Multipurpose Trees

- The Nitrogen Fixing Tree Association Joins the FACT Net (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Nitr)
- Book Review: Multipurpose Trees and Shrubs: Sources of Seeds and Inoculants (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Mult)
- Honey-Producing Trees Suitable for Multiple Use (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Hone)
- Book Review: Trees and Shrubs of the Sahel: Their Characteristics and Uses (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Tree)
- Species Selection for Different Climates and Uses (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Sele)
- The New Forests Project (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#NewF)
- "Fodder Tree Legumes" Course (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Fodd)
- *Acacia angustissima* and *Calliandra calothyrsus* (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Acac)
- *Gliricidia sepium* (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Glir)
- *Leucaena leucocephala* (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Leuc)
- