] Place a stick under the bucket lid at the point nearest the hole to allow air to enter under the bucket. This results in a constant shallow pool of nutrient solution in the bed, the depth of which is determined by how much the stick raises the edge of the bucket.

Wick Garden

The Wick Garden consists of a piece of polyester cloth (the "wick") laid out on a flat area in the shape of the desired garden and a 5-gallon bucket waterer (see above) placed directly on the wick. Set the root balls (the roots and soil attached to plants in their starting containers) of transplants directly on the wick. Finish the beds by filling in around the plants to a depth of 3-6" with some extremely airy material such as pine needles, pieces of coconut husk, or even cola cans. It is important that this material be something that will not become waterlogged. Leave a section of the cloth clear to hold the upside-down bucket. The wicking action of the cloth spreads water and nutrients to the roots, which grow above and below the surface of the cloth. Sometimes the cloth is first covered with a thin layer (0.5-1") of compost or potting soil. Best results are found with short or trailing vegetables and herbs, such as onions, radishes, lettuce and mint.



Tire Garden

Tire Gardens. The tire gardens are portable gardens that can literally go almost anywhere. The garden is made from an old tire and a small sheet of plastic film (e.g. a garbage bag). Construction is simple and elegant. Lay a tire flat on the ground. Note that the top rim is a mirror image of the bottom rim. With a knife or machete, cut off the top rim. Place a piece of plastic inside the tire on the bottom rim, large enough so that an inch or two of plastic stands up along the walls of the tire. Now turn the top rim that has been cut off upside down. It fits like a lock on the bottom rim, holding the plastic firmly in place. Fill with growing medium, usually starting with

lightweight, airy materials on the bottom and soil or compost on the surface. If the plastic is trimmed to near the bottom of the tire, the garden will essentially be a portable "shallow bed garden." If the plastic is left so that a pool of water is formed, it will be more like the "shallow pool garden."

OTHER BENEFITS OF ABOVE-GROUND GARDENING TECHNIQUES. Protection from animals and floods. There are substantial areas along the Amazon in Brazil where all gardening is done in shallow beds on platforms. Local people have differing explanations for why this is done. This has an obvious advantage in flood-prone areas where even houses are sometimes built on stilts. But platform gardens are the primary gardening method even where it never floods. Wayne Smith reports that people in his area plant gardens on platforms to avoid damage by animals. "They make a platform of sticks, an old canoe etc. from 4-7 feet tall, place a layer of dirt and ashes/cinders on top, and then grow mainly green onions." (We have also heard that some farmers of Mayan descent in southern Mexico use the same technique.) Soils in some regions of the Amazon basin are highly acidic and contain so much aluminum that it is toxic to many vegetables. The improved growing medium that is concentrated on the platforms may give much better results in such situations.

Gardens for the handicapped. Shallow beds on platforms (that can be

inexpensive because the gardens weigh so little) make gardening available to people with physical handicaps that prevent them from working in the soil. If platforms are placed at the right height, people in wheelchairs can garden easily.

Avoidance of soil diseases and pests. Root-knot nematodes are such a problem in our soils in Florida that susceptible plants cannot be grown unless the soil is sterilized. However, some fungi that live on decaying organic material kill nematodes. If we have enough organic matter in the soil we can sometimes get around the nematode problem. If we have 100% organic matter (as in a shallow bed and wick gardens) or no soil (as in the wick gardens), we have no root-knot nematodes. (After a few growing seasons, the decay process is essentially over. At this point the nematode-killing fungi may no longer be present and nematodes can again become a problem, unless the bed is renovated with fresh organic matter.)

Situations where there is a serious problem with the soil may lend themselves to above-ground gardening even in rural areas. One season we planted a few rows of green beans in the soil and, right beside them, a few more rows in a shallow bed garden. This bed was made of grass clippings just as though it were on a cement slab, except that it was in direct contact with the soil. Roots of beans from the grass clippings were totally nematode

free; roots in the soil were covered with knots. Often at ECHO nematodes kill sugar snap peas before they bear, except when planted in a shallow bed of grass clippings on top of the soil.

Ability to garden in the shade of trees. Many heat-sensitive plants thrive better in some shade in the hot tropics. Above-ground techniques can be used to make beds on a sheet of plastic under trees. Tree roots are not damaged by tillage; the plastic prevents them from interfering with the vegetables; and many plants benefit from light shade. Tire gardens can be placed anywhere that provides enough light, even directly on protruding tree roots.

LIMITING FACTORS IN ABOVE-GROUND GARDENING. It is not difficult to list possible problems with above-ground gardens. The poor may live in homes with rooftops that cannot even bear the weight of a person. Those with the most substantial rooftops may have the least incentive to garden on them. Fertilizers may not be available, especially those with micronutrients. People may not be prepared to give daily care to a garden. It may be difficult to develop a uniform formula for making the gardens when only recycled materials are considered. Water may be scarce and have to be purchased. Compost is usually not available unless people make their own, and motivation to do this may be lacking. Urban gardening projects in general

have a reputation of little payoff among many in the development community.

There are situations where any of these problems may be critical. However, the world is a very, very large place. A creative perspective and innovative attitude is necessary to see successful above-ground projects develop. An idea that, if successful, promises to make acres of prime, presently unused, arable "land" suddenly available for producing food and some income, is deserving of special effort. We can begin with those thousands of situations where the above problems are not limiting-while we consider how to include more people.

It is imperative that your first community project succeed. Do not involve many people in above-ground gardening until you are sure you know what will work and have done it for at least one season. The success of the first community project is more important than saving on every possible ingredient. I think particularly of fertilizers. In every conversation it inevitably comes up, "Why not use manure tea instead of fertilizer?" It is possible, but it is not foolproof. (See discussion of this topic below under "Constructing the shallow bed.") It is almost certain that some gardeners will fail not because the methods themselves have a problem but because of inadequate concentration of nutrients in the manure tea. It is quite possibly

cheaper (and certainly less offensive to the neighborhood) to use fertilizer than to haul in manure from the countryside. But more importantly, if it fails you will probably not get a second chance with the people who tried your "far out" idea of above-ground gardening.

Also, as with any new enterprise, consider the market before promising people that they can make money on their gardens. A Colombian organization developed a shallow bed/hydroponic system with many similarities to what we discuss in this chapter. The project used donated rubbish-rice bran from a mill and wooden crates from an auto parts shop- and recycled polythene from commercial flower farms. It cost families less than $5 to set up one square meter plot and under $9 per year to operate it, using commercial hydroponic fertilizer. In addition to what the 130 participating families used themselves, the cooperative sold over three tons of vegetables each month. A major supermarket chain bought produce from the community. Once a week produce was brought in, weighed, and paid for on the spot. From the sale of vegetables grown on the roof, the organization could pay the rent on their center. This enterprise was highly publicized, and apparently very successful for many years. ECHO was never able to make contact with the project directors. We heard that the project ended once the funding stopped, due to difficulty in obtaining the hydroponic nutrients. While it was operating, the key ingredient was that when each garden was

planted, the market for its produce was guaranteed. It may be unrealistic for an informal group of gardeners to provide the quality control and regular supply required by a supermarket contract. Marketing is crucial, but to be sustainable it may need to be limited to individuals selling through established local channels.

WHERE ARE THESE ABOVE-GROUND METHODS BEING USED TODAY? There are examples of urban gardening and above-ground gardening to be found on some scale in most cities (see review of Urban Agriculture at the end of this chapter). There is a section on ECHO's home page for updates on above-ground gardening projects in process. Send us information on what you are doing so it can be included.

A St. Petersburg gardener grows in recycled peat bags.

a roof garden

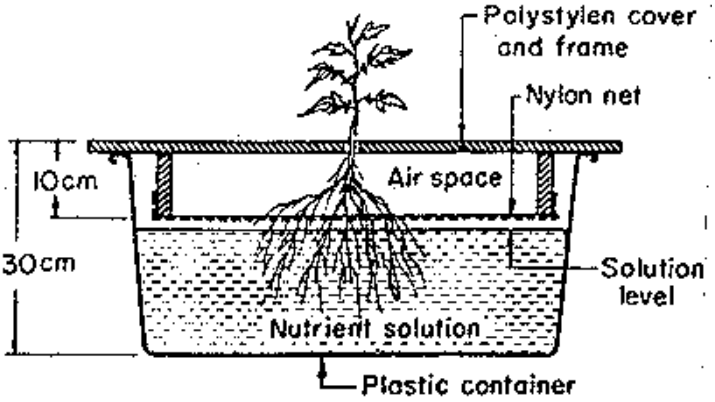
ECHO and several people in our network have been involved in projects for a number of years. A group called "Haiti Gardens" is very active in and around Port-au-Prince. ECHO staff member Dan Sonke visited some of those gardens in March 1996. We can send a copy of his trip report to interested visitors. They are using traditional methods on vacant land and also tire gardens both on rooftops and at ground level. The Christian Reformed World Relief Committee is in the beginning stages in 1996 of evaluating tire gardens for diverse settings in San Salvador, El Salvador.

ECHO and the Center for Citizen Initiatives have together sponsored a rooftop gardening program in St. Petersburg, Russia. The combination of a population that loves gardening, a shortage of food, and an exceptionally high educational level makes this an ideal location. Nearly every citizen lives and works in buildings with huge flat cement rooftops. The main problem is in getting official permission to use the roofs. Institutions can more easily establish rooftop gardens than can individuals because the director of the institution that decides to establish the garden also controls the roof. There are now about 20 rooftop gardens in St. Petersburg. One garden on an apartment building has become a mini-farm, producing onions, herbs, and growing some container berry plants for resale. In 1995 a large garden was planted on the roof of the main prison in St. Petersburg. In 1996 a garden on an orphanage rooftop is beginning in Moscow.

"WHAT ABOUT HYDROPONICS?" AND NON-RECIRCULATING HYDROPONICS. People often get excited about hydroponics for third world situations. I have never been among them. Hydroponic systems tend to be expensive, require energy and equipment for circulation of the water to get oxygen and nutrients to the roots, and demand close monitoring of nutrient concentrations. Its value is in situations where expense of production and price of product are very high, e.g. growing winter greenhouse tomatoes near a large northern city. The 3- or 4-fold yield increases from high-technology hydroponics may pay in such situations. I am unaware of many third world situations in that category, especially which would involve peasant farmers. Also, if a pump breaks down where parts are unavailable or the power goes off, the entire planting can be lost. Dr. Hideo Imai at the Asian Vegetable Research and Development Center in Taiwan sent us a description of a non-recirculating hydroponics system he developed (an abbreviated version was published in HortScience, vol 23, 906-907 (1988)). This system gets around these problems to a considerable degree. His discussion of air and water-nutrient roots is also helpful in understanding plant growth where there is at times a high water table. The following is abstracted from his reports.

Plant roots require oxygen, but I had not realized until Dr. Imai's paper that not all portions of a plant's roots require the same amount of oxygen. Plants

can form what he calls oxygen (O) roots and water/nutrient (W/N) roots. Roots exposed to air specialize in taking up oxygen; those immersed in water specialize in taking up water and nutrients.



smaller adaptation of his non-recirculating hydroponic system

This figure (from Dr. Imai) shows a schematic of a smaller adaptation of his non-recirculating hydroponic system. In the commercial unit, plants are suspended in holes cut in a lid that covers a 0.5 meter deep trough. The roots extend through the air, spread out onto a net, and then pass into water a few centimeters below the net. The purpose of the net is to provide support for extra O roots, which spread out over the screen. A smaller number of W/N roots drop on down into the water, but no further than 15

cm due to the limited amount of dissolved oxygen.

When the water level drops, the W/N roots change into O roots, a process taking only 2-4 days. However, this is not reversible. If solution is returned to the original depth the plants wilt within a few hours and do not recover. I can confirm this personally. When my interns left for the holidays it fell to me to maintain our first unit. I was surprised at how many gallons it took to get the water back to where I mistakenly thought it had been maintained. Water now covered roots that had been transformed into air roots. By the next evening the plants looked almost like they had been through a frost, and they did not recover.

ECHO did some interesting trials with the non-recirculating concept at the Caribbean Marine Research Center in the Bahamas. We thought the concept had potential for islands with only rock for soil. They had an unused commercial hydroponic unit in a greenhouse. We disconnected the pumps and grew very acceptable tomatoes, cucumbers and peppers with non-recirculating nutrient solution in each trough.

I am not recommending this system for most situations. After many trials we consider it too expensive, too heavy for a rooftop, a serious breeding ground for mosquitoes, and too temperamental for mass use. We did learn from it

some important things about how plants grow, and it also influenced the development of the other systems we recommend. The shallow pool garden, for example, allows space for the O roots throughout the growing media and the W/N roots in the pool of water. However, the shallow pool is an improvement over the hydroponic system described above in that the depth of the pool, formed by placing sticks under the edges of the plastic, is constant. Overwatering as I mistakenly did in the system above would not kill the plant in the shallow pool, as the extra water would simply overflow the pool, leaving the O roots intact in the growing medium above the pool.

If you are interested in pursuing this approach further, Dr. Bernard A. Kratky at the University of Hawaii (461 W. Lanikaula, Hilo, HI 96720, USA) has done considerable research over many years and can provide you with technical details. He produced a 38-minute video demonstrating three non-circulating hydroponic methods (US$29 in USA; $35 overseas postpaid) and a new book (39 pages, 10 illustrations; $8.95 plus postage), both titled Non-Circulating Hydroponic Methods. Order the video from UHH College of Agriculture, 200 W. Kawili St., Hilo, HI 96720, USA. The book is sold by DPL Hawaii, 39 W. Lanikaula, Hilo, HI 96720; phone 808/935-8785.

Technical details of above-ground gardens

THE SHALLOW BED GARDEN has the most in common with ordinary gardening techniques. If you have enough compost or quality potting soil to make a 3"-deep bed, this technique is straightforward and most of the following discussion would not be needed. The main difference from regular raised bed gardening is that it must be watered at least daily. It does not use more water, but it must be watered more frequently.

Shape of the Shallow Bed Garden. Like most people, when I first began thinking of gardening on rooftops I envisioned gardening in rather deep containers. Container gardens, however, can be heavy and moderately expensive. If they are too small, larger vegetable plants may grow but give little produce.

Our first model garden consisted of a three foot deep bed of wood chips. (Wood chips are much lighter than soil.) We got the idea from local nurseries. They sell to apartment dwellers half-bushel bean hampers filled with wood chips and each containing a single tomato plant to be grown on their balcony. Gardeners are instructed to pour water containing a soluble fertilizer over the plant each day. The hampers work well and the taste of the tomatoes is exceptional.

Our deep garden used large amounts of fertilizer. A very important point to

remember in working with organic matter that has not yet decomposed is that the microorganisms that cause organic matter to decay use the same fertilizer elements as do plants. This becomes a special problem if, as is the case with wood chips, the material itself is low in nutrients. The decay process can use up the nutrients, leaving the plants anemic. (These nutrients are not permanently lost. They will become available months later when the bed has been transformed into compost.) Some plants thrived, others always showed nutrient deficiencies.

After several trials, we discovered that beds only 3 inches deep were not only lighter in weight but gave better results. After several years of growing in shallow beds, I would now describe the ideal rooftop garden as being at least 3 feet (1 meter) wide and only a few inches deep.

The ability of vegetables to grow in shallow beds should not have surprised us. Greenhouse tomatoes, lettuce and cucumbers are often grown hydroponically in long rectangular bags 6-12 inches wide and a couple inches high that are filled with planting mix. Plants thrive even with such a small root volume because just the right amount of water containing a soluble fertilizer is continually dripped into the medium.

Three-inch shallow bed gardens on platforms at ECHO.

shallow bed gardens on platforms

Roots do not require much volume when there is plenty of water and nutrients. Why do roots normally cover a much larger volume? When watering is sporadic a large volume of soil (with roots throughout) is required to hold enough water to keep the plant supplied between waterings. The primary question about how thick the shallow bed must be comes down to this: How often are you prepared to water?

Often people wrongly assume that only shallow-rooted plants will thrive in a shallow bed. Except for tubers where the edible part exceeds the size of the bed, we have not found this to be true. Although a shallow-rooted plant cannot take advantage of a deep bed (its roots will not reach to the bottom), a deep-rooted plant can adapt to take advantage of the space in a wide but shallow container, as this carrot has done.

The question of weight. We place great emphasis on developing very light-weight beds for rooftop applications. That is why we use no soil and we like to keep the depth to only 3 inches. Individual soil particles typically weigh approximately 2.75 times as much as an equal volume of water. There are spaces between the tiny soil particles, however, which can account for up to 50% of the volume of a good garden soil. It is the worst case (heaviest soil) that concerns us in considering any possible danger to the roof, so we will consider the weight after a drenching rain and assume that every space is filled with water. Such saturated soil weighs 1.9 times as much as an equal volume of water. Individual particles of organic matter typically weigh slightly more than water (1.1 to 1.4 times) and the spaces between them are much more than 50% of volume. So in a worse case, i.e. a totally flooded bed of fully decayed, compact organic matter, the weight would be at most 1.2 times that of water. In most cases, the weight will be almost the same as an equal volume of water.

The weight can still be considerable. This table compares the weight of 3" (7.6 cm) and 8" (20.3 cm) deep beds that are 4 feet wide and 8 feet long (1.22 m x 2.44 m), one with soil and one with well decomposed organic matter, both fully saturated with water.

Maximum weights of four rooftop gardens.

Depth	Weight	
	well-decomposed organic matter	good garden soil
3"	598 lbs (272 kg)	947 lbs (430 kg)
8"	1,595 lbs (725 kg)	2,552 lbs (1,147 kg)

Miradieu Estinvil built his Port-au-Prince garden on the roof of a friend's home.

building a garden on a friend's home roof

At ECHO we usually have no sides to the gardens in order to keep material cost to a minimum. If cement block sides were used, the weight and cost would be considerably greater. Based on what we have seen, we have been more cautious than necessary. As you can see in the pictures, some

gardeners in Haiti are using concrete blocks for sides and depths equal to the 8 inches of the blocks. No problems have been reported although I saw perhaps half a dozen gardens. If there is any doubt about safety, remember to put the heaviest items (like a barrel of water) directly over walls.

Materials for the Shallow Bed Garden. No material will serve better for making a shallow bed than fresh compost-if you have it. Most of this discussion becomes necessary only if the people with whom you intend to work do not have affordable access to quality compost or potting mixes. In that case, because the mix of free materials is always different from one city to another, it may be necessary to do your own trials for a season or two and do some problem solving. The end goal is to have a foolproof, low-cost gardening system tailor-made for your situation.

A garden can be planted in fresh organic material if one does not have compost. Since the inexpensive raw materials available for making the garden differ from place to place, the techniques used may need to be varied, depending upon what materials are used. The choice depends mostly on what is being thrown away in the area. We have used wood chips because they are free from the electric company after they trim along the electric lines. Our favorite material is grass clippings. Contractors who mow lawns for homeowners would much rather give ECHO their load of grass

clippings than pay the county landfill to take them. Barbara Daniels in California, who developed a similar method of above-ground gardening, prefers a mixture of tree leaves. Perhaps the best results may come from a mixture of materials, which can include weeds.

Waste materials in the developing world will likely be different but equally useful. Perhaps bagasse (i.e. sugar cane waste), rice hulls, coconut husks, weeds, leaves or even manure are available in your community. In Haiti, the fine particles left in bags of charcoal are being incorporated into the mix. (Sawdust is available in places, but would be my last choice. It will use up fertilizer even faster than wood chips, because of the greater surface area, and it easily becomes waterlogged.) No matter what organic material you use, after one or two growing seasons it will have decomposed into a beautiful compost.

The beds do not need to contain organic matter as long as the material is fine enough to hold sufficient water. For example, gravel has been used in various hydroponic systems for years. Non-organic media have an initial advantage in that the lack of decomposition means that only the plants, not the decaying bed, are using up your fertilizer, but in the long run non-organic beds are more fickle. A sudden imbalance in nutrients or swing in pH (acidity or alkalinity) can more easily develop. Organic matter, even if only

partially decayed, acts as a buffer to prevent extremes. This happens because after a few weeks nutrients begin to be released from the decaying material. If the plants need more of a particular nutrient than your solution is supplying, the bed itself provides a certain amount of it. Conversely, organic material is able to absorb, for later release, some of the excess nutrient you might add. It also resists changes in pH.

As we considered various recyclable materials, shredded tires came to mind. Recycled rubber seemed to offer an inexpensive addition to the growing medium and its use would solve an environmental problem at the same time. After several trials we have failed to get good growth with this product. It is just as well. The August 1994 HortIdeas cited research which found that chrysanthemums grown in soil mixes with even small proportions of shredded tires did not fare as well as plants in rubber-free media. The plants grown in rubber had zinc levels 74 times higher than normal, which could lead to toxicity levels for some species. For now it may be best to avoid using tires in your soil mix. (We have had no such problems growing plants in our tire containers, however. Nor would we expect it, as the surface area with which roots are in direct contact with rubber in shredded tire mixes is thousands of times greater than the minimal contact with a tire wall.)

Experiment with mixtures. When possible, if compost is not available, we like to use a mixture of materials. Mixtures are especially good because you have more flexibility to create the kind of environment that roots like. It is also likely that if a needed nutrient is not released as one component begins to decay, it will be by another. You can include many common garbage items. One of our more interesting beds is made of approximately 40% by volume cola cans (with slits cut into the sides so roots can enter that well-aerated interior). The other 60% is grass clippings mixed between and placed on top of the cans. The advantages are that it provides good aeration and a deep bed with exceptionally low weight. Ordinary garden fertilizers are added when necessary.

A 2-5 inch layer of weeds packed closely together and covered with perhaps a couple inches of grass clippings or (better) compost from a previous bed works well. The 6-8 inch deep bed for corn was made in this way. A benefit to placing weeds on the bottom (rather than grass clippings, for example) is that there are more air spaces between the weeds, which is better for roots.

Once you have settled on the materials for garden construction, the available fertilizers, and the vegetables to be grown, you will be able to develop straightforward, detailed instructions for your unique system of shallow bed gardening. That is what you will pass on to new gardeners in

your community.

Constructing the Shallow Bed. An important factor that makes these beds inexpensive is that no container is necessary. Depending on the material used, sides may not even be needed, especially if a mulch is placed on top of the bed. We only use sides for platform gardens or where appearance is important. We have had a lot of heavy rains and strong winds over the years. The only bed that gave us a serious erosion problem was one in which we used a large amount of silt from the bottom of a fish pond.

The shape of shallow beds is determined by the same considerations that one uses in making raised beds. They can be of any length, but a break for a path every 8-12 feet is helpful. They should be just wide enough (4-5 feet) that a person can reach to the middle of the bed. Thought should also be given to maximum use of space. A path down the length of the rooftop with beds and aisles going off to either side is probably the most efficient.

If a sheet of plastic is available, we like to use it for a base. If the garden is on a rooftop we believe it may minimize discoloration of the roof and slow any possible seepage into cracks that might exist. No doubt it will always be moist under the plastic, but that is less of a worry than a considerable supply of water in direct contact with the roof. If the garden is on top of

ground in a situation where there is some problem, it keeps the growing medium and roots completely isolated from the soil.

Let us use grass clippings as an example. We leave the grass clippings in large piles until needed. It is best to let them decompose in a pile for at least a few weeks because the high temperatures in the piles allow much of the composting process to take place there rather than in our garden. Also we believe (no data) that most pesticides that might have been on or in the grass clippings are destroyed during this time as well. If the pile of grass clippings is not too old, the contents will be fluffy and moldy. (Be careful breathing the dust. I have developed quite an allergy to it, though no other staff are affected.) Start with a pile high enough to allow for shrinkage during the initial preparation and continuing as the bed decays.

Thoroughly wet the pile. Often the clippings do not want to absorb water- even after adding a lot of water, the clippings half an inch deep may be dry. When this happens, add a few tablespoons of laundry detergent (any variety) to the watering can and pour evenly over the surface. Detergents fall under a class of compounds known scientifically as wetting agents or surfactants (surface-active-agents). They help water adhere to surfaces. While adding water, if the clippings are fluffy, walk over the bed and stomp down the grass as much as possible. If the bed is made of other materials

that do not need to be compressed, such as wood chips, rice hulls, or dense clumps of grass clippings that have spent several months in a pile, the materials are simply placed in the bed, wet down with detergent solution, and fertilized. This will help keep the materials constantly moist, and so hasten decay.

Whenever possible, cover new beds with an inch or more of compost before fertilizing and planting. Remember that compost is the ideal medium. The shallow layer of compost is a perfect place for a seedling to begin its life. We are using these other materials only because we lack enough compost.

Finally we add an ordinary garden fertilizer and dolomitic limestone. If it is 10/10/10 fertilizer, we add 5 pounds per 100 square feet. (The numbers refer to the percent of nitrogen, phosphorous and potassium, respectively.) If it is 5/5/5, we add twice that amount, etc. Neither the exact numbers nor the exact amounts are that important. There are many other fertilizer formulations on the market. You might only be able to get something like 8/6/10, for example. Don't worry about it. Just avoid extremes like 36/10/10 used for lawns or something like 10/0/10 which would be a special purpose formulation completely lacking in phosphorous.

We always use fertilizer with micronutrients (that is elements needed only

in minor amounts). If you cannot find that kind of fertilizer, the micronutrients that will soon be released by the decaying organic material may be sufficient. One can often buy micronutrient formulations separately and inexpensively. These would be used in small amounts, following directions for a regular garden. Added micronutrients are a must with any system that is not based on organic matter. (A quick way of providing these micronutrients, if they are not contained in the fertilizer, is to apply some manure or to water the garden with a manure tea made by soaking a bag of manure in a barrel of water for a few weeks.)

If you cannot find dolomitic limestone (dolomite), I doubt if it will matter too much as long as some of the organic matter has begun to decay. Go ahead and add regular limestone instead. The main function of the dolomite is not to control acidity (this has never been a problem for us) but as a source of the two minor nutrients: calcium and magnesium. (Ordinary limestone adds calcium, dolomite adds both calcium and magnesium.) A commonly available alternative source for concentrated magnesium is epsom salts.

Whether you use fertilizer or manure and manure tea depends on your location (and philosophy). In many urban situations it is easier to obtain fertilizer than manure. Remember that your goal is to have a foolproof system that can be taught to and duplicated by dozens of gardeners. You can

develop very precise instructions for a system designed to use a particular commercial fertilizer, but it will be much more difficult with manure tea. The response of plants to manure depends upon the age of the manure, the animal's diet, how much bedding is included in the manure, and on the kind of animal. (Goat manure is reportedly one of the best manures for hydroponic systems. This may be because goats are browsers, eating a little from many kinds of plants each day. Consequently their manure has a composite of nutrients found in a wide variety of plants.) Do not just assume that people cannot afford fertilizers, especially if the produce is to be sold.

Jeff McManus uses water hyacinth for above-ground gardening in Bangladesh. Water hyacinth (Eichhornia crassipes) is one of the most prolific plants on earth. This floating weed chokes waterways around the world. People in Bangladesh clear their ponds and rivers of the floating plants and pile them on the banks. They plant vegetables in the water hyacinth, and these mounds become "floating gardens" in the monsoon season. The McManus family grows lettuce, papayas, tomatoes, and very productive roses in boxes filled with water hyacinth harvested from nearby nutrient-rich waters. They chop the plants into small pieces, let them compost for two weeks with daily turning, and plant directly in the compost. Jeff mixes the compost with a little manure and some wood shavings, but does not add extra fertilizer, since the water hyacinth is an efficient collector of nutrients.

The spongy plants hold a lot of water, so very little watering is needed. The box gardens work best with fresh material; reused compost seems to promote diseases in the plants.

Planting in the new bed. Planting seeds or transplants into shallow bed gardens made of compost is done as in any other garden. Planting directly into beds of organic material that has not yet decomposed requires some special techniques. Larger seeds like peas or beans can usually be planted directly if the medium is made of a material that packs closely enough together to remain moist most of the day and make close contact with the seed to keep it wet. Seeds must be deep enough into the medium to remain moist but shallow enough to be able to grow to the surface after germination. (The top inch or so of many materials, e. g. nearly fresh grass clippings, tend to dry out.) You may need to water a few times each day until they germinate. We have also had the opposite problem with older, matted grass clippings which stayed too wet.

Smaller seeds, like carrots, require compost or soil or something of very similar texture to get started. If you cannot cover the entire bed, just form a 1-2 inch deep trench in the packed down grass clippings, fill it with compost or soil, and plant in this trench. Even this small amount of compost will provide an environment for the seed and initial roots that is just like they

would experience in any garden. A useful technique for germinating carrots, even in a regular garden, is to place a board on top of the row. This ensures that the top cm of the soil remains moist. Look under it daily until you see the first seeds germinating, then remove it.

Transplanting likewise can demand special care if the medium is not similar in texture to soil. We often make a small hole, insert the transplant, and fill in around it with several handfuls of compost or soil.

Keep a close watch on the appearance of the vegetables. At the first sign of nutrient deficiency, add a bit more fertilizer. With high-nitrogen materials like grass clippings, this may only need to be done once or twice, or not at all. With low nitrogen materials like wood chips it will be necessary to add fertilizer frequently. A small amount of solid fertilizer can be sprinkled around the plants, taking care not to get it in direct contact with leaves or stems. Our best wood chip gardens were grown by watering every other day with a solution of soluble fertilizer or manure tea. Most soluble fertilizers are made to pour directly on the leaves (some nutrients can be absorbed through the leaves of some plants). This is especially helpful if a deficiency has already appeared. If possible have a spray bottle on hand filled with a soluble fertilizer. Use it as "medicine" to spray plants when any deficiency appears.

Refurbishing the Shallow Bed-Subsequent Seasons. You may be surprised at two things: (1) how quickly the depth of the bed drops as the material turns to compost and (2) how quickly a beautiful compost is formed. Because there is no soil in the beds, the material turns deep black and may eventually look like peat. The bed must be refurbished after harvest whenever it has shrunk to less than the desired depth or has become so dense that it holds too much water. Alternatively, the bed can be recycled: dismantled and the compost which has formed in it used as the top layer in constructing new beds.

If the bed is still deep enough for another growing season, all that may be necessary is to apply fertilizer. The bed should not need as much fertilizer as when it was new. Much of the bed, depending on its original composition, has now been converted to compost. This is not a delicate system, like hydroponics, with exacting fertilizer requirements. I trust that any frustration at not finding rigorous details on the amount of fertilizer will be more than compensated by having a bed that allows some flexibility. More fertilizer will be needed if you have heavy rains that leach away nutrients. WATCH YOUR PLANTS FOR CLUES ON WHAT THEY NEED.

The task of refurbishing is much easier than making the original bed, because we are now starting with a considerable amount of compost. Rather

than layering new organic material (e.g. grass clippings) on top of the bed, it is best to remove the composted material, layer the new material onto the empty bed, then place the remains of the old bed back on top. We add some fertilizer (less than with a totally new bed) and water.

There are two reasons to refurbish in this way. First, the older material can become so dense that, if left at the bottom of the bed, aeration might be poor. This is not a problem when it is placed on top of the less compact fresh organic material. Second, it is much easier to plant into the composted material than it would be into the fresh material.

What plants will grow in a shallow bed? We have had success with a wide variety of vegetables: amaranth, broccoli, cabbage, cow peas, corn, eggplant, cucumber, green beans, herbs (rosemary, tarragon, basil, sage, mints, chives), kale, kohlrabi, lettuce, okra, onions, quail grass, radishes, sugar snap peas, tomatoes, winged beans and a variety of flowers. It is easier to say what crops may give problems. We stay away from large vines, such as tropical pumpkins, jicama or sweet potatoes, that have such a large leaf area that they quickly deplete the reserve of water in the shallow bed. The shallow pool method described below may be better for these large plants; however, with sufficient volume (either a deeper bed or fewer plants in a bed) or more frequent watering, there should be no problem growing

vines such as pumpkin or watermelon, letting them flow over the side of the building or over rocky soil. Root crops require deeper beds. We have grown acceptable carrots in grass clippings, but had to make the bed about 8 inches deep. It shrank so much during the growing season that the carrots stuck out of the top by an inch and had L-shaped roots because the bed was too shallow. Carrots grown in wood chips were distorted because of the twists and turns the taproot made to avoid wood chips.

The Shallow Bed garden is the most foolproof. Especially when made of compost, it differs little from gardening in the soil. The main differences are its need for daily watering and the shallow roots (to which plants show a surprising ability to adapt). The ability to grow vegetables in fresh organic material while it is being turned to compost is a very attractive feature.

SHALLOW POOL GARDENS. Daily watering required by shallow bed gardens can be a problem. Pat Lahr, a missionary in Haiti, developed an ingenious system using a 5-gallon bucket to provide continuous water to the bed.

