ECHO DEVELOPMENT NOTES

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QUINOA, *CHENOPODIUM QUINOA*, THE INCAN "MOTHER GRAIN." This crop was second in importance only to corn in the Incan empire, which extended over much of the Andes mountains in South America. "Its grain is rich in protein and contains a better amino acid balance than the protein in most cereals. ...Today it is made into flour for baked goods, breakfast cereals, beer, soups, desserts and even livestock feed. When cooked in water, it swells and becomes almost transparent. It has a mild taste and a firm texture like that of wild rice.... Traditionally, quinoa is prepared like common rice or is used to thicken soups, but some varieties are also popped like popcorn."[1]

"Quinoa has demonstrated value as a partial wheat-flour substitute for enriching unleavened bread, cakes, and cookies. Blends of 70% wheat, 30% quinoa flour produce fully acceptable loaf breads."[1]

"Quinoa's large seedheads and broad leaves make it look something like a cross between sorghum and spinach." Visitors who see quinoa at ECHO before seed heads form almost always think it is the (edible) weed lambsquarter, to which it is closely related. It is sometimes called a "pseudocereal" because its use is similar to that of cereals but the plant is not in the grass family. Plants are 0.5-3 meters tall.

The leaves are eaten fresh or cooked. Nitrates and oxalates, which are high enough in some greens to be a health concern, are very low in quinoa leaves.

"Quinoa has an exceptionally nutritious balance of protein, fat, oil and starch. The embryo takes up a greater proportion of the seeds than in normal cereals, so the protein content is high. Quinoa seeds average 16% protein but can contain up to 23%, more than twice the level in common cereals."[1] It is "high in the essential amino acids lysine, methionine and cystine, making it complementary both to other grains (which are notably deficient in lysine) and to legumes such as beans (which are deficient in methionine and cystine). Quinoa is higher than wheat, corn or white rice in iron (6.6 mg, 4.6, 3.7, and 0 mg respectively.), phosphorus (449, 224, 207 and 143 mg), and calcium (141, 36, 6 and 8 mg).[2]

"While no single food can supply all of the essential life-sustaining nutrients, quinoa comes as close as any other.... It holds exceptional promise as a weaning food."[2]

Quinoa has been grown almost exclusively in the Andean countries which were formerly part of the Incan empire. The grain has been looked down upon as a poor man's food until recently. There is now increased interest in these countries of origin, due in part to efforts of local governments and increasing interest in healthy foods, and in part to its growing popularity in western countries, where new, tasty and healthful foods bring a premium price.

Quinoa is known for its resistance to tough conditions. It will grow where corn will not because of cool weather and dry conditions. During a devastating drought in the altiplano in 1982-83, 66% of Bolivia's potato crop was lost, 25% of corn, 54% of barley, 44% of wheat, 34% of cassava but only 7% of quinoa. In Peru the figures were 27% potato, 6% corn, 26% barley, and 0% for quinoa.[2]

There is great diversity in plant characteristics. "A classification based on ecotype recognizes five basic categories. (1) Valley type, grown in valleys from 2,000-3,600 m. Tall, branched, long growth periods. (2) Altiplano type, frost hardy, short, unbranched, short growth periods and compact seedheads. (3) Salar type, native to salt flat in the Bolivian altiplano. (4) Chilean type, grown at low elevation sites between 34°S and 41°S in Chile, will flower even with long days. (5) Subtropical, located in valleys between mountains in Bolivia, intensely green plants that turn orange at maturity and have small, white or yellow-orange seeds."[1]

Farmers and scientists in parts of the industrialized world where weather in the summer months

resembles weather in the Andes have been trying to develop quinoa as a crop since the early 1980s. Because they originated near the equator where days are short, most varieties are daylength sensitive (require short days to flower) and do not do well. However, there are varieties which grow near sea level in Chile where days are long. These have proved more adaptable to high latitudes.

A drawback to quinoa production and use on a small scale is that the seeds contain a substance called "saponins," located in the seed coat. These cause the grain to be extremely bitter. They can easily be mechanically removed with appropriate equipment. Lacking such equipment, the grain can be soaked in water to dissolve the saponins. However, it is more difficult to get a uniform product this way.

I spoke with Dr. Duane Johnson at Colorado State University about quinoa and its potential. He had just returned from harvesting his experimental plots of quinoa there in Colorado.

Q. We know that the equatorial types require short days to produce seed but that Chilean types do not. Do Chilean quinoas actually require long days or are they day-neutral (produce in any daylength)?
A. They are day-neutral. That means that if ECHO sends Chilean seed to its network, it should not fail because of daylength. However, people in equatorial highlands would probably prefer equatorial types. They tend to have larger, white seeds; Chilean quinoas are smaller and colored. White seeds are generally softer and it is easier to remove the bitter saponins. Chilean types are harder and more extensive work is required to remove the saponins.

Q. The Chilean types are unbranched. Does that mean they should be planted more densely than equatorial types?
A. Yes. We plant 2 pounds/acre of equatorial seed but 5 pounds/acre with Chilean. That corresponds to a plant spacing of 3-4 inches (7.6-10 cm) and 2 inches (5 cm) respectively. Most farmers in Colorado use rows 16 inches (40 cm) wide, but some use 8 and others 20 in (20-50 cm), depending on moisture. [If rainfall is limiting, having fewer plants with wider spacing will require less water.]

Q. What are the climatic boundaries beyond which quinoa has little potential? E. g. will Chilean sea level types do well in tropical lowlands?
A. They have the greatest heat tolerance, but we don't recommend them where temperatures exceed 92°F/33°C, especially during the flowering period (July here in Colorado). We have quinoa growing from Finland to Australia, but mostly in temperate regions. Quinoa is very susceptible to downy and powdery mildew. It likes low humidity. Cool nights are probably important, though I have no data to prove that. It does well here where temperatures average 80°F day, 45°F night (27°C and 7°C). It does not do as well in broad valleys where night temperatures remain rather high, though at 7,000 feet it does great even in valleys.

Q. Are there Subtropical quinoas?
A. There are related species, mainly back garden types. They grow, for example, in parts of Mexico. [Ed: Can anyone get us a start on seed for these?]

Q. I read that the equatorial quinoas grow so well in Colorado that they might make good forage.
A. Equatorial types produce tremendous biomass here, but we get no seed production. It could be used for forage only if we imported seeds.

Q. How complex is it to remove saponins at the "village" level?
A. It is pretty simple. Pillsbury Co. gave us a $7,000 rice dehuller (a carborundum stone that spins and knocks the coating off, designed for 3rd world countries). It works even with the harder Chilean types, though they require 2 passes. Once dehulled it tastes just as good. Actually I prefer the Chilean varieties, which to me have a richer, nuttier flavor. I find the equatorial types somewhat bland.

Q. Do the saponins give the color to the seed coat? If so, can you learn anything important by noting the color of the grain, e. g. whether birds might avoid it?
A. The saponins are buried in a pericarp, like the rind on an orange. Color does not really tell you anything useful. There is no correlation between color and bird resistance.

Q. What is the status of saponin-free varieties? Are they more prone to insect and disease loss?
A. We are currently investigating these varieties, but I have some hesitation after this year's results. Birds were definitely a more serious problem with saponin-free varieties -- I'd estimate 30% loss to bird damage. This is in middle of a 150-mile valley with no trees within 2 miles of the plots. But migrating birds found it (other grain fields had been harvested). [ED: Has anyone noticed whether bird damage is a more serious problem in general on farms making heavy use of agroforestry techniques?]

Q. I read that in early trials in Colorado improved, selected varieties from South America did not do as well as less selected varieties. Presumably the loss in variability during the selection process lost some traits that were important in Colorado. So should I offer your selected varieties to ECHO's network or will they likewise perform less well than the original seed might have done?
A. We find that selected lines from South America aren't as good for us. The same may be true of our varieties when tried elsewhere. We have selected two: Apalawa and Colorado 407. I maintained the old original material, which would probably be better for widespread preliminary trials.

Q. Is quinoa becoming commercialized outside the Andes?
A. About 500 acres are grown in Colorado and 200 each in Washington and Wyoming. It is processed and sold to health food industries. Till this year 50% was sold here and 50% went to Europe. This year 99% will be sold in the USA. Europeans are now buying from South America. Nestle invested $5,000,000 in Ecuador in research in quinoa. Starch from quinoa is being used in synthetic cream products. The market for quinoa is increasing. Canada is becoming a dominant force, growing 2,000 acres last year.

Q. Where are the main places for seed of diverse types? Or are Andean countries hesitant to share seed?
A. Ecuador and Bolivia have been very helpful in exchanging seeds with us. An organization in

Ecuador, INIAP, would be the place to write for equatorial types. Their address is Estación Experimental "STA Catalina", Casilla 340, Quito, Ecuador. FAX 593-2 504240. In Bolivia it is more a matter of going down and seeing what you can find.

Q. Do you have any final comments?
A. There is a southern Bolivian type that I like very much. But it requires a longer season than we have in Colorado (105 days). I like it because it has larger seed and a softer pericarp, but is day-neutral.

If you want to try growing quinoa in your area, ECHO suggests three options.

Option 1: Chilean types. Dr. Johnson is sending ECHO enough Chilean quinoa seed (Apalawa and Colorado 407 varieties) to let us send small introductory packets to our overseas network. These should bloom under the broadest range of day lengths (assuming that temperature and other conditions are right.

Option 2: Equatorial mix. If you work nearer the equator and at high altitudes, you may prefer the equatorial type. We will send a packet containing seed of several varieties mixed together. Since you will harvest seed only from those that do well, you will soon have your own mix of locally adapted quinoa. If your work is more of a scientific nature where the variety names are important, we can send separate packages of named varieties.

Option 3: Chilean and equatorial mixes. If you are unsure which type would do best, one packet contains a mix of equatorial varieties and one packet a mix of the two sent by Dr. Johnson..

Seeds are free to community development workers, $2.50 per packet for others. (We do not consider quinoa worth trying in hot, humid lowlands nor where high temperatures are much over 92°F/33°C.)
[This article relied heavily on the book [1]*Lost Crops of the Incas*, the National Academy Press, 1989 and an article [2] "Quinoa: Grain of the Incas" by David Cusack, in *The Ecologist* Vol 14: 21-31, 1984.] David, an early member of ECHO's network, was shot and killed during a 1984 trip to South America to collect quinoa seed.

USE OF PINEAPPLE JUICE TO SHORTEN COOKING TIME OF BEANS. Imaglo Newton at the University of Science in Kumasi, Ghana is excited about a discovery of one of his masters students, Viggo Dodoo-Ghana. "For some time I have been working to introduce soybeans to some missionaries. One major problem is the difficult cooking properties of the bean. ...[We now find that] a group of proteolytic enzymes (bromelin) found in pineapple juice is able to digest the outer seedcoat and ease the difficulty of cooking the bean.

"The beans are soaked for 6-10 hours in water to which pineapple juice has been added. It is then easy to peel off the seed coat. The cooking is then easy." [ED: There is a good chance that the enzyme has been destroyed in canned juice, in which case you would need to make fresh juice.]

A few years ago Roland Bunch told me that women in Guanople, Honduras used papaya leaves when they cooked beans. Apparently papain in the leaves softened the seed coat also. I have no further details. A volunteer tried cooking some beans the way we imagined the process would be, but the taste was so bitter they were inedible.

Both of these approaches might be worth pursuing. A shorter cooking time for beans would both be more convenient for the cook and use less firewood. If you experiment, let us know the results.

NEMATODES IN AGROFORESTRY. Nematodes are tiny "wire worms" that abound in the soil. The root-knot nematode, *Meloidogyne incognita*, is one of the most infamous, both for its devastating effect on crops and the ease with which its presence can be identified. It causes knots to form on the roots, in some cases making roots look something like a string of beads. Other kinds of nematodes cause major crop losses, but require a nematologist to identify them.

The increasing use of agroforestry systems in which trees and shrubs are permanently grown in

close association with annual crops raises an interesting question. How do these associations affect nematode damage, especially if the trees are themselves hosts for nematode survival and population build-up? This question is addressed in an article in *Agroforestry Today* by Mia D'Hondt-Defrancq (April-June 1993, pp 5-9), from which the following is abstracted.

"Two types of interaction between trees and crops affect nematode populations. Direct interactions take place where the nematode population is directly influenced by the introduction of a species of plant new to the area or a new species of nematode." *Indirect* influences occur when the nematode population is altered by the local environment.

Direct Influences: Some species of trees and shrubs actually reduce the number of certain species of nematodes. This might be due to a chemical that is exuded which kills nematodes. In other cases the tree or shrub acts as a trap-host (it attracts nematodes but prevents their reproduction).

"In Nigeria, for example, the deliberate planting of *Leucaena leucocephala* in a fallow period dramatically reduced parasitic nematode populations in the soil. When the fallow was converted to leucaena alley-cropped with maize, the population of parasitic spiral and root lesion nematodes remained low. In West Africa, *Sesbania rostrata* acts as a trap host for the *Hirshmaniella* species of nematode that are prevalent in flooded areas where rice is grown."

"In cases where trees and shrubs are suitable hosts for harmful nematodes ... [the damage] may increase drastically. This is because the host will not only allow continuous build-up of the nematode population but will become a very efficient reservoir from which attacks can be made [on future crops]." For example, there were many more nematodes within 2.5 meters of a sesbania hedgerow in the Rwandan highlands than there were 5 meters from the row. In Malawi studies suggest that *Acacia, Leucaena* and *Sesbania* species can act as good hosts for root-knot nematodes. Presumably crops susceptible to this nematode will be more seriously attacked when grown in alleys with these trees. "Similar problems can be expected if *Tamarindus indica* or certain species of *Acacia, Albizia* and *Casuarina* are planted where the burrowing nematode is a threat to crops such as banana or vegetables."

Indirect Influences. Trees can reduce nematode problems by indirect interactions. For example, many crop plants have some natural resistance to nematode attack, but this is reduced by high air and soil temperatures (both of which are reduced by shade). Trees and shrubs can also reduce soil erosion and hence prevent the spread of nematodes that are attached to soil particles. To the extent that trees reduce growth of weeds that harbor nematodes, crop losses may be reduced. If benefits of the trees cause crops to be more vigorous, this in itself can reduce nematode injury. "There is also evidence that leachates from the litter of certain trees and shrubs [Ed: water that has soaked through the litter] have nematicidal properties, e. g. *Azadirachta indica* (neem), *Ricinus communis* (castor bean) and *Leucaena leucocephala*."

Indirect interactions can be negative. Plowing reduces nematode density. Reduced cultivation in an alley crop system can thus enhance nematode populations.

I have often wondered if knots caused by nematodes might not sometimes be confused with galls caused by nitrogen-fixing rhizobia. How can you tell them apart? "The nitrogen-fixing galls are readily identified because they are easily rubbed off from the roots and are often pink-red inside."

Many leguminous trees are also good hosts for nematodes. Nematode infection may reduce rhizobial colonization and, hence, nitrogen fixation.

"The following trees have been found to be resistant to the widespread *Meloidogyne incognita* (root-knot nematode): *Acacia senegal, Acacia tumida, Anacardium occidentale, Azadirachta indica, Cassia obtusifolia, Cupressus sempervirens, Eucalyptus camaldulensis, Leucaena leucocephala* (found resistant in most countries), *Sesbania tetraptera* and varieties of *Sesbania macrocarpa*." The author did not provide a list of trees that definitely are harmed by nematodes. He did mention that *Sesbania sesban* failed in east Africa due to nematodes. *Sesbania grandiflora* is badly damaged by them at ECHO.

A CAUTION ABOUT ONE USE OF THE BIRD RESISTANT GRAIN SORGHUM. Dr. Larry Butler at Purdue University has been working on the dwarf bird resistant sorghum which ECHO includes in our seedbank (EDN 32-6,7). In some parts of the world people roast sorghum, like is done with corn (roasting ears) in the United States. Larry cautions about consuming this variety fresh roasted. "The roasting would not detoxify the cyanogenic glycoside dhurrin, which seems to be responsible for its bird resistance. The levels of dhurrin are higher at the dough stage than in the mature grain. The conventional processing method (grinding and wetting and cooking) does eliminate the cyanide." Dr. Butler adds that in both Kenya and India he "was told that if food supplies are scarce it is better to have a small amount of sorghum than maize, because one is more satisfied and can work longer on sorghum. I presume slower digestibility, is the reason." This would assure a slow release of nutrients to the body over a longer period of time.

USE OF LEGUME COVER CROPS IN ORCHARDS OR PLANTATIONS. This is the theme of *Cover Crop News* # 7. A brief summary of the insightful six page report follows. For a copy, and to get on their mailing list, write CIDICCO, Apdo Postal 4443, Tegucigalpa MDC, Honduras, Central America. Phone/fax 504/32-7471.

Since the early 1900s legumes have been used as cover crops in oil palm plantations in Asia. More recently it is being evaluated for other trees: soursop (*Annona muricata)* in Costa Rica, citrus in Honduras and Surinam, bananas in Panama, etc. Primary benefits are controlling weeds, reducing production costs and use of chemicals, and increasing yields.

The largest oil palm plantation in Honduras has had an aggressive program of intercropping legumes for 15 years (at least 1,000 hectares). Weeding is one of the greatest expenses in the early years of establishing oil palms. They begin producing after three years, but it is six years before the canopy is dense enough to restrict weed growth. Many fruit trees never provide enough shade to substantially restrict weed growth.

Tropical kudzu, *Pueraria phaseoloides*, is the most commonly used legume. Seeds are small and slow to emerge, so one must start with a weed-free field, planting 5-8 kg of seed/ha. Full soil coverage occurs in about 10 months, so some weeding is required. Once established, the vine tends to climb trees. Cutting circles around the trees is the main labor in established fields.

There is so much shade in an established oil palm plantation that kudzu growth is reduced. At that time a more shade-tolerant legume, *Desmodium ovalifolium*, is planted at this particular plantation. A further benefit is that it does not climb trees. In Belize, "A privately owned farm called Parrot Hill operates several hundred hectares of citrus plantations covered with *Desmodium*."

Often farmers grow corn between rows in a new plantation. In this case, the legume of choice is velvet bean because it is much faster to establish. The drawback to velvet bean is that its vigorous growth requires much more frequent pruning around trees. [At ECHO velvet beans easily reach the tops of pine trees, though they have never hurt the trees].

CIDICCO, International Center for Information about Ground Cover Crops, is a networking organization. If you have had experience in this area, they (and ECHO) would like to learn details from you, especially from readers in Asia.

ECHO can place your request for seed for cover crops mentioned in this article on our "wait list." We have ordered seed for *Desmodium* (greenleaf variety) and are looking for a source of tropical kudzu. As usual, these are just trial packets to let you become familiar with the plant. For larger plantings, save your own seed or purchase elsewhere.

CONTROL OF LEAF-CUTTER ANTS. Marianne Frederick contacted ECHO with a vivid description of problems of leaf-cutter ants in Guyana. She said that farmers even tried building water filled moats around plants but the ants built leaf bridges and crossed right over. She wonders if there are controls that do not involve commercial insecticides.

Dr. Keith Andrews at Zamorana in Honduras told us of a technique using freshly cut leaves of jack bean *Canavalia ensiformis*. The following comes from "*The use of jackbean as a biological control*

for leaf-cutting ants" in *Biotropica*, vol 11(4) 1979 pp 313,314. Five to 15 kg of leaves were placed nightly on top of and around mounds covering an area of 25 to 100 square meters for three consecutive nights. All the leaves disappeared by the following morning, the ants apparently preferring them over the plants surrounding the colony ...[including citrus, cashew and mango trees]. A single three-night treatment usually resulted in complete cessation of ant activity for periods ranging from four months to five years (when observation ended). Infrequently, very small black ants (possibly forms of the same species) would appear 2-3 weeks following treatment of the colonies. Because of their random and disorganized activity, they were controlled with small doses of insecticide.

"It is presumed that the effect of jackbean on leaf-cutting ant colonies is due to the action of fungicides such as demethylhomopterocarpin contained in jackbean leaves on the ants' fungus gardens." The ants carry the leaves into the mound where they are normally transformed by fungal activity into the food upon which they depend. That's about all the article reported, and no data was included.

Tom Post had trouble establishing neem trees in Belize because of leaf-cutter ant damage. "They would strip whole trees. I planted jack bean around the trees. When the plants got about a foot tall all damage stopped. But there was no evidence that they were stripping jackbean leaves. In fact, we placed leaves on their trails and on the mound and ants would not pick them up. A project in El Salvador likewise found they would not pick up leaves spread on the trail or the mound."

Dr. Warwick Kerr in Brazil writes that "One recent research revealed that sesame, *Sesamum indicum*, protects the plantations against leaf-cutter ants, *Atta sexden*. The ants bring it to the ant hill and it stops growth of fungi."

This is a serious problem. Let us know if you try jack bean or sesame control, or if you have another method. There are too many unanswered questions to recommend the method with much conviction. This would be a good research project for some of the scientists among our readers.

ECHOS FROM OUR NETWORK

Duane Neuenburg, Mozambique. "While working at a German hospital/orphanage in Uganda I observed an effective seed storage method to protect against insect damage. They immersed beans and maize kernels momentarily in a vat of banana juice. The juice is the material from which they ferment an alcoholic beverage (rombe), only they used it before fermentation in this application. They then spread the seeds on a rack to dry. As soon as they were dried they were placed in sacks. The seeds showed no damage 4 months later." This is a new one to us at ECHO. Has anyone else seen this method? How is the banana juice prepared? Have you seen it tried with an untreated control to prove whether or not there is a difference? Do you have any idea why it works (if it does)?

Jimmy Richardson, Australia. Your note on a fruit fly trap made from basil and insecticide (EDN 44-4) prompts me to send the simple plans for the one that we use. The trap uses harmless ingredients VERY effectively against the fruit fly. To make the trap, cut two holes in the side of a 2 liter container with a screw-on cap about 4 fingers high from the bottom. To suspend the trap, drill a hole in the center of the cap, then push a double width of string through and knot on the inside.

To make the attractant mixture, mix 1 cup of vinegar, 2 cups of water and 1 tablespoon of honey and shake well. Fill the trap to just below the holes with this mixture and hang the container about 5 feet high. Flies enter the container and fall into the attractant. I estimate it is 90-95% effective, and no poisons."

Laura Raab, Kenya. "Some time ago I asked you how to get garlic to sprout and you referred me to Dr. Pathak with AVRDC in Taiwan. His answer is so simple that I thought it might benefit others. He said that the problem in sprouting garlic cloves may not be dependent only on temperature. The age of the bulb is equally important. If bulbs are freshly harvested, it is very difficult to get them sprouted. Bulbs which have been stored for 3-4 months will easily sprout once you put them in soil."

UPCOMING EVENTS

Joshua Daniel, Program Director of the Nitrogen Fixing Tree Association in India, writes that they will host an *International Workshop on Nitrogen Fixing Trees for Fodder* in Pune, India, March 20-25, 1995. "The workshop will bring together researchers and practitioners to exchange information and develop strategies for the increased use of NFT's in fodder production systems." They expect to have about 40 invited and contributed papers. The US$100 registration fee includes all lunches, opening and closing dinners, and field trip. Hotel rates approx. $30 per day single occupancy. "A limited amount of financial assistance will be available on a competitive basis." Contact Dr. Daniel at Nitrogen Fixing Tree Association; c/o BAIF, Kamdhenu; Senapati Bapat Road; Pune 411 016, India. Phone 0212-342621 or 0212-342466. FAX 91-212-349806.

CONFERENCE ON UNDERUTILIZED CROPS. The conference is almost two years in the future, but we mention it now because the theme seems to fit so well with ECHO's own efforts in this area. The International Centre for Underutilised Crops is sponsoring this 2½ day conference starting Thursday June 20 1996 at Southampton University. Just before this conference, June 17-19, 1996, the Society for Economic Botany will hold its meetings at the Kew Gardens in England. The two conferences are separate, but organizers will be working closely together. Every effort will be made to keep cost to a minimum, including using dormitory rooms at local colleges rather than expensive hotels. Conference literature has probably not yet been prepared. But you can register your interest in either conference by writing the organizers. For the ICUC conference write Dr. Nazmul Haq, International Center for Underutilised Crops, Dept. of Biology, School of Biological Sciences, University of Southampton, Bassett Crescent East, Southampton SO9 3TU, United Kingdom. The organizer for SEB is Dr. G. Wickens, Society of Economic Botany, The Triangle, Buxton Road, Aylsham, NORFOLK, NR11 6JD, U. K.

CONFERENCE OF THE AUSTRALASIAN COUNCIL ON TREE AND NUT CROPS. The conference will be held September 11-15, 1995 at Lismore NSW. "Where's Lismore? Where the sun first greets Australia." The conference will "embrace a wide range of topics and every sort of climatic and environmental growing condition. Both established and potential new or underexploited tree crops are covered." Proposals for papers are requested for both academic and practical topics. I find no information on cost. Request information from Conference Secretary; ACOTANC-95, P. O. Box 7091; Lismore Heights NSW 2480; Australia.

TWO TRAINING COURSES IN THAILAND This issue is too late for most of you to take advantage of these. They are included to show you the kind of training available at the Regional Community Forestry Training Center. You can contact them yourself to be on a mailing list for any future courses. November 7-December 2, 1994 they offer "A short course in community forestry extension," cost $3,850. December 12-20 is "A short course in conflict resolution," cost $1,550. They orient courses toward middle management personnel.

BOOKS AND OTHER RESOURCES

LIST OF WORLD BANK-FINANCED PROJECTS WITH POTENTIAL FOR NGO INVOLVEMENT. "The World Bank welcomes increased involvement by nongovernmental organizations (NGOs) in the projects and programs it finances or administers, particularly on the poverty and environmental aspects of development. This publication, known commonly as the 'NGO Project List,' provides a list of current and upcoming Bank-supported operations in which the Bank staff responsible see potential for NGO involvement."

The 35 page book arranges projects by country, with very brief information given in columns. Column headings include Project Title, Project Status, NGO name (if already identified)/ Form of Involvement, Objectives of NGO Involvement, and Bank Contact (including phone number.)

To order send your name, organization name and address, and phone and fax number, to Mr. Arthur Thomas; International Economic Relations Division; Operations Policy Dept.; 1818 H St., N. W., Room T-8102; Washington, DC 20433. Phone 202/473-1151; Fax 202/676-0576.

