

EDN ISSUE 32. MARCH, 1991.

32-1 WOOD ASH TO PRESERVE TOMATOES FOR MONTHS. Ken Hargesheimer sent us a copy of the "Garden to Kitchen" newsletter published by UNICEF. This and the following items were among topics covered in this 4 page issue. No subscription fee is mentioned. Write the Family Food Production & Nutrition Project, UNICEF Pacific Operations, c/o UNDP, Private Mail Bag, Suva, Fiji.

Farmers know all too well the problem of large quantities of tomatoes (and low prices) during season, followed by short supply and higher prices. The Bureau of Education in the Philippines says you can extend the season in which tomatoes are available. Fresh tomatoes can be preserved in wood ash for up to three months.

Preserve only newly picked tomatoes which are ripe but not soft and overripe. They must be free of bruises and blemishes. Select a wooden or cardboard box or woven basket and line it with paper. Gather cool ash from the cooking fire and sift to remove sharp particles. Spread the ash evenly on the bottom, 1.5 inches (4 cm) thick. Arrange the tomatoes upside down (stem end facing down) in one layer and pour another thin layer of ash on top. Continue layering tomatoes and ash until the container is full. Cover and seal the container and keep in a cool dry place. [The article does not say how to cover and seal. My best guess is to cover with ash then a loose fitting cover to keep the ash from being disturbed.] The skin will wrinkle but the pulp inside will remain juicy.

The article does not mention what effect the wrinkling of the skin has on marketability. If you try this method, I would be interested in your observations.

32-1 BREADFRUIT BREAD. Another interesting item in the UNICEF "Garden to Kitchen" newsletter was this recipe for one loaf of bread using 25% (by volume) grated cooked breadfruit and 75% wheat flour (originally from the Methodist Handicraft and Farming School in Fiji). If breadfruit goes to waste where you live, this is a good use and will cut down on need for imported wheat flour.

Sift 1 3/4 cup flour, 3 teaspoons baking powder and a dash of salt. Pound very ripe breadfruit until mushy. Mix 1 1/4 cup breadfruit pulp, 1/3 cup oil, 2 tablespoons of milk, 2 eggs. Add 2/3 cup sugar. Stir into flour mixture, pour into greased pan and bake 1 hour at 350 F (175 C).

32-1 WHERE CAN I FIND SEED FOR BREADFRUIT? We were recently asked that question. Actually breadfruit does not produce seed. It must be propagated asexually. On a recent trip to Malaysia, however, I learned from Dr. Lee Ming Yong at the Tenom Agricultural Experiment Station that they are able to V-graft breadfruit onto breadnut trees. The breadnut has a lot of seeds.

32-1 SEED AVAILABLE FOR MALAYSIA EXOTICA PAPAYA. (Overseas network only). In September I joined a group touring agricultural research stations in Malaysia. I especially enjoyed the papaya we were served by Dr. Tony Lamb at the Tenom Agriculture Experiment Station.

The "solo" sunrise papaya from Hawaii that is so successful commercially does not do exceptionally well in Malaysia. (It also does not do well in many parts of Central America and the Caribbean, where it is badly affected by virus diseases). However, the solo has many positive characteristics. Every tree will bear fruit, in contrast with most papayas for which half of the trees are males which bear nothing. The fruit is small enough (grapefruit size) that the entire fruit can be used without the need to store leftovers. The flavor is good and there is no objectionable smell.

So the sunrise solo was crossed with suban, a local Malaysian papaya, then backcrossed again to solo. The resulting fruits have a deep orange color and great taste and smell. The trees are better adapted to the heat and other conditions in Malaysia.

Dr. Lamb gave us enough seed to share some small packets with our network. If they do well for you, you can keep the line pure by harvesting seed only from the hermaphroditic fruit (same flower has both male and female parts). Dr. Lamb said that if you plant seed from a hermaphroditic papaya, 1/3 of the trees will be female (F) and 2/3 will be hermaphroditic (H). (Half of the trees grown from seeds of female solo trees pollinated by solo trees will be 1/2 F and 1/2 H. Trees grown from seeds of a female solo pollinated by a male tree will be 1/3 each H, F, and M). At the research station trees are marked either F or H, then seed is saved only from the H trees. Hermaphroditic fruits bring a better price too. They are oblong with a small seed cavity compared to fruits of female trees which are round with a large seed cavity.

32-2 SOME OTHER "GEMS" FROM MY CONVERSATION WITH DR. LAMB. (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 way up 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). 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.

32-2 AN UNEXPECTED REASON FOR INCREASED SOIL FERTILITY UNDER TREES. I was surprised by a report by John Wilson in the January-March 1990 issue of Agroforestry Today. We all know that agroforestry systems can increase soil fertility, e. g. by pulling nutrients from deeper in the soil or by nitrogen fixation. He refers to frequent reports of improved grass growth under tree canopies. Such work is usually with leguminous trees, and sometimes with a different kind of grass than the grasses that grow in full sun. For example, an Australian article reported "a 250% higher yield of Panicum maximum under the canopy of a leguminous tree, Albizia lebeck, than outside the canopy in full sun." Dr. Wilson's work found a 30% increase in growth of the grass Paspalum notatum under the non-leguminous tree Eucalyptus grandis and an increase of 70% in total nitrogen in the grass.

Dr. Wilson suggests that the effect of shade on the soil may be one of the leading factors. As evidence, he cites an experiment he performed in an open pasture field of *Panicum maximum* where shade was the only factor. Areas were covered with shade cloth so that the sunlight was 50% of its normal intensity. The total herbage yield increased 43%, nitrogen in the leaves increased 43%, and the soil nitrogen increased 106%.

He attributes this to lowered soil temperatures (maximum centigrade temperatures of 30-36 under shade verses 45-50 in full sun). The lower soil temperature promotes microbial activity and soil mineralization. "This influence is important in areas where the soil nitrogen level is a limitation to crop or pasture growth."

32-2 STUDY OPPORTUNITIES. Correspondence Course on Plant Propagation. "Pennsylvania State University is offering the undergraduate course 'Hort 202: Plant Propagation' by mail. ...it received the 1989 Second Place award in a national competition sponsored by the University Correspondence Course Association. Total cost to take Hort 202 at home is \$282.95, which covers the tuition, two textbooks, a study guide and two video tapes. You can register through the Office of Independent Learning, 128 Mitchell Bldg, Pennsylvania State University, University Park, PA 16802, USA. Phone 1/800/458-3617. (This information from the newsletter HortIdeas, subscriptions \$15 USA, \$30 overseas airmail from Route 1, Box 302, Black Lick Rd. Gravel Switch, KY 40328, USA).

Apprentice Program in Tropical Biological Agriculture. Dr. Ed Bernhardt (author of Home Gardening in Costa Rica, in English or Spanish) directs this program. It is based on regenerative and sustainable agriculture principles and is designed for university students and volunteers who plan to work in home and community food production in Latin America. The farm has a collection of tropical fruit and other multipurpose trees, pasture, grain production and gardens.

The one month course, which costs \$250, teaches the basics of natural insect control, fertilization, composting and weed control with tropical cover crops. Students participate in the morning farm activities and local school garden, and in workshops and seminars held at the farm for local farmer groups. Classes are available in English and Spanish (and Spanish lessons are available). Graduates of that course can stay on as apprentice workers in exchange for 6 hours of work M-F for room and board. Visitors are welcome to stay for a day or so for \$5 per day plus meals. Write Dr. Ed Bernhardt, Apdo. 372-8000; San Isidro de El General; Costa Rica, Central America.

[After I wrote this, a fellow who spent 9 months with Dr. Bernhardt, Mike Moore, spent a couple weeks studying at ECHO. Mike says the highlight for him was working as an apprentice on the farm and in local schools. He speaks well of the program.]

A Course on Storage of Durable Agricultural Products in the Tropics. This intensive 4-6 month course is offered in Great Britain by the Overseas Development Natural Resources Institute, ODNRI. The deadline has passed for the course that begins this March. But it is not too soon to begin writing if you are interested in taking the course in 1992. "As with all United Kingdom training opportunities for personnel from developing countries, financial support for official nominations can be requested through the British Technical Cooperation Training Programme (Contact any British Council, Embassy or High Commission for details)."

A partial listing of the subjects covered in the initial one month course segment include recognition of mould growth and prevention, mycotoxins in food grains, crop drying, rodent biology and control, insect and mite recognition, inspection methods, loss and quality assessment, chemicals in pest control, buildings for storage, non-chemical insect control methods, storage management, packaging, implementation of training, extension methods. This is followed by 3-5 months of specialized in-depth training modules in several of the above topics.

The address is ODNRI, Central Avenue, Chatham Maritime, Chatham, Kent, Great Britain ME4 4TB

32-3 PESTICIDE FROM SEED OF THE NEEM TREE BEING TEST MARKETING IN FLORIDA. The following is abstracted from HortIdeas (reviewed in EDN 21-4). "Margosan-O, the first commercial insecticide derived from the seeds of the neem tree (*Azadirachta indica*), is registered by the Environmental Protection Agency and is being test marketed. So far its official use is limited to greenhouse use on bedding plants, potted plants, foliage plants... and other non-food crops." This formulation is used as a systemic insecticide. That means that rather than just being located on the surface it is moved throughout the plant following drenching of the soil. It appears to be practically nontoxic to mammals, birds and many beneficial insects, including honey bees. It is also biodegradable.

32-3 CAN A "PESTICIDE TREE" SUCH AS NEEM HAVE SERIOUS INSECT PESTS? The ILEIA newsletter March 1990 says that a scale insect, *Aonidiella orientalis* (oriental scale) is often associated with neem trees in Africa and elsewhere. It is not harmful under normal conditions, but outbreaks can become serious when plants are stressed. For example, the drop in groundwater level when Lake Chad dried out led to an outbreak.

"Several scale insect species exist on neem, avoiding the insecticidal components of the host by uptake of plant juice from the phloem. This is practically free of azadirachtin," the major insect control chemical in neem.

They conclude that fear of a pest like the psyllid that almost wiped out leucaena in Asia is not justified, but beware of monocultures of neem (i. e. large plantings containing only neem trees).

32-4 CASHEW WOULD SEEM TO BE A GREAT CASH CROP. IS IT AS GOOD AS IT APPEARS? You would be surprised how often we receive a question similar to this. It does indeed do very well on poor soil. However, Dr. Campbell has mentioned to me that it is seldom a successful development project. One serious problem is the terribly toxic fumes that are produced during processing. They can be safely processed on a large scale, but it is not simple to do. The Overseas Development Natural Resources Institute (ODNRI, Central Avenue, Chatham Maritime, Chatham, Kent, Great Britain ME4 4TB) has some intermediate technology designs for processing cashews. My guess looking at the picture is that it would cost several thousand dollars.

I was replying to a question on cashews from Tom Taylor in Guyana when Dr. Frank Martin came by to begin work on a new teaching video for us on tropical root crops (we are excited about that one!). I asked his opinion.

Dr. Martin said that while cashew is often touted for areas where soils are poor, the tree has serious fruit setting problems. If there is excess moisture during flowering the fruit will not form. He gave this example. "A project I was consulting with in northern Haiti asked me to look at cashews. I questioned many farmers very carefully. It turns out that even though the climate is dry, there is enough condensation of water at night to impede fruit development." That does not mean it is never a good

choice. "I have never seen it grow as well as it does in central Panama." Dr. Martin said that if you have not already had a successful experience with cashews (including good fruit set) in the particular area being considered, be careful.

He also pointed out that cashew trees are associated with poverty worldwide. There is so much labor involved that there is little income produced per person. So it has little promise unless there is cheap labor. "It is a poor man's crop and a crop for poor soils."

If you know of a cashew project that would lead you to a different opinion, we would like to hear about it.

32-4 UPCOMING EVENTS. The International conference on Development of New Crops will be held in Jerusalem, Israel March 8-12, 1992. For information write the Conference Secretariat; ORTA Ltd.; P. O. Box 50432; Tel Aviv 61500, Israel.

32-4 ECHO'S FROM OUR NETWORK. Ken Hargesheimer "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. I can send all kinds of information and plans to anyone interested." His address is P. O. Box 1901, Lubbock, TX 79408, USA.

Ralph Kusserow in Tanzania wrote not too long ago with an interesting observation. Some of the beds were mulched with grass and some with rice hulls. He noticed that chickens did considerable damage in the beds mulched with grass but seldom bothered those mulched with rice hulls. He was intending to mulch everything with rice hulls the next time.

More recently he wrote, "The red glow on this paper is a reflection from my face." This year the chickens ravaged the beds mulched with rice hulls. He attributes the difference to the weather. "Last year was very dry and the mulch quickly formed a crust over the top. Although we have not had a large amount of rain this year, at the beginning of the season it rained at least a little almost every day for six weeks. That kept the rice hulls soft so that the crust did not form, making it easy for the chickens to scratch it. When the normal weather pattern returned, with a heavy rain followed by a week or so of sun with no rain, the crust formed and the chickens have not bothered coming into the garden at all."

He only noticed one problem with rice hull mulch. The crust that forms tends to cause water from a light rain or a watering can to run off. So he forms the rice hulls like a bowl around each plant to make watering easier. There was one other temporary problem. The light-colored mulch reflected the heat and made it hotter than usual. However within several days the mulch darkens, then both looks and feels better.

Ronald Watts in Zimbabwe sent a copy of a letter to the editor that he wrote concerning moringa. It was published in "Productive Farming" magazine. "...I noticed several villages growing trees that I was unfamiliar with. They turned out to be moringa trees, Moringa oleifera. What was remarkable is that they were being grown for their leaves. One homestead had over 30 of these trees growing in a circle. In 36 years of wandering around Africa this was the first time I had seen trees grown in a traditional village purely for their leaves. The farmers said that the leaves were in high demand from their neighbors particularly in times of famine. Fresh leaves appear towards the end of the dry season when green food is in short supply. This tree would seem to have immense potential for improving human diets particularly in the hot and dry areas of Zambia and Zimbabwe. ...[Moringa] would seem to have great potential for feeding livestock. Several Zambian farmers who have tried leucaena for this purpose have been disappointed because it is extremely susceptible to termite damage. Moringa has the advantage that it is less susceptible and can be grown from cuttings. A 2 meter cutting means that from the day of planting

the top of the tree should be out of reach of goats." Ronald says that though palatable to termites, moringa seems to be able to resist the challenge, particularly when grown from cuttings.

32-5 "FARM FORESTRY NEWS." The forestry / fuelwood Research and Development Project, funded by the U. S. AID, publishes this quarterly newsletter. It is written primarily for scientists working on problems of small-scale farmers, but should also be of interest to those of you responsible for developing or strengthening your organization's agroforestry work. Write to Norma Adams, Editor; 1611 N. Kent St., Suite 600; Arlington, VA 22209. Subscriptions are free. The following item was taken from a recent (12 page) issue.

32-5 A CREOLE LANGUAGE TREE NURSERY MANUAL. Readers in Haiti may find this manual by the Pan American Development Foundation (PADF) helpful. The following is excerpted from "Farm Forestry News." "Wide range of instructions includes containers, seeds, pesticide handling, hand pump care and planting species by species. Techniques are simply depicted and information is adaptable to other arid settings. Clarity of text and excellent drawings are addressed to the barely literate. Contact Phoebe Lansdale, Project Officer, PADF, 1889 F. St. NW, Washington, DC 20006-4499 [I assume the PADF office in Port-au-Prince would have it also]."

32-5 SEED FOR MORINGA STENOPETALA NOW AVAILABLE. (OVERSEAS NETWORK ONLY) The number one seed in our seedbank, in terms of number of requests and positive reports, is the moringa, M. oleifera, a native to India. When we learned that a moringa native to Ethiopia had larger edible leaves, more drought resistance, and larger seeds (important for those using moringa to purify water), we were obviously interested. Thanks to Dr. Samia Jahn, we have a modest supply of seeds to share with you. There may not be enough to go around. So if this is your first interest in moringa, please do initial trials with M. oleifera. If you have had success with M. oleifera, now may be the time to try this "new" species.

Michael Madany, one of our readers in Somalia, wrote of his comparison trial with seed received from elsewhere a few years ago. "In spite of the initial rapid growth of M. oleifera, in drier years the species has not done well without some watering. The M. stenopetala, by contrast, has the lushest green foliage and continued to grow during the exceptionally long dry season from last August until this April. We began cooking leaves and young shoots in April (taste of the two species very similar). We obviously aren't eating it fast enough, since two large limbs have fallen under their own weight."

Freezes damaged our one M. stenopetala, forcing subsequent branching from low on the trunk. Consequently, I have not seen a "normal" mature tree. Dr. Jahn says that in the Sudan M. oleifera develops into a slender tree, M. stenopetala into a round shrub-like tree. Before the first freeze, however, a few important differences became clear. The trunk is considerably thicker at the base, the tree seems more vigorous, the leaves are larger, and if tasted raw the leaves are milder.

The more bushy M. stenopetala can be planted as a wind break. "Seedlings were planted in a windy corner at a spacing of 1 m. As soon as the upper branches of the tree grew broader, they were cut and the trees responded by more profuse growth of their lower branches, thus thickening the hedge. Vegetables cultivated behind it profited from this protection."

M. stenopetala has been grown as an ornamental in private gardens of Europeans in Kenya, reaching 10-12 meters and their trunk diameter is at least 2-3 times as thick as that of M. oleifera in Sudan. In Ethiopia it is cultivated as high as 1800 meters (5400 feet), where people use ash as the main fertilizer. By the end of a long dry season the trees may have lost their leaves.

We have been disappointed that ECHO's 3 year old *M. stenopetala* tree has not yet flowered. We thought it was due to its having been badly damaged by two freezes. There may still be hope (and a lot more seed available to our network). Dr. Jahn cites reports that *M. stenopetala* trees are not as quick to set flowers as *M. oleifera*. In Sudan the first flowers appeared after 2 1/2 years, compared to 11 months for *M. oleifera*.

There is another interesting difference. The roots of *M. oleifera* are used as a condiment similar to horseradish. With *M. stenopetala* it is the bark that is so used.

Dr. Jahn reports on work in the Sudan which shows that optimum light for germination of all moringa species is half shade. When sown in the hotter weather of mid-April, germination percentages for *M. stenopetala* and *M. oleifera* were only 54 and 40 percent, compared to 92 and 94 percent in half shade. During the cool dry season there was little difference. Both moringa species can be started from cuttings. However, trees grown from cuttings are known to have much shorter roots. Where longer roots are an advantage for stabilization or access to water, seedlings are clearly preferable.

32-6 SEED FOR A NEW "BIRD RESISTANT" GRAIN SORGHUM AVAILABLE. I am especially pleased to make this offer because it relates to the subject of my three years post-doctoral research at Purdue University. Grain sorghum is one of the world's major cereals, grown primarily in locations which are just a bit too dry for reliable yields of corn. The plant looks like corn when young. Then stalk emerges from the top of the plant on which a head of grain develops. Unlike corn, where the grain is protected by a husk, the sorghum grains are fully exposed. In some cases an entire field can be lost to birds.

There are two ways to protect the grain, neither very acceptable. One is to have the children or older people stay by the fields during the most susceptible weeks and scare the birds away. The other is to grow varieties which have a high tannin content. I once led a trial in Puerto Rico in which regular and high-tannin sorghums were grown on 3 acres. My plans for measuring degrees of damage by birds were discarded because there was 100% destruction of the kind with no tannin. The high-tannin varieties scarcely lost a grain.

So why is tannin not a good option? Tannin is the substance in green fruits (e. g. persimmons or banana) that causes your mouth to pucker up. The tannin binds with proteins, causing them to come out of solution. If this happens in your mouth, the lubricating proteins of saliva are removed, resulting in the puckery sensation. In the digestive tract they may tie up proteins in the diet or, worse yet, digestive enzymes. The consequences are serious. In feeding trials with rats and chickens, the animals grow much slower, or sometimes even lose weight, with rations based on high-tannin sorghum compared to varieties with no tannin.

Farmers face a terrible choice. Grow regular sorghum and risk low yields due to bird damage or high-tannin sorghum and get good yields of grain that is very bad nutritionally.

Dr. Larry Butler at Purdue gave me the good news that Dr. John York at the University of Arkansas and Roger Bullard with the U. S. Fish and Wildlife Service have a sorghum with no tannin that birds seldom bother. Dr. Butler's feeding trials showed that it was as good a feed as any other sorghum.

Dr. Butler says, "In trials in Indiana for two summers the new variety was not damaged at all, whereas susceptible lines in the same fields were totally destroyed. However, one planting in Puerto Rico, where the sorghum was planted next to some millet (a common ingredient in bird feed), was wiped out. So in special cases it can still be damaged."

Trials will be conducted in Brazil, Kenya and Tanzania next year. You might want to wait until a lot more research has been done. But if you would like to get in on a tiny trial yourself, Dr. Butler gave us enough seed to send you a trial packet. Plant a row in the same field as your other sorghum and see if there is a difference. I asked if it was important to plant in a separate location, thinking that perhaps the birds needed to learn that a particular patch of grain was not "tasty." He said that birds seem to be able to distinguish individual resistant sorghums right in the row. Be sure to let us know what you find. We will pass the results on to Dr. Butler.

Dr. York has just released the variety, called AR 3048. He said that no yield trials have been done. (I think it was released primarily for use by plant breeders). It is a triple dwarf, which means it may only get to be knee high. The plants are just now blooming at ECHO at a height of about 3 feet (1 m). That does not mean yields will necessarily be low, as many commercial varieties are dwarf. Although the short stalks mean that there is less danger of lodging (falling over) in wind, there will not be long stalks after harvest for other uses.

Dr. York reported a trial in which 2% of grain was lost during the "milk" stage of grain development to birds with AR 3048 and 86% for a control. There was some loss in that case after the grain was more mature ("dough" stage). He had earlier released another variety which proved to be resistant some years and not in others. There are a lot of mysteries in just what is happening and what is responsible for this "bird resistance."

If you are inclined a bit toward plant breeding, note that this bird resistance is a recessive trait. If you cross with another variety the seed will produce plants that are not resistant.

Third World readers can request a free packet, in return for your observations. Others send \$2.50.

32-7 FOOTSTEPS, A QUARTERLY NEWSLETTER FOR CHRISTIANS IN RURAL DEVELOPMENT. Editor Isabel Carter offered a free subscription to our readers and sent the enclosed insert with details. Each issue follows a particular theme. "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...."

The theme of the 12 page review issue in front of me is water. The lead article gives two case studies, a success and a failure, and suggestions for how to work with the community in 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. Write to Isabel at Tear Fund, 100 Church Road, Teddington, TW11 8QE, United Kingdom. "Footsteps" will soon be available in Spanish and French also, so give your preference.

32-7 "ECHO'S INVENTORY OF TROPICAL VEGETABLES." How many kinds of vegetables did God create? You can count the hundreds in this 157 page publication by Dr. Frank Martin, Victor Doku and Ruth Ruberte. Plants are considered in alphabetical order by family, with good indices for genus and common names. Within each family the "major" vegetables, if any, are described by a paragraph with standardized format, while the hundreds of minor vegetables receive only a single line (scientific and common names, type of growth, country of origin, plant part eaten, and whether cultivated or wild). The uses, and any poisonous properties, are noted when known. Thumbing through the book is the best way to find vegetables of a particular country. A very good bibliography lists the most important sources of further information. Remember that this is an inventory, not a detailed description of everything you might want to know about the plants.

This may be the most complete listing of tropical vegetables ever developed. Because we did not consider the "market" was large enough to pay printing costs, we have "published" it as a xeroxed copy in a binder. While most valuable in libraries, many will want a copy on his/her own desk. At \$20 (\$15 for private voluntary organizations) it is a bargain considering the years of work that went into the book, and the difficulty of getting the information elsewhere. Order from ECHO enclosing postage of \$2 North America, \$6 Latin America and \$9 elsewhere. If ordering from a Florida address, add 6% sales tax.

32-8 TWO NEW TECHNICAL NOTES BY DR. FRANK MARTIN. "Meat Production on the Small Farm with Cavy (Guinea Pig)," 6 pages. The cavy is a rodent that was domesticated in the Andes as a source of meat. Because it is small, it can be eaten by a small family in one meal and does not require refrigeration. The meat is much like that of a rabbit, with low fat content. The cavy multiplies rapidly, though not at the rate that folk literature would suggest. With breeding as recommended here, one pair might produce 260 new pairs in 2 years.

The wide variety of foods that the cavy will eat is a benefit. In parts of Latin America cavy breeds much larger than those common in the United States are used. Both of these Technical Notes are free to private and volunteer agencies, \$1.50 to others.

"The Living Fence, Its Role on the Small Farm," 6 pages. This brief overview lists advantages and disadvantages of living fences. Five exceptionally useful living fence trees are briefly discussed. Finally, a 3 page table lists 66 species that have been used in living fences, their climatic adaptation, method of propagation, size, whether pruning is necessary, and other uses. I wish that someone would publish a well-illustrated and carefully written book on this practical subject (do you know of one?). Until then, this is a good start.

32-8 HOW TO MAKE A FISH EMULSION FERTILIZER. We have been asked this question but I never knew the answer. Organic Gardening magazine answered it in their February 1990 issue. It does not make me want to go to my suburban home and try it, but I could see its use on the small farm.

"Place fish scraps in a large container and add water. Cover the top securely with a cloth plus a wire screen to keep out animals and insects. Put the container in a sunny location to ferment for 8 to 12 weeks. You can add a small amount of citrus oil or other scent to mask some of the odor, but be sure to keep the container where your neighbors won't complain. Try to avoid spilling any fish scraps or fishy water on the ground, where they will attract animals.

"When finished, a layer of mineral-rich oil will float on the water, and fish scales will have sunk to the bottom. Skim off the oil and store in a tight-fitting container. To use, dilute 1 cup of oil with 5 gallons of water. Your homemade fish emulsion will be rich in nitrogen, phosphorous and many trace elements, but generally low in calcium."