Pat used a principle that farmers have used for decades to automatically water animals. A 3/8" hole is drilled in the lid (one inch from the edge) of a 5-gallon bucket. The bucket, optionally filled with nutrient solution (manure tea or water containing a complete hydroponic fertilizer), is placed upside

down in the pool. The side of the lid nearest the hole is placed on a stick just thick enough to provide the desired depth of water. Water flows from the bucket until the pool of water rises to the point that air can no longer get under the lid and into the bucket. This ensures a continual, shallow pool of water. When the pool level drops enough to allow a few bubbles of air into the bucket, more water flows into the pool.

In our first trial with the system, we used only a 6" layer of pine needles and hydroponic solution to grow an okra plant in a 4 ft square shallow pool garden. It fell over when it was two feet tall, but shoots grew rapidly from several points along the stem. These new shoots, supported by the portion of stem on the ground and the now substantially larger root mass, did not fall over and grew into an exceptionally large, bushy and productive okra plant. Incredibly, we found that the leaves transpired 5 gallons of water on a hot summer day. Results are more reliable the closer you come to a normal garden. Today our shallow pool gardens are basically shallow bed gardens sitting in the pool and extending at least 2-3 inches above the maximum water level.

The roots of most food plants and flowers require plenty of air to thrive. You may have heard that "more houseplants are killed by overwatering than by underwatering." The problem with overwatering is not that the roots do not

like to stay moist, but that if heavily watered, water fills most of the spaces ordinarily filled by air in dry soil. Likewise, if you filled the shallow pool with heavy clay, it might remain so moist that few plants would grow for lack of air. (We have nothing but sand here in Florida, so have never been able to try a clay soil.) Now the concept of air roots and water/nutrient roots in the earlier discussion on non-recirculating hydroponics becomes important. We want to design a medium that will encourage the growth of both.

There is an element of artistry involved in creating the medium. You need to create a medium with such large air spaces that no matter how much water is around, the roots will still find plenty of air, but dense enough that water in the pool can move up by capillary action and keep the medium moist. One way to achieve good aeration in the States is to include perlite in the medium. Perlite is a special inorganic material sold to make potting mixes very airy. One formula we frequently use is "Cornell mix." The Cornell mix contains 1/3 perlite, 1/3 peat moss and 1/3 vermiculite. In third world settings perlite is too expensive to consider. There are several alternatives.

If you have compost or any mix that has a lot of small air spaces, it may work well with most plants. A good way to create air spaces is to incorporate small particles of either organic or inorganic material. We have found that it works well to have a bottom layer of inorganic material (that will not decay)

in the pool itself (sand, small gravel, small pieces of lightweight volcanic rock, cola cans with slits cut in the sides to allow roots to get inside) then to cover this with small pieces of fresh organic matter (pieces of coconut husk, corn cobs, rice hulls, weeds, wood chips). Finally we place a layer of compost on top. In such a mix, roots will always be able to find air even right at water level.

There is one other step in the above description that will improve performance. We have found that all these large air spaces can be so effective that there may be no connection left to pull water by capillary action up to the top of the bed. The result is that until new plants develop roots deep enough to reach the water and form water/nutrient roots, the beds must be hand-watered from above. This can be solved by including spaces where "columns" of compost extend clear into the base of the pool. Newly planted beds should probably still be supplemented with hand-watering until seedlings have a good start.

Why do we recommend using inorganic material in the pool itself? In our first version we did use all organic materials. The bed of pole beans did quite well-until the bottom material rotted and the level of the bed dropped. When this happened, many of the air roots ended up in standing water. As discussed above, this is harmful (even fatal) for the plant. With decay-

resistant materials like cans or coconut husk pieces extending above the water level, the bed can never sink into the pool.

"Appropriate technology" refers to technologies which are sustainable and affordable in your situation. The following two examples are given to encourage you to look for what might be available locally. An "appropriate technology" shallow pool garden in Florida can be made from the inexpensive plastic wading pools sold for children. Make drainage holes three inches up the sides. After a coat of redwood paint, they make attractive, circular raised bed gardens instantly. Place an empty one-gallon flower pot in the center on the bottom of the pool as a "monitoring well": a quick glance allows us to monitor the water level and judge when to add more. (Formerly we used a depth of one inch, but less frequent watering is needed with the deeper reservoir. Tree roots also managed to find the lower drainage holes and end up growing in the garden itself!) A ground-level shallow pool garden could be constructed with a rim of rocks, or even soil, covered with a sheet of plastic. If elevated, wooden boxes lined with plastic can be used. To keep costs to a minimum, the tire gardens constructed to retain a pool of water would seem to be the most durable and inexpensive.

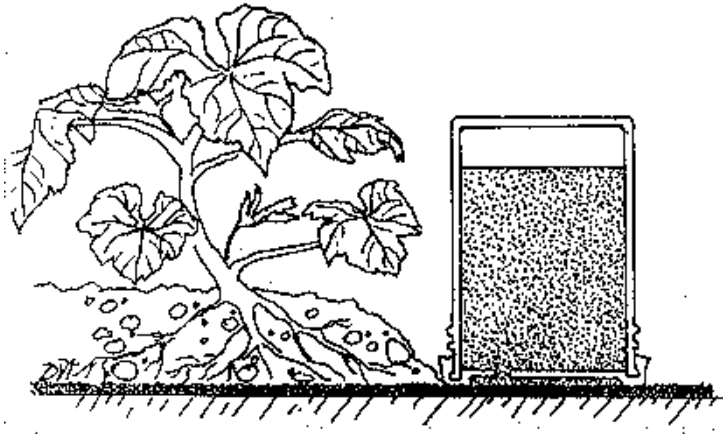
A variation of this technique, "appropriate" to Florida, that visitors find especially attractive, is what we call "eave trough gardens." The ends of an

eave trough (normally used to divert water as it runs off of a roof) are bent upward so it holds about a 1" pool of water. The trough is then filled with medium as in the shallow pool garden. Instead of a bucket one can use inverted glass or plastic bottles to extend the time between watering. This technique is useful only for small plants (unless a trellis and very frequent watering are used). Leaf lettuce, onions and kohlrabi do quite well, as does the flower called "impatiens."

In the Shallow Pool garden, the volume available for air roots seems to be a limiting factor for larger plants. Most larger vegetables only produce well with at least 3 inches of soil above the water level. (Okra is an exception. It seems to be very adaptable to and forgiving of any of these systems, even suspended just above the water in a pile of pine needles! When we finally pulled out the single okra plant in a 4 ft2 shallow pool we found a dense 1" thick mat of roots. See the picture two pages back.)

WICK GARDENS. Similar principles are involved in another innovation of the Lahrs in Haiti. Pieces of polyester cloth are laid out to the dimensions of the desired bed. Seedlings are transplanted into a deep bed of an airy material such as pine needles, as was done in the shallow pool system. The bottom of each root ball must touch the cloth. The 5-gallon bucket is placed upside-down (no stick to raise one side of the bucket this time) on a piece of cloth

extending from the side of the garden. I am not sure how air gets into the bucket. Apparently a seal develops between the lid and cloth and the space between them is filled with solution which "wicks" out and keeps the entire cloth-covered area drenched in nutrient solution.



watering shallow pool gardens

Polyester cloth is chosen rather than a natural fabric because it is slower to decompose. Natural materials such as wool or cotton are composed of building blocks common to many living organisms (amino acids or glucose respectively) and are readily attacked by a variety of microorganisms.

The cloth moves water within your bed as surely as a pipe might carry water to a garden. Just as you would chose a pipe that was large enough for the job, you should use the thickest cloth you can find. A very thin cloth that we used failed to transport enough water. Alternatively you can use more than one layer of cloth. After harvest you will find that there are two thin mats of roots, one covering the top surface of the cloth and one between the cloth and the cement.

The portion of rooftop used for a wick garden must be very nearly flat. If the slope is great enough to cause water to flow, it will continue flowing right off the edge of the cloth. If the slope is just a little too steep for either the wick or shallow pool techniques, we have had success by using a combination of the two. We made a cement rim along the lower edges of the garden only, then covered the entire area to be gardened with a cloth. Where the pool stops the water continues up grade to the rest of the garden because of wicking action. The bucket must be positioned at some point lower than the top edge of the rim, or the pool will overflow.

Capillary mats are sold through greenhouse supply catalogs. Commercial growers of bedding plants place the mat on a flat surface, keep it moistened with nutrient solution, and place pots with cuttings or seeds directly on the mat. (We purchased some of the material and compared it to polyester

cloth; we noticed no difference).

It is difficult to imagine a garden that is lighter in weight than a wick garden. When a shallow bed or shallow pool garden has been newly constructed out of undecayed organic matter, it is sometimes tricky to add just the right amount of fertilizer to provide for the needs of both the plants and the microorganisms that are turning the bed into compost. This is not a problem with the wick systems (the rate of decay of the fluffy pile of pine needles is not rapid enough to be much of a factor).

The most serious disadvantage is that the wick method is almost strictly a low-technology hydroponic system. As such, very complete hydroponic fertilizers must be used. This means that not only must the major nutrients (nitrogen, phosphorous and potassium) be supplied in the nutrient solution, but the two minor nutrients (calcium and magnesium) and important micronutrients (iron, manganese, zinc, boron, copper and molybdenum) as well. Other elements may be important to plants but are probably present in sufficiently high concentrations that they do not need to be added.

In some situations community development projects can readily obtain hydroponic fertilizers or the ingredients to mix their own. Making your own is technically not difficult, but could not be done by the average gardener. A

little hydroponic fertilizer goes a long way because, unlike field fertilizers, less inert fill is used in making soluble fertilizers. It is not unreasonable to import such fertilizers yourself as long as the project makes economic sense and a steady supply is assured.

Gardeners will fail if at any time an incomplete fertilizer is used in a system containing no or little organic matter. Let me share an example of our own. At one point we switched from a fertilizer shipped 2,000 miles by a hydroponics supply company to a fertilizer that could be purchased locally. The description led us to think it contained everything needed to maintain a soilless mix. The plants started out exceptionally well, then began wilting, leaves became discolored, roots failed to develop and many died. It turns out that the fertilizer contained every nutrient EXCEPT magnesium. The manufacturer apparently assumed that magnesium would have already been added to any soilless mix and that the fertilizer could "maintain" the mix without containing magnesium.

The precise demands placed on the fertilizers can be reduced by placing a very shallow layer of compost or potting mix on top of the wick. We have grown very nice lettuce, radishes and green onions using no more than an inch of such medium. The plants can obtain almost any micronutrient they need from the compost. It also provides extra space for root growth and

gives a bit more support to the plants.

During the rainy season, the wick method works better with something like pine needles that retains almost no moisture rather than dense materials like grass clippings. Peppers planted on a wick covered with 2" of packed grass clippings grew three times as fast near the bucket as those a foot farther away. We believe it is because the dense grass clippings held a considerable amount of water after each rain and so did not put any demand on the bucket for water (hence received no nutrients). This is less of a problem if compost or field fertilizer is spread across the wick and just water is in the bucket.

The bucket provides a sufficient reservoir of water that the garden should go for a day without attention. However, once the bucket is empty you are instantly out of water. (In contrast, a shallow bed may contain less water, but the plants run out more slowly as they must extract water from the medium with increasing difficulty.) In practice, I highly recommend that any of these gardens be tended daily, especially once the plants are bigger. Used plastic buckets can be purchased in Florida for a dollar or less from bakeries or paint stores. The price can be much higher in some locations. If the price is high in relation to a day's wage, it is not only more difficult for the poor to afford, it is in danger of theft.

TIRE GARDENS. I visited Doug VanHaitsma and his national colleagues in El Salvador to evaluate the potential of urban gardening in a low-income part of San Salvador. After seeing slides of all the methods that we have explored, everyone chose the tire gardens as most relevant for their needs.

tire garden construction

The tire gardens are the "jeep" of above-ground gardening methods: portable gardens that can literally go almost anywhere. The garden is made from an old tire and a small sheet of plastic film (e.g. a garbage bag). The group in El Salvador had fun moving a tire garden to unlikely places for a garden: on a flat rock, on a steep hillside supported on the downhill side with rocks, on the roots under a tree. If there is danger of theft or damage by chickens and goats, the tire can be placed on top of something, even along the edge of the tin roof of a shanty. (People often put pieces of iron on

this type of roof to keep it from blowing away because there is not enough framing to adequately secure the corrugated roofing, so a few gardens might not be a problem.)

If a vegetable needs full sun in the winter it can be set there, then gradually moved into the shade of a tree as the season approaches when the sun is overhead. If the garden is on a rooftop, it can be placed on sticks or stones so that air can circulate underneath, keeping the roof surface dry. If gardeners themselves have to move, they can take their gardens and their improved soil to their new home. When ECHO staff member Dan Holcombe (in picture) returned from his vacation to the church in Mexico City where he had a rooftop tire garden, he found it flourishing-on a different building. The church moved it to add a second story to their original building.

Construction is simple and elegant. Lay a tire flat on the ground. Note that the top rim is a mirror image of the bottom rim. With a knife or machete, cut off the top rim. Place a piece of plastic inside the tire on the bottom rim, large enough so that an inch or two of plastic stands up along the walls of the tire. Now turn the top rim that has been cut off upside down. It fits like a lock on the bottom rim, holding the plastic firmly in place. If the plastic is trimmed to near the bottom of the tire, the garden will essentially be a portable "shallow bed garden." If the plastic is left so that a pool of water is

formed, it will be more like the "shallow pool garden."

Any suitable soil, compost or potting mix can be used to fill the tire. You will need to judge when/if fertilizer is needed, based on what you use for a medium and how plants are growing. At ECHO we sometimes place an empty flower pot or a PVC pipe in the center so that we can see how much (if any) water is standing in the bottom and so judge when to water. We usually incorporate something with a lot of air space into the medium. This also helps extend the growing medium that is usually in short supply, and makes the garden much lighter. At ECHO we use cola cans with holes cut into the sides so roots can penetrate the can. In El Salvador coconut husks, which are everywhere, were broken up and incorporated. In Mexico City, Dan used a layer of alfalfa hay to provide initial aeration plus subsequent nutrients.

Urban agriculture resources

THE URBAN AGRICULTURE NETWORK has been active since 1993, and now has 3000 members in 40 (primarily developing) countries. Network staff wrote the book reviewed below. They have an information and technical referral service on UA, assist networking among groups who work in adjacent countries, sponsor regional workshops and newsletters, advise on UA policy, and support research of people doing graduate degrees related to

UA. They have an extensive library in Washington, D.C., which network members may use during a visit. Contact Jac Smit (President) at 1711 Lamont St., N.W., Washington, D.C. 20010, USA; phone 202/483- 8130; fax 202/986-6732; e-mail 72144.3446@compuserve.com; they are developing a web page.

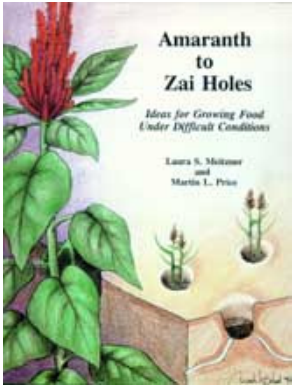
URBAN AGRICULTURE: FOOD, JOBS AND SUSTAINABLE CITIES (300 pp., from the Urban Agriculture Network and the United Nations Development Programme) examines factors which influence urban food production systems (including animals) worldwide. This is the most comprehensive resource we have seen on the topic. One of the authors set out to promote urban agriculture, but soon realized that documenting existing activities would be a major task in itself. The book is researched thoroughly, includes many case studies and pictures, and gives helpful perspectives on the current status and potential of food and income production in the city. Topics include: history of urban agriculture (UA), different classes of urban farmers, spaces used for UA, organizations which influence UA, benefits, problems, constraints, and promoting urban agriculture through policy. The book presents a convincing case for urban food production.

Here are a few of the insights excerpted from the book to give you an idea for the variety of its content. As an operational rule of thumb, "urban" is

distinguished here as the agricultural product that gets to city markets or consumers the same day it is harvested. By the year 2000, 57% of the poor in developing countries will live in urban areas, up from about 33% in 1988. As many as 80% of the families in some smaller Asian and Siberian cities are engaged in agriculture. Hong Kong, the densest large city in the world, may produce within its boundaries two thirds of the poultry and close to half of the vegetables eaten by its citizens. Singapore is fully self-reliant in meat production. Recent migrants to the city have a difficult time putting together the resources necessary to grow and market their produce; they need time to adapt rural technologies to their new urban environment. The book is available from the UA Network above or UNDP, Urban Development Unit, DC1- 2080, One United Nations Plaza, New York, NY 10017, USA; fax 212/906-6471.

CITIES FEEDING PEOPLE: AN EXAMINATION OF URBAN AGRICULTURE IN EAST AFRICA (146 pp.) argues the case that urban food production should have a larger role in providing food for city dwellers. The book, published by IDRC in Canada, documents the extensive role of urban agriculture already practiced in East Africa, with detailed case studies from Tanzania, Uganda, Kenya, and Ethiopia. This study is insightful for people seeking to understand and promote food production in the cities. The book costs US$14.95 plus shipping from UNIPUB, 4611-F Assembly Drive, Lanham, MD

20706, USA; phone 800/274-4888 or 301/459-7666; fax 800/865-3450; e-mail query@kraus.com.



- 28 additional technical notes about tropical agriculture
- Principles of agroforestry
- Good nutrition on the small farm

18: What is ECHO?

PURPOSE.
ECHO is a nonprofit, interdenominational Christian organization which serves to strengthen the work of both missionaries and national churches as they reach out to those who are farming under difficult conditions. Our aim is "to prepare God's people for works of service, so that the body of Christ may be built up" (Ephesians 4:12). We also gladly help other individuals and groups who are doing similar work (e.g. national extension agents and scientists). ECHO does not send out workers; rather, we assist those who are already in the field by serving as a technical resource.

TECHNICAL INFORMATION AND EDN.
ECHO serves as a technical resource for people who help people grow food. Each week we receive 20-35 letters from around the world requesting information, seeds, or contacts in a particular field. Our library and files are used to answer your questions whenever we can; we may also refer you to

individuals, publications, or organizations that specialize in your area.

Our quarterly technical networking bulletin ECHO Development Notes (EDN) is available in English and Spanish. This network has grown from 35 people in 1981 to over 4000 people in 140 countries today. Recipients are agricultural development workers, missionaries, health workers, teachers, managers, scientists, and others who devote at least part of their time to helping small farmers make a living under difficult conditions. Martin Price wrote EDN from 1981 until Laura Meitzner joined as co-editor in January 1995. Updated indexes of EDN are available upon request. Back issues of EDN can be purchased (this book contains #1-51).

Your letters relating your experiences is one primary way we learn of new ideas to share with others through EDN. Though we are able to quote from only a small number of the letters we receive, you never know when something you say might be shared with others in our network. If for some reason you do not want to be quoted in EDN or if you wish to place any restrictions on ECHO referring to your work, please note this in large print at the top of each letter.

occasional EDN articles in their regular newsletters. Consider this a blanket authorization for such use. (For-profit users wanting to quote more than a few paragraphs or anyone wanting to regularly publish EDN in another language, please write for permission.) We do have two requirements for any use of our material. 1) Mention that the source is ECHO Development Notes, giving the date of publication and address. Be clear whether you are quoting directly or abstracting. 2) It is very important that you delete any reference to free seeds. We grow enough seed for our own network of development workers, but not for large numbers of people beyond that. There are so many farmers in the world that we limit our free seed distribution to people working with church and mission agencies or development, educational or research organizations. Others can purchase seed for $2.75 per packet, postage included. If you want to include offers of seed, contact us to see whether we might happen to have an extra large amount. We might give permission for another newsletter to extend our offer to their own network of development workers, or we might have enough to be able to sell you a modest quantity of seed to distribute.

SEEDS. We maintain a small seedbank with over 125 active accessions of hard-to-find plants with great promise for people growing their food under challenging environmental conditions. We specialize in tropical plants which are particularly hardy (to drought, heat, flooding, etc.) or valuable to

nutrition (high in particular nutrients). Write us for a current seed list. We do not carry common garden seeds available through commercial suppliers. See the chapter on Germplasm for details on ECHO's seedbank.

VIDEOS. We produce videos on technical subjects of interest to people in our network. This is "training" for you while you are serving in the field. We currently have series on tropical fruit crops, root crops, and urban gardening. Write for current information. Please indicate which video format you use: NTSC (N. America, Japan and parts of Asia, and wherever exported); PAL (UK, parts of N. Europe, Asia, and some anglophone African countries); and SECAM (France, eastern Europe, and some francophone African countries).

CREDIT CARD ORDERS. Most of ECHO's services providing seed and information are sent free-of-charge to our overseas network. However, there are times when payment is required, e.g., purchase of books or video tapes, phytosanitary inspections, third party purchases, etc. We will not accept any check that is not written for US funds and on a bank located in the USA (otherwise the bank charges are prohibitive). On the other hand, it is easy to accept payment via Master Card or Visa from anywhere in the world. So ECHO spent the $1,000 needed to purchase an EMS (Electronic Merchant System) allowing us to accept credit card orders. All we need from

you is a letter giving your Visa or Master Card number, the card's expiration date, and a note from you giving us authorization to charge on your account.

CONTACTING ECHO.

You may contact ECHO by letter, telephone, fax, or electronic mail. E-mail and fax provide us with almost instantaneous communication. However, always include your postal address on your fax or e-mail message. Occasionally when we try to reply to requests electronically, the messages are returned, leaving us no way to contact the individual. Also, ECHO cannot afford the high cost of responding by overseas fax. If you want an immediate reply by fax, please include a master/visa card number, expiration date and your signature authorizing us to bill the card for the overseas call. Otherwise be sure to include your address and we will reply by airmail. You may also access our technical information on our Web site, http://www.xc.org/echo.

VISITING ECHO.

We welcome you to visit us! Your visit benefits ECHO, and we value every opportunity to meet people in the ECHO network and learn more about your work. A few slides of your agricultural work would be welcome. You should plan about an hour for a tour and up to two hours for

conversation/consultation about your work. Arrange your visit as many weeks in advance as possible. (Members of the public who are not working overseas are also welcome to visit our farm for an informative tour. These tours are offered every Tuesday, Friday, Saturday at 10 A.M.) If you would like to study while here, plan on a day or several weeks. We do not have a formal program, but provide the opportunity and environment in which to learn, including our specialized library and demonstrations of new plants and techniques on our farm. Many key resources are for sale in our bookshop. This is open to those who are working (even a small amount of their time) with small farmers or urban gardeners or have firm plans to do so. If you only have a day to study, you will likely spend it jotting down notes about books you would like to obtain and photocopying items of interest. Most longer-term visitors spend mornings at hands-on projects around the farm with the interns and the afternoons studying. Write for more information. ECHO is in the middle of a popular area for tourism, particularly in the winter months (November-April) when the weather is very pleasant. Fort Myers has a major airport, served by many airlines, and is 3 hours by car from the Miami airport. Though we can meet you at the Fort Myers airport, there is no public transportation in our rural area. You may want to bring or rent a car if you wish to stay more than a few days. If you need a time of "technical refreshment," plan a visit.

ANNUAL AGRICULTURAL MISSIONS CONFERENCE. This conference, begun in 1994, is open to anyone doing or preparing to do agricultural development work in a third world setting. It is held around the beginning of November every year. This is a time for people from around the world to get together for networking, learning from several keynote speakers and other people in the field, attending workshops on the farm, and using our library. Many conference delegates really appreciate the opportunity to exchange experiences with other people who do similar work and understand the challenges. Watch EDN for conference announcements, or write to receive information about the next one.

SOME THINGS ECHO DOES NOT DO.
We sometimes receive requests for things which we cannot do. It will save us needless correspondence if you read this section carefully. We do not: offer money to carry out any project or cover any travel expenses; suggest contacts to find funding; help in locating a place to study or provide scholarships; arrange schedules, write supporting letters to an embassy, make contacts or help in any other way in conjunction with a visit to this country; or give away anything that has not been mentioned as free in EDN.

We do not provide seeds for farmers' gardens. What we do offer is a single packet of seed for a plant new to your area, not readily available through

seed catalogs, for you to try on an experimental basis. You can save your own seed after that, if the plant does well, and never be dependent on anyone for that seed again. (Please do not write for a supply of common temperate vegetable seeds.) There are so many millions of farmers in the world, it is obvious that our small organization cannot help them all directly. We must channel our help through people like you who work with organizations that in turn help peasant farmers or urban gardeners. Please do not give our address to private farmers. If you need help in answering their questions, please write us yourself.

INTERNS.

Each year we hire six recent college graduates as interns (plus one special internship in public relations/non-profit organization management). They must have a strong Christian commitment and a desire to work with small farmers or urban gardeners in the third world, as it is a training opportunity for them. The interns have major responsibilities for operation of the seedbank and farm. Only U.S. citizens or others with papers authorizing them to work in the U.S. can be considered, unless an overseas sponsor handles all financial details. Interns are given housing and paid a modest salary. After their year on ECHO's farm, they have a three-month overseas experience, usually in Haiti. After that, many continue on to graduate school, while others take positions with agricultural missions or development

organizations. Let us know if you have job openings which could be filled by a graduated intern.

ECHO'S FARM.

ECHO is located on a 12.5-acre demonstration farm, which features many of the plants and several technologies you read about in EDN. The farm is used as a teaching tool, for seed production, and in explaining to visitors some of the challenges faced in food production overseas and the work of ECHO. Of our four greenhouses, one is reserved for seed testing and plant propagation, one houses plants which require trellises, one simulates a "rain forest" climate and plants, while the other is a model "semi-arid" greenhouse, used to grow some of the plants adapted to very dry conditions. We have several kinds of animals- usually a few sheep, goats, bees, rabbits, chickens, ducks, and occasionally quail, guinea pigs, a pig, or a water buffalo. There are demonstrations on aquaculture, rooftop gardening, and various planting systems. Most of the plants in ECHO's seed catalog are grown on the farm at some point during the year.

ECHO is located about 30 minutes from the coast of southwest Florida. We receive almost daily rainfall and thunderstorms through the hot, humid summer months, and flooding can be a severe problem. Winters provide a beautiful temperate growing season, but occasional frosts or freezes require

us to watch the weather reports closely and protect the sensitive tropical plants on cold nights. Our soil is basically sand, and we have serious problems with nematodes. Growing food in Florida's variable climate and poor soils is excellent training for the conditions the interns may encounter when they go overseas.

OUR FUNDING.
ECHO is supported entirely by donations and an occasional grant. Our annual budget in 1996 was around US$500,000. We do not ask or expect donations from the EDN network, though we have appreciated it when some have included ECHO in their giving. [Note: ECHO cannot provide funding to other organizations.]

SPECIAL INTERESTS.
ECHO would like to collaborate closely with groups seriously interested in urban gardening. Acres of "land" are represented by flat rooftops in tropical cities. Gardens can be on the rooftops of institutions, such as schools or orphanages, or homes. Something with so much potential is worth considerable effort to find a way around any technical, social and economic problems. If you might be interested, send a note describing your urban ministry and we can correspond from there. Also let us know if you are planning a Small Farm Resource Development Project. We always appreciate

hearing from you about your implementation and adaptation of ideas written in this book and future issues of EDN.

A BRIEF HISTORY OF ECHO (BY MARTIN PRICE).
ECHO began its current ministries humbly in 1981, staffed by myself, my wife Bonnie (as a volunteer), one intern, and sometimes a few faithful volunteers. Every question answered or receipt acknowledged was done personally by myself on a typewriter. In 1996 we have 9 permanent staff members and 7 interns. Volunteers donate over 9000 hours of time each year. Office work is facilitated by 11 computers. All these people and resources are here to serve you in the name of Christ as you serve others.

Soon our tiny overseas network began sending in technical questions. To help with answering, twice a week Bonnie would take a stack of books to a store six miles away to photocopy the pages I had selected. When the ministry was new, we were unsure what the need overseas would be. I remember calling my intern during our first vacation to see whether any overseas mail had arrived. At first we received perhaps 20 letters a month. Now we regularly receive 20-35 letters from around the world each week, and one staff member spends most of his time answering the requests.

The occasional visitors who came by for a tour sat around our kitchen table

to see our first slide presentation projected onto the freezer door. We called it the "appropriate technology projection screen." Now ECHO has become something of a tourist attraction and is also in demand for school tours. In 1995, over 6000 visitors took our educational tours. Visitors now view a slide program in our bookstore/visitor reception center.

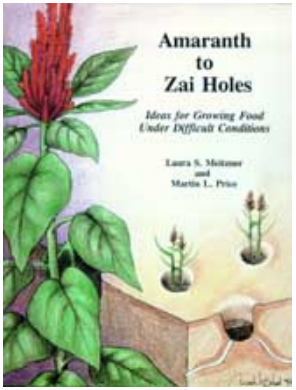
Some years we lost most of our tropical plants to "unexpected" freezes. The most important and sensitive plants are now protected in 4 greenhouses, and a new irrigation and freeze protection system will allow us to plant tropical trees in areas which suffered regular cold damage without protection.

After our first year, one missionary asked if he could spend a few weeks at ECHO studying before going overseas. Now we have seen folks stopping by for a day, a week or even for several months of hands-on study on the farm in preparation for their work in many of the 140 countries in ECHO's network. A special benefit for those who work at ECHO is that we have gotten to know and now count as friends so many of you.

God has greatly blessed our first fifteen years. Now we are evaluating ways to be of even greater service to you in the coming years. We have several ideas. However, we are determined to not jeopardize the quality of our

present set of services in order to add new ones. Our annual agricultural missions conference, a missionary-in- residence program (in which someone from the field stays at ECHO for a month or more while on furlough to assist in a special project and mentor the interns), launching a collaborative initiative with Living Water International as an aquaculture resource, and making our technical information electronically accessible are recent areas of expansion. We appreciate your feedback on how we are currently serving you, and how our assistance may be improved.

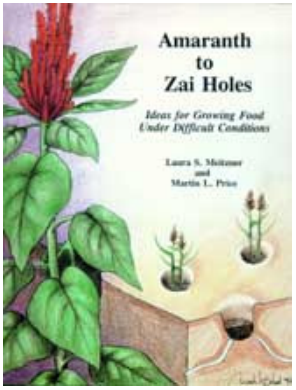
ECHO only has an impact on the world as we are able in some way, great or small, to help you to have a more effective outreach. ECHO's staff and Board of Trustees is committed to do all that we can, with God's help, to help you to be an even greater blessing to a hurting world.



Additional ECHO publications

Home-immediately access 800+ free online publications. Download CD3WD (680 Megabytes) and distribute it to the 3rd World. CD3WD is a 3rd World Development private-sector initiative, mastered by Software Developer Alex Weir and hosted by GNUveau_Networks (From globally distributed

organizations, to supercomputers, to a small home server, if it's Linux, we know it.)ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



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    - Tropical high-altitude growing conditions
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    - Neem seed shelf life
    - How toxic is the herbicide 2,4-d?
    - The nitrogen fixing tree association
    - Seeds for the americas
    - Home-grown beans produce less gas
    - Announcements from echo
    - Echoes from our network
    - Upcoming events
    - Books and other resources

Amaranth to Zai Holes, Ideas for Growing Food under Difficult Conditions (ECHO, 1996, 397 p.)

ECHO development notes - issue 52

Echo Development Notes
Issue 52, April 1996

Edited By Martin L. Price And Laura S. Meitzner

In memoriam Scott Sherman, age 36

ECHO and Scott's family were dealt a severe blow on January 10 when Scott, ECHO's Assistant Director, died unexpectedly after a brief illness. He is survived by his wife Kelly (formerly ECHO's Director of Public Relations), a two-year-old son Levi, a baby girl Hosanna Joy born in March, and his parents and sister.

Many in our network either knew Scott or corresponded with him. For the last eight years he spent over half of his work time answering the technical questions that arrive daily. He was unique in being able to spend hours at the computer writing careful replies to inquiries, or in the library or on the phone researching answers to difficult questions.

How will his death affect ECHO's ministry? He was exceptional at organizing information. A common phrase around ECHO was "Ask Scott." He would either know the answer or have it for us in a few minutes from his incredible computer databases. This trait has made the transition much easier than might be expected as we learn how to locate and use all the things he had on computer.

ECHO's 1995 Five Year Plan emphasized cross-training so that there would be no essential function at ECHO that only one person knew how to do. This has served us well in the face of this tragedy-and will be emphasized even more in the future. ECHO's technical writer, Laura Meitzner; nursery manager, Peggy Kemna; and Scott's assistant, Dan Sonke, have ably taken up the assignment of answering your inquiries.

So keep them coming. We know from Jesus' words in the Bible (John 5:24) "Most assuredly I say to you, whoever hears my word and believes in Him who sent me has everlasting life. He shall not come into judgment but has passed from death into life." Scott heard, believed, and worked harder than most of us to make his life like that of Christ. So our grief is moderated by the knowledge that he is now with the Lord. Return to INDEX.

Tropical high-altitude growing conditions

seem quite similar to the temperate-zone summer growing season. North American workers in the lowland tropics expect to "relearn" agriculture in their new settings, since the climates and crops of the lowland tropics are so different from temperate regions. But at higher elevations in the tropics, where cooler temperatures favor Brassicas, apples, and other familiar "temperate" plants over "tropical" crops, they feel right at home-but should they? We asked our network to identify unique factors in growing food at high altitudes in the tropics.

Latitude (distance from the equator) is very important when discussing altitude (height above sea level). While "high elevation" crops may be found at 1500 m in Central America at 15°N, the same plants may start growing at a much higher altitude in Ecuador at 0° latitude. You must adjust for your latitude when reading "altitude limitations" given for plants, such as tree species recommended for reforestation in a certain area.

Microclimates and climatic instability are very important aspects of growing food in the highlands. The complex ecological mosaic of mountain ranges and valleys determines wind and rain patterns, leads to marked temperature differences within a small area, and creates many microclimates which farmers can identify and use in their planning. The topography also produces wide variation in soil type and fertility and phenomena such as localized

frost pockets. Paul Bueker in Ecuador writes that "microclimates are somewhat unstable over time. Rainy and dry seasons, hail, frost, and pest cycles are harder to predict than in temperate climates. There is an extra degree of randomness in the growing conditions and therefore less certainty for agricultural investment. The variations are not extreme, but they are sufficient to cause real problems in agriculture." Farmers in the Andean highlands cope with this variability and uncertainty by staggering plantings through time, planting in several plots at different altitudes, and maintaining a diversity of crops.

Alfredo Petrov works with gardening and reforestation in Bolivia between 2700 m and 4100 m (at about 18°S). "At high altitudes, our sunlight is extremely intense: the atmosphere is thinner and so absorbs less of the shorter wavelengths like UV, and the sun angle is higher [than in the temperate zone], resulting in less shade, higher soil surface temperatures, and more evaporation. The intense sunlight is not a problem in temperate lowlands, regardless of temperature. The sun is great for solar energy, but young seedlings can get fried by the burning light. Two things that help combat this are artificial semi-shade and walls or thick hedges to reduce wind and evaporation. We use a black net for partial shade in our tree nurseries; results were poor before we started using this. Even native tree seedlings in the wild have a much higher mortality out in the open than in

the shade of their mother tree. It was found in the high-altitude deserts of California and Arizona that the most important factor in growth of cultivated plants is walls for wind protection."

Intense sunlight and other climatic factors can result in extreme weathering of exposed soils in the highlands. Bare soil at high altitudes can quickly lose its fertility. Hillside fields are also particularly vulnerable to erosion, and heavy rains and strong winds can quickly carry the soil off a slope. Soil protection and conservation techniques, such as creating living barriers along contour lines or planting trees, may be priorities in mountainous areas. Windbreaks and soil cover are more critical in the tropics than in temperate areas which have snow cover for several months of the year.

Many workers new to the tropical highlands are thrilled to discover a very pleasant climate with temperatures that could produce food year-round (with sufficient water, which is often a seasonal problem). They discover that crop yields are not directly comparable to temperate areas. Short days result in less photosynthesis, and together with the relatively low average temperatures, the same crops may take much longer to mature at high elevations in the tropics than in temperate areas. Alfredo Petrov notes that vegetables do not reach the sizes they do at higher latitudes, even with optimal fertilizer and watering. (At the other extreme, huge vegetables are

grown in Alaska.)

Some crops require long or short days to flower, so plants must be selected for their adaptation to tropical daylengths and grown in the proper window for seed production. Plants which can flower regardless of the hours of light are called 'day-neutral,' such as tomatoes, peppers, eggplants, sweet peas, artichokes, and most cucurbits. Photoperiod-sensitive plants are classified as long-day or short-day. Long-day plants are those which flower at some time during the long days (in reality, short nights), including spinach, sugar beets, radishes, Chinese cabbage, and most onions and carrots of temperate origin. Short-day plants only flower and set seed during short days. Examples include pigeon peas, chayote, roselle, amaranth, jcama, and most winged beans. (Daylength also affects plant growth responses other than flowering. For example, short days favor root and tuber growth in many tropical crops: white and sweet potatoes, taro, yam, jcama, Jerusalem artichoke, and cassava.)

In addition, many temperate plants are not adapted to the daily temperature extremes common in the highlands. Alfredo Petrov tells of a treeless Bolivian village at 4000 m in which a Canadian student initiated a tree-planting project. Since winter night temperatures sink to -20° C in that area, the student tested Siberian elm trees, which withstand temperatures

even lower than -20° C in their native range. However, the village's temperature usually reaches +20° C by 11 AM. All the trees died, perhaps due to the temperature fluctuations which never allowed them to go dormant.

Many traditional highland foods, such as quinoa in the Andes and buckwheat in Asia, are well adapted to high altitude conditions and are exceptionally nutritious. However, the temperatures may simply be too cold at very high altitudes to grow the variety and quantity of foods needed for optimal nutrition. In addressing the cold limitations, Food for the Hungry-Bolivia has had great success with mini-greenhouses in the highlands at 3000-4200 m. Greenhouses enable people to grow vegetables and other crops under plastic where previously there was little food production, despite the abundant sunlight. In Ecuador at 2900 m, I [LSM] found that the biointensive vegetable gardens, which were planted in beds filled 1 m deep with undecomposed organic material, did not show the frost damage evident in adjacent gardens planted in normal soil. The heat generated by the 'composting' in the beds apparently protected the plants from cold damage.

Most highland crops do not thrive in ECHO's climate, so we do not specialize in crops suitable for cooler, highland areas. A university in a highland zone may provide good information on plants adapted to your conditions. At

present, we do not know of any one organization which connects people working in highland agriculture worldwide, although there are many interested individuals. ECHO is building a list of resource groups for people working in highland regions; if you work in the mountains, please write us with information about your organization and services.

The seed company High Altitude Gardens (P.O. Box 1048, Hailey, ID 83333, USA; phone 208/788-4363; fax 208/788-3452; e-mail higarden@micron.net) specializes in frost-tolerant, quick-maturing varieties which do well in cold climates. Their catalog ($3) lists over 300 varieties of vegetables, plus herbs, wildflowers, and grasses. The cover crops resource CIDICCO has a bulletin on "Using Legumes in Traditional High Altitude Farming Systems" (US$1.50). Write them with your experiences and ask for a publications list: CIDICCO, Aptdo. Postal 4443, Tegucigalpa, MDC, HONDURAS; fax 504/39-9896; e-mail cidicco@nicarao.apc.org. The catalog of the Kenya Forestry Seed Centre (Kari, P.O. Box 74, Kikuyu, KENYA) has an exceptional listing of tree species categorized by their suitability in various climate zones; contact them or ECHO for a copy of their seed list.

A great introduction to crops adapted to the highlands is Lost Crops of the Incas (EDN 29-1). It is out of print, but is being reproduced, with color photocopies of its excellent pictures, from Craig at Redwood City Seed Co.,

Box 361, Redwood City, CA 94064, USA. Cost is $40 including surface mail. For airmail add: Americas, $12; Europe, $16; Pacific Rim, $20. His home page is http://www.Batnet.Com/rwc-feed/. Return to INDEX.

Portable gardens made from old tires.

We have hardly mentioned rooftop/above-ground gardening since EDN 30, but activity has continued in this area both at ECHO and a few other locations. Last summer a large garden was grown on the roof of the main prison in St. Petersburg, Russia, and 18 other rooftops there had gardens ranging from small to substantial. We are exchanging weekly e-mail messages with a group in Moscow that expects to begin work this summer.

I [MLP] recently visited Doug Van Haitsma and his national colleagues in El Salvador to evaluate the potential of urban gardening in a low-income part of San Salvador. After seeing slides of all the methods mentioned in EDN as well as tire gardens, everyone chose the tire gardens as most relevant for their needs. I share their enthusiasm. (The method seems to have been developed or at least promoted by a United Nations project).

Portable gardens that can literally go almost anywhere are made from old tires and a small sheet of plastic film (e.g. garbage bag). The group in El

Salvador had fun moving a tire garden to unlikely places for a garden: on a flat rock, on a steep hillside supported on the downhill side with rocks, on the roots under a tree. If there is danger of theft or damage by chickens and goats, the tire can be placed on top of something, even along the edge of the tin roof of a shanty. (People often put pieces of iron on this type of roof to keep it from blowing away because there is not enough framing to adequately secure the corrugated roofing, so one or two gardens might not be a problem.)

If a vegetable needs full sun in the winter it can be set there, then gradually moved into the shade of a tree as the season approaches when the sun is overhead. If the garden is on a rooftop, it can be placed on sticks or stones so that air can circulate underneath, keeping the roof surface dry. If gardeners themselves have to move, they can take their gardens and the improved soil they contain to their new home. When ECHO staff member Dan Holcombe (see picture) returned from vacation to the church in Mexico City where he had a rooftop tire garden, he found it flourishing-on a different building. The church moved it to add a second story to the original building.

Construction is simple and elegant. Lay a tire flat on the ground. Note that the top rim is a mirror image of the bottom rim. With a knife or machete,

cut off the top rim. Place a piece of plastic inside the tire on the bottom rim, large enough so that an inch or two of plastic stands up along the walls of the tire. Now turn the top rim that has been cut off upside down. It fits like a lock on the bottom rim, holding the plastic firmly in place.

Any suitable soil, compost or potting mix can be used to fill the tire. You will need to judge when/if fertilizer is needed, based on what you use for a medium and how plants are growing. At ECHO we sometimes place an empty flower pot or a PVC pipe in the center so that we can see how much (if any) water is standing in the bottom and so judge when to water. We usually incorporate something with a lot of air space into the medium. This helps extend the growing medium that is usually in short supply, and makes the garden much lighter. At ECHO we use cola cans with holes cut into the sides so roots can penetrate the can. In El Salvador coconut husks, which are everywhere, were broken up and incorporated. In Mexico City, Dan used a layer of alfalfa hay to provide initial aeration plus subsequent nutrients. Return to INDEX.

Neem seed shelf life

is generally very low; seeds may not germinate after 3-4 weeks in storage. The Green Gold International seed company (EDN 51-3) recently wrote us of

their method for extending the viability of neem seed. "As you know, neem seeds lose their viability quickly if they are swept from the floor. We collect the seeds right from the tree which maintains better seed keeping quality. ...The shelf life of the neem seed can be improved if green drupes with slight yellow tinge are collected right from the tree, depulped quickly through running water, dried slowly in the shade, then stored at low temperature (4°C) after treating with fungicide. In this way the seed life can be improved up to 7-8 months." Return to INDEX.

How toxic is the herbicide 2,4-d?

[Abstracted from HortIdeas February 1996].

This is the most widely used herbicide in the world and the third most widely used in the USA. The US Environmental Protection Agency has required that it be re-registered to assure its safety. Several years ago I [MLP] spent a summer in laboratory research on 2,4-D. People were not yet so conscious of delayed injury from chemicals, so I often had it on my hands. When I heard that the EPA was taking a new look, I recalled that time with concern.

After completion of nearly all of the more than 200 studies required for re-registration, members of the pesticide industry task force presented results

in a symposium. "None of the studies suggest that the chemical poses any significant risk when used properly." Various experts reported the following: when ingested orally [eaten] it is less toxic than caffeine and about as toxic as aspirin; it has low reproductive toxicity; it does not cause birth defects or genetic damage; it has low potential for damaging the central nervous system; there is little risk of exposure from eating crops treated with the herbicide; it rapidly degrades into non-toxic materials in the soil; it is improbable that it is carcinogenic.

For those not familiar with 2,4-D, it mimics a plant growth hormone, causing uncontrolled growth and curling, leading to death after several days. Grasses are not affected because they contain an enzyme that destroys the herbicide, but most broad-leafed plants are killed. Return to INDEX.

The nitrogen fixing tree association

is now part of the FACT Net (Forest, Farm, and Community Tree Network). Their publication formats will remain the same but will now cover both N-fixing and non-N-fixing multipurpose tree species. You can still address all your questions on various species and tree management to their "global extension service." They are one of the best resources for selecting, planting, and maintaining trees. To join the FACT Net, request publications,

or present technical questions, write FACT Net, Winrock International, 38 Winrock Dr., Morrilton, AR 72110-9537; phone 501/727-5435; fax 501/727-5417;

Seeds for the americas

sends garden seeds to participating agencies throughout Latin America and the Caribbean. End users might include needy individual families, orphanages, schools, churches, 4H clubs, community groups, prisons, etc. One unit of 1,400 packets of seeds normally include 12 kinds of vegetable and two kinds of flower seeds for each garden, packed 100 packets of each seed per bag. The quality of the seed is checked by Mississippi State University before packing. They charge 3¢ per package to help defray costs.

I asked whether seeds were selected for various micro-climates. "The seed we distribute is very well received, but has not been tested in all the microclimates in which they may be used. In many cases the varieties/hybrids are superior to what is available locally. Seeds distributed in the program are for vegetables that are normally grown and have proven successful in many places in Latin America and the Caribbean."

If your organization is interested, contact John Batcha for further details:

4947 Foxbriar Trail, Charlotte, NC 28269, USA; phone/fax 704/597-7789; e-mail GGFG89A@ prodigy.com. Please do not write if you do not work in Latin America or the Caribbean. Return to INDEX.

Home-grown beans produce less gas

The November 1995 Organic Gardening quoted Dr. George Hosfield, a dry bean researcher with the USDA. "Despite being dried and stored, the beans you grow in your own garden are fresh. Store-bought beans are anywhere from 6 months to a year older than homegrown. As those beans age they get harder. Hardened beans are less likely to soak up water and soften when cooked. The result is starch that doesn't cook no matter how long you leave your beans on the stove. The starch goes through your stomach undigested, passes into the large intestine and [produces] gas." He suggests storing the beans in as ideal conditions as possible, namely "a dark place where the temperature [in degrees F] and [percent] humidity added together are less than 100." [Ed: This is the same formula often used for seedbank conditions.]

"As further insurance against flatulence [gas], soak your beans overnight before cooking them and discard the water. Then when you cook them, make sure the water temperature gets up to at least 200°F. If you don't eat

beans regularly, gradually introduce them into your diet. Eating small amounts of beans frequently, rather than a lot of them once a month, also helps minimize [gas]." Return to INDEX.

Announcements from echo

E-MAIL AND FAX provide us with almost instantaneous communication these days. We have been receiving many requests by these methods. However, always include your postal address on your fax or e-mail message. Recently we tried to reply to several requests electronically, but the messages were returned, leaving us no way to contact the individual. Also, ECHO cannot afford the high cost of responding by overseas fax.

Note our new e-mail number, ECHO@xc.org. (This is a "cross-connect" account with Missionary Aviation Fellowship. Its purpose is to provide a constant address from which e-mail is forwarded to whatever address you give. It could even follow you from country to country if you do a lot of travel. ECHO still uses the old Compuserve number, but we don't want to commit to it forever. ECHO@xc.org will always deliver to whatever internet access company we happen to be using. The cost is $40 per year. Contact them at helpdesk@xc.org).

ECHO is placing all of our technical publications on the World Wide Web (http://www.xc.org/echo). Though not yet completed, our web site is active and already contains much material. Many of you cannot access the Web because it requires a direct connection to the internet. We just learned that there is a way to retrieve documents from the Web using regular e-mail.

If you already have some familiarity with the Web and would like to try it, you should get a file called "Doctor Bob's Guide to Offline Internet Access" which will give details. Retrieve this file by sending an e-mail to one of the addresses below:

In the Americas: mail-server@rtfm.mit.edu
Enter only this line in the BODY of the note:
send usenet/news.answers/internet-services/access-via-email

In Europe and Asia: mailbase@mailbase.ac.uk
Enter only this line in the BODY of the note:
send lis-iis e-access-inet.txt
Return to INDEX.

Echoes from our network

Joel Matthews in Niger sent a photo of a pigeon pea he had received from

ECHO two years ago. "The short-duration pigeon pea (#89-077) has done quite well. We are continuing to experiment with this variety as an intercrop with millet. The local pigeon peas take too long to mature for use as a rain-fed crop." The picture shows a plant only 3 months old with a lot of flowers and many full pods. Joel planted it in July with no inoculant. Thanks for the good report!

Mike Salomons with the Mennonite Central Committee in Zaire sent us his seed trial report form. The tropical onions (see EDN 39-1) have attracted a lot of interest when two varieties produced good bulbs, but local seed supply is a problem in his area. Of the two sweet corn varieties from ECHO's seedbank ('Buhrow's White Desert Sweet' and 'Hawaiian Supersweet'): "A lot of the corn here is eaten fresh, so the advantages of these types are that they are ready a month or so before the field corn varieties, and they taste sweet. Local people were very surprised by how sweet it is, and lots have asked for seed to grow corn for their kids." [Both these sweet corn varieties are open-pollinated (not hybrids), so you may save and distribute your own seed.]

"Quinoa has attracted a lot of curiosity...'What is that?' People here eat a lot of leaves, so I think it may have potential for that, as well as for the seed. ...they seemed to produce very well. One problem was that quite a few seed

heads broke off because of the weight of the seeds. I could use more information on quinoa. When do you harvest it? How do you get rid of the saponins on a small-scale, village level? How do you cook and eat it?"

Let us address two issues he raises. First, the problem of local supply of onion seed. In EDN 39 we asked onion researcher Dr. Lesley Currah, "Under what conditions might a farmer be able to save his/her own onion seed?" She replied that it can be difficult. "You need a variety that will easily bolt (send up a flower stalk) the second year. You do not want any variety that bolts the first year because that trait would create havoc in your harvest. Select bulbs from the best onions and store until the next season. Timing then becomes important. If you plant too soon while daily temperatures are increasing they may go into bulbing mode and split rather than flower. Wait to plant the bulbs until the average daily temperatures have started decreasing. The stalk gets a lot of diseases so, unless it is very dry, you may need to spray a lot."

Now, the questions about quinoa. Saponins are bitter, toxic anti-nutritive substances which must be removed before cooking, or the food may be too bitter to eat. (The laboratory method of testing saponin content is to place 0.5 g quinoa grains in a 16 x 160 mm test tube with 5 ml distilled water. Cap the test tube and shake for 30 seconds. Allow to sit 30 minutes then

shake another 30 seconds. Saponins produce a foam on the surface of the water; 'sweet' quinoas will have very little if any foam, while 'bitter' varieties may have up to 8 cm of foam.)

Saponin elimination from traditional varieties involves washing the seedcoats, which contain most of the saponins. Grain can be washed 1:8 in water, sometimes with up to 20 changes of the soapy water. Grains are rubbed on a hard surface (rock, tile, etc.) with much water, but this can damage and lose many grains. Another method is putting grains in a cloth sack and agitating it in running water or placing the sack in a stream. Where available, grains can be put with water in a blender on medium speed, changing the water until the grains are no longer bitter. Mechanical 'dehullers' may also be used, such as barley dehullers or rice polishers.

Quinoa breeding has largely been focused on selecting "sweet" (low saponin) varieties, although these may suffer increased bird damage. ECHO now has seed of the new commercial variety 'Tunkahun' selected by INIAP for the highlands of Ecuador. The saponin content is so low (0.06%) that seeds need only a light rinse before cooking. It has large leaves, and it is recommended for 2200-3400 m at the equator (lower at higher latitudes), with 600-1200 mm rain/year. Development workers overseas may request a free packet of this variety; $2.50 to others.

According to an INIAP booklet, quinoa must be sown when the soil is very moist and harvested in the dry season when the plant turns yellow and/or loses its leaves and the grain resists pressure of the fingernail. Harvesting in the Andes is usually done manually with sickles, early in the morning (afternoon harvests drop more of the dried grains). If there is no danger of rain and birds are not a problem, the grain can be left in the field to dry, but many seeds may drop if plants are left in the field too long. If there is excess humidity when the grains are mature, they may germinate while still in the seedheads. Threshing is carried out by beating the seedheads, or using modified cereal threshers for very dry grain. After threshing, dry the grains in the sun.

Quinoa is usually cooked in soups or as with other cereals. It contains no gluten, so pure quinoa flour bread is not recommended, although it may be added (10-20%) to bread and other baked goods. A good cookbook of Andean crops with many quinoa recipes is available in Spanish from FAO-Chile (see EDN 47-7/8).

If you have had good success with your quinoa trials so far, Dr. John McCamant (at Sierra Blanca Associates, 2560 S. Jackson, Denver, CO 80210, USA) is a specialist in quinoa breeding and has a big quinoa collection from various regions in the Andes. He will share seed samples if

you would like to try a few more varieties. Return to INDEX.

Upcoming events

Aquaculture Workshop, November 15 and 16, 1996 at ECHO. An intensive two-day aquaculture workshop will be held immediately after ECHO's conference this fall. It will be taught by Living Waters International (LWI) staff, most of whom are professors at Auburn University's International Aquaculture Center. Details are still being arranged. It is being held right after the conference (at ECHO) to minimize travel costs for people wanting to attend both events.

Two additions to resource speakers at ECHO's Third Annual Agricultural Missions Conference (November 12-14, 1996) are Dr. Bryan Duncan, head of Auburn's International Aquaculture Center, and Dr. Uday Yadav, a specialist in using mycorrhizal fungi to obtain greater growth of trees in reforestation projects and to help get trees established in severely denuded areas.

Agricultural Missions Conference in Haiti. ECHO is making serious plans to sponsor a conference in Haiti sometime in the spring of 1997 to enhance networking among the many groups working in that country. The conference

language will be Creole with translation into English available. It will be held near Cap Haitien. We are gathering a list now of people who want to be kept informed of plans. Write "Haiti Conference" on the envelope. Registration limited to 150 people. Return to INDEX.

Books and other resources

LOST CROPS OF AFRICA. VOLUME 1: GRAINS (383 pp.)

is now available from ECHO! This is the newest in the National Academy of Sciences series on very promising but little-known or neglected species. Writing was funded by USAID. This inspiring volume (the first of three which are planned) discusses the potential of African grains for producing food and other products in Africa and around the world.

The series is "intended as a tool for economic development" among those who may promote these crops for local cultivation, develop markets for the grains, and explore the multiple uses of these species. The species discussed in this series were selected from nominations by people around the world (see EDN 29-3). The information given about the crops helps readers to understand and appreciate the unique value of each plant and evaluate its potential for a given area. There are also very insightful appendixes on

"potential breakthroughs" in some of the most pressing problems for development workers, including grain handling and child nutrition.

The species covered include: African rice, finger millet, fonio (acha), pearl millets, sorghums (subsistence, commercial, specialty, and fuel and utility types), tef, other cultivated grains (guinea millet, emmer, irregular barley, and Ethiopian oats), and wild grains. These plants offer much promise because they tolerate many extreme growing conditions and produce well with minimal inputs. They are generally nutritious and offer new flavors. They also offer other benefits; for example, the "fuel and utility sorghums" are used as firewood, liquid fuels, soil reclamation, wind erosion protection, weed control, crop support, fibers, brooms, and animal feeds. As with all the NAS books, further reading and many research contacts are given for each crop.

Noel Vietmeyer and Mark Dafforn with the National Research Council told us they can think of no group more likely to make use of this book than those of you in ECHO's network who work in Africa. So they will donate enough books to send you a free copy while our supply lasts. IF you are already a member of ECHO's overseas network working in any Third World country you may request one free copy of the book by writing clearly the address where the book is to be sent and enclosing postage if your work is not in

Africa.

For addresses in Africa only ECHO will pay surface postage. Readers in Western countries can purchase the book for $24.95 plus $4.00 surface postage and handling. For all others (and in Africa if you want airmail) please send appropriate postage: surface $4; airmail Latin America, $6.00; airmail Europe, $11.00; airmail Africa and Asia, $11.70. MasterCard and Visa or checks in US dollars written on a US bank are the only payments we can accept.

"INTRODUCTION TO TROPICAL ROOT CROPS" VIDEOS FROM ECHO.

(Reviewed by Dr. Al Gebben, retired professor of botany at Calvin College.) ECHO has produced two videotapes on tropical root and tuber crops featuring Dr. Frank Martin, a familiar name to ECHO's network as author of many of our technical notes. Dr. Martin is a retired research scientist in tropical crops, long associated with the USDA research station in Puerto Rico, and a frequent consultant to ECHO on a variety of technical questions. This new video series covers one of his specialties.

In Part I (35 minutes) of the series, Dr. Martin provides insights on the nutrition, agricultural origins, adaptations, propagation, growth rate to

maturity, seasonality, storability, processing, food values, and insect and disease problems of six categories of tropical root and tuber crops: potatoes, sweet potatoes, cassava, true yams, taro or dasheens, and tanias. Each category noted above is compared for the crop characteristics mentioned.

In Parts II-V, Dr. Martin gives detailed descriptions of individual root crops using live plant materials. He describes plant propagation and plant culture, frequently illustrating the techniques in the field. In addition, methods of food preparation are sometimes demonstrated in the kitchen. Food processing tips are included along with discussions of potential problems and methods of control for pests and diseases within the root crop category. In Part II (47 mins.), true yams are described. In Part III (38 mins., beginning the second videotape), he discusses corm-producing aroid species such as tanias, taros, eddoes and dasheens. Cassava constitutes Part IV (32 mins.), and sweet potatoes, Part V (43 mins.).

The nutritional value of most root crops is limited primarily to calorie-providers or "belly-fillers" in Dr. Martin's words. They frequently are the starch staples in tropical diets, much as the cereal grains are in temperate regions. Some provide additional benefits as sources of dietary fiber or as sources of vitamins A and C. Limited amounts of protein are contained in all of them; however, some like the potato and yams are much better sources

of protein than the others. Dr. Martin stresses that root crops by themselves are not a source of a complete diet, just as no single food crop, by itself, can be considered a source of a complete diet.

Tropical root crops are differently adapted to tropical climatic conditions. The white potato needs moderate rainfall in regions with cool nights and warm days. Sweet potatoes and cassava require a hot climate but need only moderate rainfall. Cassava is quite drought tolerant. Taro and tania root crops are very "thirsty." Taro often is grown in paddy culture but tania is normally grown in wet upland conditions.

Root crops also differ greatly in their growth rate to maturity. Whereas white potato may be harvested in 2-3 months, sweet potato requires 5 months in the tropics and up to 7 months in the temperate regions. Cassava commonly requires up to 18 months to maturity but early varieties may require only 10-12 months. Yams commonly require 8-11 months to maturity; taros and tannias 10 months to a year. Information on harvesting times is helpful in planning farming systems. The video series may help you define whether a new crop would be suited to your area, or to better understand common crops in your area that you may not know much about.

Dr. Al Gebben also prepared several excellent study helps to accompany the

video series, which will be sent with the video. Outlines and study questions guide you through each section, highlighting some main points of the material in the video. A few questions answered in the videos include: Which of the tropical root crops do not store well? How can you tell when yams are ready for harvest? What parts of the tannias are used for seed material? How should a dasheen corm be prepared for eating? What is tapioca, and how is it prepared? What other plants may harbor the sweet potato weevil?

You may purchase the Introduction to Tropical Root Crop video series from ECHO. The two-tape set costs US$32 in VHS/NTSC format (used in the USA), $50 in PAL or SECAM [specify which], plus postage. Postage is $5 in the Americas, $11 elsewhere.

MOVABLE CHICKEN HOUSING PLANS.

Dr. John Bishop (see EDN 50-1) wrote two technical notes on housing chickens in a "protected free-range" system. These houses give small farmers a relatively inexpensive alternative to fencing while protecting birds from predators and garden areas from free-range chickens. There are two documents: "Movable Henhouse with Free-Access Range Run for Single Sire Flock of 25" and "Movable Brooderhouse with Free-Access Range Run for

Natural Reproduction of 25 Chicks." Complete building instructions and diagrams are given for each range run. They use minimal housing materials and include wire-covered range areas, with a lift bar for moving to a new site. Plans for homemade feeders and waterers are also given. Available from Heifer Project Exchange, P.O. Box 808, Little Rock, AR 72203, USA.

TWO GUIDES TO APPROPRIATE EQUIPMENT.

It is important to have the right tool for the job. Tools for Agriculture (238 pp.), now in its fourth edition, can help you identify and find the most suitable tool for your situation. This is an unbelievable resource for anyone who uses agricultural equipment from plows and threshers to oil expellers, pumps, and shovels. Thought-provoking and informative chapters discuss various processes and equipment used in land preparation, sowing and fertilizing, pest control, harvesting, water lifting, livestock care, and beekeeping. The text will help you evaluate which technologies are suitable for your work and area. Then, many manufacturers (mostly in developing countries) are listed for the equipment. [In addition, the publishers maintain an agricultural tools database which is periodically updated. Specific, detailed questions on a wide range of technical matters may be directed to their Technical Enquiry Unit at ITDG, Myson House, Railway Terrace, Rugby CV21 3HT, UK; fax +44 -1788 540270; e-mail itdg@gn.apc.org.]

Small-Scale Food Processing (158 pp.) gives you information about and sources for the equipment needed for preserving and packaging products (including vegetable oils, baked goods, beverages, milk and meat products, and more). As an example, the chapter on fruit and vegetable products outlines basic production stages and equipment required for jams, marmalades, chutneys, sauces, and dried products. The "packing" stage refers you to an illustrated section on the back of the book which lists sources for various sealers in 12 countries. Half of the book is the directory; it includes sources (many in India and the UK) for slicers, hullers, mills, packaging equipment, and much more.

The books are available free from CTA only for nationals of the 70 ACP countries (most of Africa and the Caribbean, and several Pacific Island nations); write CTA, Postbus 380, 6700 AJ, Wageningen, Netherlands. Non-ACP nationals can order the books directly from Intermediate Technology Publications, 103-105 Southampton Row, London WC1B 4HH, UK; fax +44 171 436 2013, or in the US from Women, Ink., 777 United Nations Plaza, Third Floor, New York, NY 10017; fax 212/661-2704; each book costs £30 or US$58.50 plus postage. Ask for their catalogs for some of the best new books in development and technologies. Return to INDEX.

students). Persons working with small farmers or urban gardeners in the Third World should request an application for a free subscription. Issues #1-51 will soon be reprinted in an updated and expanded book form (see EDN 51-7). ECHO is a non-profit, Christian organization that helps you help the poor in the Third World to grow food.

ECHO DEVELOPMENT NOTES - ISSUE # 52
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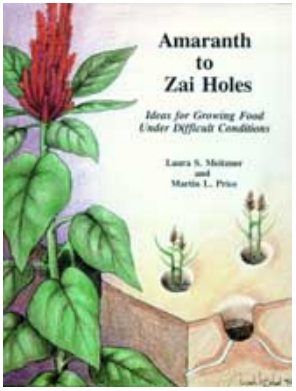

under Difficult Conditions (ECHO, 1996, 397 p.)

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  - Solar water disinfection
  - "Why don't my tomatoes set fruit?"
  - Insights from a biogas project.
  - Malnutrition and child mortality
  - List of distance learning courses is available from ECHO.
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Amaranth to Zai Holes, Ideas for Growing Food under Difficult

Conditions (ECHO, 1996, 397 p.)

ECHO development notes: issue 53

Echo Development Notes
Issue 53, July 1996
Edited By Martin L. Price and Laura S. Meitzner

Fifty-one issues of edn in one book!

ECHO Development Notes informs you about plants, resources, technologies, and contacts to improve food production in the tropics. We link a worldwide network of people so you can learn about and try ideas which have succeeded in other regions. Amaranth to Zai Holes: Ideas for Growing Food Under Difficult Conditions (404 pp.) is an updated and expanded compilation of the first fifty-one issues of EDN, from 1981 to January 1996. We hope this is a resource you cannot do without!

The articles are arranged by topic: Basics of agricultural development, Tropical vegetables and fruits, Staple Crops, Multipurpose trees, Farming Systems, Soil health, Water resources, Pest control, Animals, Food science, Human health, Seeds, Technologies, From farm to market, Training and missionary resources, Oil crops, and Above-ground gardening.

The chapters offer a combination of details on ideas you can try right now, some research questions, and key books and organizations. It is a handbook for choosing and testing new ideas, as well as a basic reference book to guide you to tropical plants suited to your climate, contacts specializing in each field, and sources for seed and equipment. The book gives you a head start on finding your own answers to a wide variety of questions.

We have worked hard to make it inviting for you to use: almost every page has an illustration, and a new index makes it easier to find the information you need. We updated articles and contacts, included our most-requested Technical Notes, and direct you to many of the resources we use at ECHO to answer your technical questions. Even if you have a backset of EDN, you will appreciate the current information and easy-to-use format.

We hope that most members of our network order a copy of Amaranth to Zai Holes. The book costs US$29.95 plus postage in North America, but there is a special discount for members of ECHO's overseas network. If you qualify for a free subscription to EDN, prices are as follows: in the Americas, US$25 includes airmail; in Europe, Africa, and Asia, $25 includes surface mail and $35 includes air mail. We accept only US dollars. Write a check to "ECHO" or give us your Mastercard/Visa number, and expiration date and signed authorization to charge your account. To order a large quantity, contact us

first for shipping details. This will be a great resource as you evaluate new ways to help people produce their food and make a living in the tropics. Return to Index.

Position announcement.

ECHO is adding a senior staff position in 1996 or 1997. The person chosen will have several years' experience in areas that will make him or her a great resource person for our network.

ECHO emphasizes the use of plants in agricultural development, but we have become a resource center for a broad range of issues faced by those working with small farmers. Consequently we need a core of people who are knowledgeable about many things and who have alert minds to filter all they hear and read for relevant ideas, techniques, information and seed sources to enrich the ministry of those in our network. In a few years we will probably have 3-4 technical people, each specializing in 1/3 to 1/4 of the areas of interest that ECHO covers.

The person chosen must have a devout Christian walk that can be a model for and earn respect from staff and interns; first-rate technical competence on a wide range of agricultural issues relevant to development and mission

work; perspective that comes from extensive experience; a teacher's heart, to mentor interns and students; "perceived stature" as a valued consultant so that members of ECHO's network will consider a visit to us even more valuable; be very approachable, apt to listen first, then share just the right things to meet the expressed need. Requirements include at least a bachelor's degree and US citizenship or permission already granted to work in the USA. If you are interested, write first for more details and an application. (E-mail version is available.) Return to Index.

The nutritive value of chaya, one of the most productive green vegetables

The nutritive value of chaya, one of the most productive green vegetables, was the subject of a recent question at ECHO. Many of you wrote for Moringa seed in response to the article on a leaf-based diet for pigs (EDN 51-1). Some asked, "Are there other plants which can be used in the same way?"

We immediately thought of chaya (Cnidoscolus chayamansa, EDN 18-2), an attractive perennial shrub native to Mexico which produces abundant quantities of large, dark green leaves. Chaya thrives on a wide range of soils in both hot, rainy climates and areas with occasional drought. It grows very

quickly, especially at higher temperatures, and resprouts well after harvesting. Young leaves and the thick, tender stem tips are cut and boiled as a spinach. It is a tasty vegetable, and is exceptionally high in protein, calcium, iron, and vitamin A. Chaya is virtually pest-free and has low weed potential, as it is propagated only by cuttings and does not generally produce seed. As a year-round source of high-quality food in a wide range of conditions, it is one of the most important plants at ECHO. [Important: many chaya varieties have stinging hairs which are very irritating during harvest. ECHO now distributes only a non-stinging variety, which we obtained from Belize about 10 years ago. If only the stinging ones are present in your area, you might wish to introduce this superior variety.]

If you request chaya from ECHO, we will send several stalks wrapped in paper; cuttings can survive for several weeks in the mail. Trim any blackened areas on the ends. Be sure to put the correct end in the ground, so the leaf scars look like smiles, not frowns. Chaya (especially a new cutting) prefers good drainage, but can survive some waterlogging. Since leaves are larger and more tender when grown in partial shade, many people like to plant chaya near a tree that provides light shade. Avoid contact with the irritating white, sticky sap when harvesting. Harvest often enough so the new shoots stay within arm's reach, or coppice the whole plant and allow for regrowth. You will quickly have sufficient stems to share.

For its great nutritional value, exceptional drought tolerance, and productivity, chaya would seem a logical choice for animal feed, in addition to its primary use as a vegetable for people. However, uncooked chaya contains hydrocyanic glucosides, which release hydrogen cyanide when eaten. The toxicity is eliminated after a few minutes of boiling. We wondered about its effect on animals, which would eat uncooked leaves.

We asked Dr. Ricardo Bressani, retired head of the Institute of Nutrition for Central America and Panama, about using dehydrated chaya leaves as a feed ingredient. "As far as I know, studies with pigs have not been conducted. Amaranth and many other leaves are used in pig feeding in many countries. Usually, leaves which are edible are consumed by pigs, but I have not seen pigs consume chaya which is often found as part of fences in rural areas, probably due to the toxins it contains. On the other hand, if it is processed and dried, it may be part of the feed, since antiphysiological factors are partially or totally destroyed. On the basis of the nutrient content of chaya leaves, it would be worth the effort to conduct more feeding trials with pigs."

Dr. Bressani directed us to the article "Chemical composition of chaya leaf meal (CLM) and availability of its amino acids to chicks" (Anim. Feed Sci. Tech., 30: 155-162). Chaya leaves were cut, air dried, and ground to

produce CLM, which can be stored in air-tight containers. The study found that CLM was high in calcium, iron, and had a moderately high availability of amino acids (which make up proteins), comparable to many tropical legume leaves. Overall availability was 84%, but CLM was low in the sulfur-bearing amino acids cystine (66.7%) and methionine (69.9%).

No anti-tryptic activity was detected in the CLM. (Trypsin is an enzyme which splits proteins in the process of digestion. Many uncooked plants contain substances that inactivate this enzyme.) The samples did contain hydrocyanic glucosides and oxalates. The former may account for the low availability of sulfur-containing amino acids, because the body uses sulfur in the process of detoxifying cyanide.

Perhaps we can gain a perspective by considering another plant that has cyanide-producing substances. Cassava leaves, which also contain these glucosides, are commonly dried and stored in Brazil. Cory Thede reported on their convenient use in soups (EDN 49-6). We asked David Kennedy with Leaf for Life for his perspective on using dried cassava leaves as a food, since cassava contains substances that produce hydrocyanic acid (HCN) when fresh leaves are eaten or pulverized. "HCN is a fairly common toxin in food. Cassava, lima beans, and sprouted sorghum have caused HCN poisonings. Acute [severe, sudden onset] HCN poisoning is quite rare. The

minimum lethal dose is estimated at 0.5-3.5 mg per kg of body weight. So a child weighing 20 kg would need to consume between 10 and 70 mg of HCN. Ten grams of a low-HCN variety of dried cassava leaf would contain something like 0.08 mg. Chronic toxicity (also quite rare) has been reported mainly where there is a great dependence on cassava and a very low protein intake. Damage to the nervous system and especially the optic nerve can be caused by chronic exposure to HCN. Low consumption of proteins, especially sulfur-bearing amino acids, cigarette smoking, and air pollution all intensify the body's negative reaction to HCN.

"One would be tempted to steer clear of cassava leaves altogether to avoid any toxicity problems, except that the plant has several important attributes as a leaf crop, yielding large quantities of leaf that is high in dry matter, protein, and micronutrients...throughout the year in most locations. ...People are currently eating cassava leaves as a vegetable in much of Africa, and parts of Asia, and Latin America. I think the question is not whether to eat cassava leaves, but rather how to. Encouraging the use of low-HCN varieties is critical to this effort. A grinding technique that ruptures cell walls will dramatically increase the rate and total amount of HCN that disperses into the air. It is important that the leaves be ground when fresh, and quite well pulped, not just shredded. The loss of HCN is very dramatic then during drying."

David Kennedy sent us a Ministry of Agriculture publication from Brazil which showed the following HCN content for one variety (Cigana) of cassava: fresh-737 ppm; flour from a leaf dried whole-123.89 ppm; flour from a shredded leaf-75.58 ppm; and 33.60 ppm when dried after thorough pulping (a 95% reduction). This report showed a lot of variation in HCN content based on variety and drying method (in the shade or an oven), but all varieties showed greater drops in HCN content with increased pulping. Leaves of the six varieties tested ranged from 48-123 ppm dried whole, 20-78 ppm when shredded, and 7-36 ppm when pulped.

We cannot say for certain that this data for cassava can be applied to chaya, but it may help you decide how these leaves may be used in animal feeds. We have not been able to find data on the HCN content of raw chaya [please let us know if any of the scientists in our network have tested this!]. Drying the leaves to any extent would almost certainly reduce HCN content, and cutting them first would be even better. If you decide to use significant amounts of chaya, you can be totally safe by boiling the leaves for a few minutes before feeding it to the pigs. Chaya definitely has potential as a source of cheap protein in poultry diets, although no optimal levels of inclusion are available at this point. (As a guideline, poultry specialist Dr. John Bishop recommends that a chicken's diet consist of no more than 5-10% leaf meal on a dry weight basis, since leaves are high in fiber with low

digestibility.) Start with small amounts, and let ECHO know the results if you use CLM in your feed mixes. Return to Index.

Solar water disinfection

can be used to reduce bacteria counts in small volumes of drinking water at the individual household level. The simple technique of putting water in plastic bags or other containers and exposing it to the sun for 2-6 hours inactivated up to 100% of the bacteria in contaminated water. Scientists at Brace Research Institute in Quebec, Canada have been working with solar water disinfection since 1988. Several of their recent research reports are summarized below.

It was found that near ultraviolet (UV) radiation of 300- 400 nm had a bactericidal effect apart from temperature: "water temperatures from 12-43C did not affect the inactivation of bacteria." The bactericidal effect of the radiation is affected by the turbidity of the water, the materials of the container, and the climate. Highly turbid and contaminated water is not easily disinfected by the sun, so it is best to settle and/or filter the water before putting it in the sun. On cloud cover: "The time for complete elimination of pathogenic bacteria was found to vary from 2 hours in hot arid areas to 5 hours in humid tropical regions or when clouds partly

obscured the sun." "An average solar intensity of about 600 W/m2 over 4-6 hours must be maintained in order to permit the complete elimination of all bacteria in a water sample." Obviously, best results can be achieved around midday when the sun is strongest.

What is the best container to use? Many tests have been done with various materials. In general, clear containers are better than tinted ones. Transparent plastic bottles and glass jars, while they may be used, have many formulations and they can give inconsistent results and may transmit poorly in the required UV range. The two best containers were transparent plastic bags (disinfecting "to a level of zero coliforms on almost all occasions when the water was exposed for 6 hours or more") and open metal (aluminum) pans. The advantages of the pans over plastic bags are their greater capacity and durability. Containers should be capped or sealed with thin plastic wrap (usually with UV transmission levels 90%) to prevent contamination, especially in dusty areas.

For more information and publications from the Brace Research Institute, contact the Publications Department, Faculty of Engineering, P.O. Box 900, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec, CANADA H9X 3V9 phone 1-514-398-7833 fax 1-514-398-7767 email AE12000@Musica.McGill.CA. Return to Index.

''Why don't my tomatoes set fruit?''

is a common question asked by gardeners from temperate climates who move to the tropics. A related question is, "Local markets only have cherry or plum type tomatoes. Can you send seed of a larger tomato?"

If you have a tomato plant that is healthy and flowering but not setting fruit, the reason is likely related to temperature. Both daytime highs and nighttime lows have a variety of effects on the ability of a tomato to set fruit. Cherry, plum, and other small tomatoes seem to be less adversely affected by these extremes, which is why those types are the ones in local markets. We had hoped to find clear-cut guidelines, but could not, so we will venture our own: If daytime temperatures are not less than 33C (92F) and nighttime temperatures less than 22C (72F), you may experience difficulty. If daytime temperatures are over 40C (104F) or nighttime temperatures over 26C (79F), you will almost surely have poor fruit set and possibly damaged fruit.

These are fine rules-of-thumb, but the reasons are too complex to be precise. Understanding some of the factors may help you find a solution.

Nighttime temperatures. These can be too low or too high. Night

temperatures that do not drop to at least 26C (78F) are clearly damaging to fruit set. Cultivars developed for early production in temperate regions are able to also set fruit earlier-when temperatures are low, some as low as 4.4C (40F). On the other hand, those developed for warm climates typically will not set fruit if temperatures fall below 10C (50F).

Pollen grains must germinate before the ovule can be fertilized. At 25C (77F) germination takes about an hour; at 10C (50F), 5 hours; at 5C (41F), 21 hours. Once it germinates, the pollen tube must grow until it reaches the ovule. Growth rate increases with temperature from 10-35C (50-95F), but is reduced outside that range. The ovule may deteriorate before it is fertilized.

High daytime temperatures. The anther must dehisce (burst open) before pollen grains can be released. This process is inhibited by temperatures that are too high. Over 35C (95F), the surfaces of both the pollen grain and the stigma may dry out, causing poor fruit set. The pollen germination rate increases with temperatures up to a point, but is inhibited over 37C (99F).

A high of 40C (104F) seems to be a critical point. Exposure to temperatures greater than this can damage both ovules and pollen production. E.g., if the ovule has been exposed to very high temperatures nine days before flowering, it can deteriorate. Once fertilized, the endosperm of the

developing seed can deteriorate over 40C (104F) for between 1-8 days after fertilization.

The difference between daytime highs and nighttime lows (diurnal variation). In regions and seasons where days are long, tomatoes are not productive unless the difference between day and night temperatures is at least 5.5 C (10 F). We have been told that a very high diurnal variation, as might occur in a desert or high in the mountains, can apparently overcome some of the above effects of high temperatures.

Fruits that do set at high temperatures are often so badly damaged or misshaped that they are not marketable. Red varieties may become more orange at higher temperatures. This is because synthesis of the red pigment, lycopene, is slowed at high temperature but the orange pigment, - carotene, continues to accumulate normally.

Heat-tolerant varieties have been developed which can extend the range a bit. Recent examples are 'Solar Set' and 'Heatwave' which are supposed to give improved fruit set at temperatures around 32-35C (low 90s F). Presumably tomatoes grown under shadecloth would be a little less damaged by heat.

[References: Vegetables: Characteristics, Production and Marketing by Lincoln Peirce, Wiley & Sons, 1987; The Tomato Crop, Atherton and Rudich, Chapman & Hall, 1988; personal conversation with Dr. Don Maynard, Florida Gulf Coast Research and Education Center.] Return to Index.

Insights from a biogas project.

Technical information is often much easier to obtain than perspective on its use. Rus Alit's discussion on biogas digesters in his newsletter Appropriate Technology (vol. 6, 1995) shows the value of perspective.

Biogas is produced by placing a slurry of animal manure in a closed container. Gas bubbles to the surface and is collected for cooking or lighting. Excess water, rich in nutrients released from the decaying manure, is directed towards gardens or fish ponds. It sounds wonderful-so why do we not see these inexpensive units everywhere?

Rus faced two problems in his village in Indonesia: lack of fuel for lighting and loose pigs that destroyed gardens and spread disease. "Obtaining methane gas is usually the main attraction ... unfortunately [in most cases] there is not enough manure to run the system...." Rus says that to get enough gas for cooking and lighting for a family, we need one cow or buffalo

or two mature pigs PER PERSON. So a family of five would need 10 pigs or five cows. What about using human manure? "Don't put your hope on generating much out of human excreta. It doesn't produce much gas. I ran a unit using the product of 20 orphanage children, and the gas produced hardly matches the production of gas from a couple pigs." He feels that the primary value is in using the effluent as fertilizer. [Ed: I question whether there is a linear relation between people and required manure. Surely adding one family member does not put that much more demand on the rice pot or lighting system.]

The inexpensive $70 design had a fatal flaw when a key component rusted out. But his project succeeded at his second goal. People had to fence in their pigs to collect the valuable manure. The roaming pig problem is now history. No more are the neighbors fighting each other over damage caused by the others' pigs. "Even though biogas is not operating anymore, the pig fences are there to stay." Fungal infections caused by scattered pig manure are virtually gone and tapeworms are curbed.

His newsletter, published by World Vision Australia, is available free to development workers. Each 4-page issue deals with one subject. Write Rus at 7 Bonython St., Rochedale, 4123 AUSTRALIA. Return to Index.

Malnutrition and child mortality

[Excepted from Cornell Focus, vol 5, 1996.]

According to Dr. David Pelletier with the Division of Nutritional Science at Cornell University, "More than half of all children's deaths in the Third World are due to malnutrition's interactive effects on disease. Of these deaths, more than 80% are due to mild-to-moderate, not severe, malnutrition." His research group developed a model to estimate malnutrition based on age-to-weight data. "Children with severe malnutrition have a risk of death 8.4 times higher than children who are adequately nourished. Children with moderate malnutrition have a 4.6 higher risk, and those with mild malnutrition have a 2.5 higher risk." Return to Index.