A NEW ECHO TECHNICAL NOTE Comparison Charts of Tropical Crops" by Dr. Frank Martin and intern Mike Fennema summarizes in 13 one-page charts information to help in selecting new crops. There is some overlap with our technical note "Selecting the Right Crop," which lists the adaptation of individual crops to particular ecological conditions. The charts differ in that they compare crops by category. The charts complement ECHO'S overseas seed catalog (although they include many items we do not distribute) using the same crop groupings: Grain Crops, Leguminous Vegetables, Pulses, Fruit Vegetables, Vegetable Leaves, Roots and Tubers, Miscellaneous Vegetables, Selected Tropical Fruit Crops, Nut Crops, Industrial, Plantation and Beverage Crops, Ground Covers and Green Manures, Tropical Pastures and Field Crops, and Special Purpose Trees.

ALTERNATIVES TO SLASH-AND-BURN (A QUARTERLY BULLETIN). The International Centre for Research on Agroforestry (ICRAF), publisher of *Agroforestry Today*, is coordinating a "Global Initiative for Alternatives to Slash-and-Burn Agriculture." Publication of this bulletin is part of that effort. It will highlight ASB activities around the world, including research at three benchmark sites in Cameroon, Brazil and Indonesia and related training programs. ECHO has not yet seen this bulletin, but to add your name to the mailing list, write ASB Update; ASB; P. O. Box 30677; Nairobi, Kenya. Fax (254 2) 521 318. E-mail D.Bandy@CGNET.COM.

AN APPROPRIATE TECHNOLOGY NEWSLETTER. Rus Alit (inventor of the Rus pump, EDN 41-1) 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 $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.

EXPANSION SET TO APPROPRIATE TECHNOLOGY MICROFICHE LIBRARY. This library was reviewed in EDN 17-5. A thick book, called the *Appropriate Technology Sourcebook* is an annotated guide to some of the best books in appropriate technology. The purpose is to give enough information to let the reader decide whether to purchase the book. In 1987 they got permission to put about 80% of those books on microfiche, which made quite an impressive library about the size of a shoe box that you could carry overseas. Now they have added 125 new books or revised editions to what they call an "expansion set." The price for the expansion set and the latest version of the

sourcebook is $200. Shipping is $6 in the US, $16 to Canada, $20 surface to Central America & the Caribbean, $20 surface to Europe, Asia and South America. Order from Appropriate Technology Project, Microfiche Library Expansion Set, Volunteers in Asia, P. O. Box 4543, Stanford, CA 94305, USA.

A FAX/E-MAIL DIRECTORY OF CHRISTIAN MISSION ORGANIZATIONS: Greg Slade with Computer Aided Ministry Society (CAMSoc) is trying to make it easier for E-mail and/or fax-equipped Christian organizations to "find" each other. The directory will be part of their Christian Telecommunications Toolkit. We'll tell you more about the Toolkit when it becomes available. In the meantime, if you would like to be listed in the directory or get more information on CAMSoc or the Toolkit please contact Greg. For the directory he'll need to know: The Church or Mission Organization you're working with, mailing address, phone number, fax number and official E-mail address (not your personal account), and a description of the organization (if not obvious from the name). Send to: Greg Slade, Computer Aided Ministry Society, #102-1421 Burnaby Street, Vancouver, BC, V6G 1W6 Canada, Internet: gslade@cyberstore.ca, FidoNet: Greg Slade at 1:153/313, FamilyNet: Greg Slade at 8:7501/132, Global Mission Network: Greg Slade at 12:2000/37.

 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 through #35 in a binder, *EDN: the First Ten Years*, costs $20 plus air postage: $3.00 USA (surface), $6 Latin America, $10 Europe, $13 elsewhere. Issues 36-46 cost $10 postage paid. A limited number of free back sets are available for hardship situations. ECHO is a non-profit, Christian organization that helps you to help the poor in the Third World to grow food.

ECHO DEVELOPMENT NOTES -- ISSUE # 46
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