List of distance learning courses is available from ECHO.

Thanks to those who sent us information on your correspondence courses. We learned of several graduate degree programs in development as well as single courses you may take in agricultural topics. ECHO can now send (by mail or e- mail) a list of universities which offer these courses, or you can find it on our home page. Return to Index.

From ECHO's seedbank

The following plants are new to our seedbank. Trial packets are free to those ALREADY IN ECHO'S NETWORK working with small farmers overseas; others please send $2.50/packet. Tropical vegetable soybean variety trial, Glycine max: from the Asian Vegetable Research and Dev't Center, Taiwan (a May 1996 summary of their work stated that AVRDC's improved vegetable soybean varieties are planted in 93% of the total vegetable growing area in tropical Asia). Short-duration pigeon pea, Cajanus cajan: see EDN 29-4, 52-5; two new accessions from ICRISAT. Rio Grande ´Bloody Mary' red corn, Zea mays: from New Mexico, USA, grows to 2m, 1-2 ears, makes a fine flour, feed. ´Cariflora' papaya, Carica papaya: resistant to papaya ring spot virus; not a solo variety. Atemoya, Annona squamosa X A. cherimola: delicious, fast-growing fruit tree for tropical lowlands; not tolerant of waterlogging. Cherimoya, Annona cherimola: creamy Andean fruit grown as a delicacy; requiring close management (including hand pollination, careful harvesting); difficult to ship; 1500m elevation at equator (cool but not cold temperatures); 1200mm rain during growing season. Malabar spinach, Basella rubra: we have seed again of our large-leafed, vigorous variety; (mucilaginous) leaf crop suited for humid regions; easy to cultivate; requires trellis. Fodder turnips and forage kale: for cool highland regions, fast-growing short-season from Sharpes International Seeds, England. Acacia mangium: fast- growing N-fixing tree tolerates low-fertility, very acidic soils in humid tropics; used for eradication of Imperata grass; not flood tolerant.

A. auriculiformis: widely adaptable to harsh sites (pH 3-9), Imperata eradication. Erythrina berteroana: leguminous shade tree suited to wide climatic range; alley cropping and windbreaks; propagate by cuttings. Caesalpinia spinosa/Coulteria tinctorea (known as "tara" in Bolivia): slow-growing, leguminous, very drought-resistant tree for high altitudes; young seeds reportedly edible by humans but mature seeds toxic; not palatable to goats. ´Lee' or American joint vetch, Aeschynomene americana: green manure, forage good for low areas or drainage ditches, 1000mm rain.

Request the following from Dr. Phillip W. Simon, Dept. of Horticulture, University of Wisconsin, Madison, WI 53706, USA; fax 608/262-4743; psimon@facstaff.wisc. edu. High-carotene cucumbers, a cross of commercial US varieties and a Chinese variety yield a large proportion of yellow-orange fruits. This is a new release from the University of Wisconsin with potential to add Vitamin A to the diet. You may request a packet for trial and selection in your area from Dr. Simon (not ECHO). Return to Index.

Echoes from our network

Isabel Carter, Footsteps Editor, United Kingdom. "At ECHO's first conference, I shared a vision about the year 2000 being a year of Jubilee when the backlog of Third World debt should be cancelled as a one-off celebration of

the millennium. It was following the response from the audience that I was encouraged enough to pursue this vision. A billion people in the Third World are trapped under a mountain of debt they can never pay back. Individuals can declare bankruptcy-countries cannot. Africa now spends four times more paying interest on its debts than on health care. Over half a million children die each year because of cutbacks in their health services. The poor are bearing the burden of debts incurred by previous governments or corrupt dictators. For a billion people, development is being thrown into reverse.

"Much has happened since the ECHO conference. A group of dedicated people have been meeting and planning for over a year. Countless letters, applications, and contacts have been made. In April 1996, the Jubilee 2000 office opened in Christian Aid HQ London. We now have charity status and an enthusiastic Administrator and Coordinator in place! We are encouraging 'sister' groups to establish around the world. Jubilee 2000 is an idea whose time has come, a practical solution to a problem that has been afflicting hundreds of millions of people for over fifteen years. It will only succeed with massive public support. Please join us!" For more information write Jubilee 2000, P.O. Box 100, London SE1 7RT, UK; phone +44 0171 620 4444; e-mail j2000@gn.apc.org.

Don and Nancy Richards with YWAM in Labria, Amazonas, Brazil, reported

seeing very, very small fire ants which "guard" trees from leaf-cutter ants, according to farmers in the area. The fire ant nests look like thick tree bark and hang on the tree trunks. Someone collected a nest and secured it to one tree, then attached vines from that tree to neighboring fruit trees. The 15 trees connected by vines had no leaf-cutter ant damage. Some neighboring trees (not connected by vines) were completely stripped by leaf-cutter ants. This is very interesting, but we have written everything we know. Has anyone else heard of this?

Bill Lewis from Ethiopia recently visited ECHO and gave a good report on buckwheat seeds he obtained from our seedbank. When his family left Ethiopia, they left some plants nearly ready for harvest, and they were eager to see how the plant was used in their absence. He returned to Africa and sent this update: "We only had a few months to try it at about 5000 feet. We left our seed with church members when we went on furlough. We found that they love it. By adding a little wheat flour or oil they say it is as good as anything they have. I have some church property now with water available, so I will grow buckwheat continuously until the next rainy season for seed. We are really excited about the possibilities! The buckwheat here matures in 9-10 weeks and is prolific. The bees really love it. We will also be trying other things-even some of your chaya!" ECHO has buckwheat seed if you would like to try it in the highlands.

Martin Price offers this family recipe for buckwheat pancakes. Growing up in Ohio, we had buckwheat pancakes almost every morning from the time the weather cooled down in the fall until it became warm again in the spring. The reason it required cool weather is that we fermented the buckwheat on the cool porch or in the sparsely heated kitchen. To start, we mixed buckwheat 50:50 with wheat flour, then added some yeast and enough water to make a thick paste. By the next morning it had expanded to 2-3 times its original size. We then added enough water for a nice consistency for pouring pancakes. We never liked it the first morning, but ate it anyway. That night we added more of the buckwheat/wheat flour mix (but no more yeast) and the process was repeated. After the third day, the pancakes were absolutely delicious and gave a wonderful aroma when cooking. Buckwheat pancakes from a mix (not fermented) do not compare to how good the sourdough approach can be. It is like a totally different food, and it is very filling. Return to Index.

Upcoming events

ECHO's Agricultural Missions Conference (Nov 12-14, 1996): a registration form for the conference and the aquaculture conference immediately following is enclosed with this issue. We hope to see you here! Aquaculture Workshop (Nov 15-16, also at ECHO) is an introduction to technological

levels and appropriate role of aquaculture in farming systems, pond site selection and management, fish biology, project planning, and specific small group discussion times. Price for overseas members of ECHO's network is US$25; $90 for others.

´Course Design and Delivery' Workshops for Trainers in Sustainable Agriculture to be held in Kitwe, ZAMBIA (2-20 Sept 1996) and Arusha, TANZANIA (27 Oct-15 Nov 1996). The yearly practice-oriented workshops cover course design, training materials development, and facilitation and information sifting skills. The courses are sponsored by the PELUM Association (participatory ecological land-use management), which works throughout east and southern Africa to promote sustainable resource use. Write: Workshop Coordinator, PELUM Association, PO Box CY 301, Harare, ZIMBABWE; fax 263-4- 744470. (In Zambia, also contact Chileshe Chilangwa, Harvest Help, Box 36548, Lusaka; in Tanzania, Cleophas Rwechungura, TOPP, Box 9421, Dar es Salaam.)

Agroforestry Short Course, 30 Sept.-14 Dec. 1996, œ3500 plus living expenses (about œ1200). These courses are designed for master's-level professionals who want to learn about recent advances in agroforestry. Subjects include: Systems and practices, Measurement and modelling of ecophysiological interactions, Multipurpose tree species, Applied sociology in

project design, and resource economics. Write Dr. R.M. Brook, Short Course Coordinator, School of Agricultural and Forest Sciences, University of Wales, Bangor, Gwynedd LL57 2UW, UK; fax (01248) 354997; e-mail r.m.brook@ bangor.ac.uk. Individualized training in agroforestry may also be available at the university (œ1400/month).

"Forestry for Sustainable Development" will be the theme of the next World Forestry Congress, to be held in Antalya, Turkey, on 13-22 October 1997. A huge spectrum of topics will be addressed in the technical program. They expect people of all backgrounds and experience to attend. Contact Mr. Mesut Kamiloglu, Secretary-General, XI World Forestry Congress, Ministry of Forestry, Ataturk Bulvari 153, Ankara, TURKEY; fax 90.312.4179160; e-mail obdi-f@servis.net.tr or luis.botero@fao.org. Return to Index.

Books and other resources

The Tropical Perennial Vegetable Series by Jay Ram and Nancy Glover features plants especially suited to lowland, moist conditions. Perennial vegetables require less care than annuals, and they provide a regular source of nutritious greens for home use; some also have commercial potential. This practical series gives the botany, ecology, uses and preparation, nutritional value, cultivation and management, propagation, pests and

diseases, limitations, and sources for the vegetables. Even people already quite familiar with the vegetables will find the information useful. ECHO distributes seed or cuttings of many of the species. We recently found that even some of the more succulent plants can survive at least three weeks in the mail if old stem cuttings are taken.

The ten plants covered are chayote, perennial cucumber (ivy gourd), tree kale, sissoo spinach, katuk, moringa, okinawan spinach, celery stem taro, tropical lettuce, and chaya. These include several of the most promising and productive tropical vegetables, deserving a space in home gardens. The set of leaflets (36 pp. total) is available from ECHO: US$5.50 in N Amer; $6.50 in C/S Amer; $7.50 elsewhere.

Urban Agriculture: Food, Jobs, and Sustainable Cities (328 pp., from the Urban Agriculture Network and the United Nations Development Programme) examines factors which influence urban food production systems worldwide. This is the most comprehensive resource we have seen on this topic. One of the authors set out to promote urban farming, but soon realized that documenting existing activities would be a major task in itself. The book is researched thoroughly, includes many case studies and pictures, and gives great perspectives on the current status and potential of food and income production in the city. Topics include: history of urban agriculture

(UA), different classes of urban farmers, spaces used for UA, organizations which influence UA, benefits, problems, constraints, and promoting urban agriculture through policy.

Here are a few of the insights excerpted from the book to give you an idea for the variety of its content. As an operational rule of thumb, "urban" is distinguished here as the agricultural product that gets to city markets or consumers the same day it is harvested. By the year 2000, 57% of the poor in developing countries will live in urban areas, up from about 33% in 1988. As many as 80% of the families in some smaller Asian and Siberian cities are engaged in agriculture. Hong Kong, the densest large city in the world, may produce within its boundaries two thirds of the poultry and close to half of the vegetables eaten by its citizens. Singapore is fully self- reliant in meat production. Recent migrants to the city have a difficult time putting together the resources necessary to grow and market their produce; they need time to adapt rural technologies to their new urban environment. The book is available from the Urban Agriculture network (see below) or UNDP, Urban Development Unit, DC1-2080, One United Nations Plaza, New York, NY 10017, USA; fax 212/906-6471.

The Urban Agriculture Network has been active since 1992, and now has 3000 members in 40 (primarily developing) countries. Network staff wrote

the above book. They have an information and technical referral service on UA, assist networking among groups who work in adjacent countries, sponsor regional workshops and newsletters, advise on UA policy, and support research of people doing graduate degrees related to UA. They have an extensive library in Washington, D.C., which network members may use during a visit. Contact Jac Smit (President) at 1711 Lamont St., N.W., Washington, D.C. 20010, USA; phone 202/483-8130; fax 202/986-6732; e-mail 72144.3446@compuserve.com; http://www.cityfarmer.org.

Root Crops (380 pp.) by Daisy Kay is a handbook on 42 species. While ECHO's tropical root crop video (EDN 52-7) covers the major crops, this book also includes those of local importance. The cultivation conditions and planting procedures, details of harvesting, and descriptions of the products and processing are particularly helpful if the crops are new to your area. Nine species of yam (Dioscorea spp.) are individually described, along with many native Andean and Asian plants. The book costs œ15 including surface postage; make check payable to CAB International and send the order to Publications Distribution Office, NRI, Central Ave, Chatham Maritime, Kent ME4 4TB, UK. Ask for their excellent catalog if you have not seen it. NOTE: No charge is made for single copies of publications requested by government, educational, research, or non-profit organizations in countries eligible for British aid. Use your official title when writing.

Re-Entry: Making the Transition from Missions to Life at Home (150 pp.) by Peter Jordan, YWAM, 1992. Many of you in our network are missionaries. Hopefully you feel professionally fulfilled, life is interesting and full of meaning because of the important work you are doing, you are respected in the community, and in some cases you have never felt so close to God because of the marvelous things you see Him doing and the close fellowship with national workers and other missionaries.

When the day comes to leave this work and return to your home country, the re-entry can be devastating. Preparing for re-entry is a neglected area that I am convinced, after reading this book, should be given very serious attention by anyone about to return home. The author and his wife head YWAM Associates International, a ministry to the alumni of Youth With A Mission. This group involves large numbers of short-term missionaries, so they have had a lot of experience watching re-entries and the problems that can develop. They suggest things to evaluate in your situation, things to avoid, and steps to take. A few excerpts give the "flavor" of the book.

"Closure is the art of bringing to a satisfactory conclusion the passage of life through which we have just passed ... without carrying burdens of guilt or false expectations. [Failure to bring closure] means you will never truly leave the mission field behind ... it will thwart a positive re- entry

experience...." "Instead of focusing on having to leave work unfinished, focus on whether it is God's will for you to leave."

Be sure conflict with fellow workers is not the reason you are leaving. "It is not necessarily wrong to be disappointed when expectations are not met. But it is wrong to let that ... fester into bitterness. ...it will be a stumbling block the rest of your life." "Set aside some time to assess what changes have occurred in your life during your absence from home. ...How do you think people back home are going to react to these changes in you?" "One change you will probably notice is much greater understanding and acceptance of people from other races and ethnic groups. ...it is easy to anticipate that there may be some conflicts back home ...."

Often missionaries have worked with Christians of many different doctrines and become more responsive to and accepting of other doctrinal points of view. "If you go home seeking to change the convictions of people in your church, you are likely to meet with a negative, even hostile response. So be wise in how you share things." "You may well have to overcome your own jealousy" as friends back home have prospered financially while you seem to have gone backward."

"One young lady wanted to speak in front of her whole church, but realized

that the pastor was not comfortable [with this]." She sent him a "list of questions he might like to ask her in an interview, with a brief idea of the answers she would give. This worked out wonderfully."

The 150-page book sells for US$8. (The publisher is giving a quantity discount-$3.50; $2.80 if over 60-to mission agencies who order before Sept. 1, 1996.) For individual missionaries, the price of one copy will be $5 if you mention ECHO on your order, plus postage (for 1-2 books): N. Amer. $3; overseas surface $6/airmail $11. Make checks out to "YWAM Associates" and send to Peter Jordan at P.O. Box 2060, Point Roberts, WA 98281, USA; phone 604/274-9926; fax 604/271-5000; e- mail 103005,3043@compuserve.com.

Animal Traction training videos by Palabana in Zambia give a high-quality, thorough introduction to the use of oxen in draft power. There are six sections (about 20 minutes each): Training and Selection of Draft Animals (breaking, training exercises, general commands); Yoke making (detailed measurements and procedures); Riem, stroop, and halter making (clear close-ups demonstration using local materials); Plowing and weeding (furrow- making. Groups working in Africa should contact them first with details of their work; some discounts may be available.

If you work with animal traction, you should also know about Tillers International. Write for information on their courses and newsletter at 5239 South 24th St., Kalamazoo, MI 49002, USA; phone 616/344-3233; fax 616/385-2329.

 Subscriptions are $10 per year ($5 for students). Persons working with small farmers or urban gardeners in the third world should request an application for a free subscription. Issues #1-51 (revised) are available in book form as Amaranth to Zai Holes: Ideas for Growing Food Under Difficult Conditions. Cost is US$29.95 plus postage; there is a discount for missionaries and development workers in developing countries (see page 1 of this issue). ECHO is a non-profit, Christian organization that helps you help the poor in the third world to grow food. Return to Index.

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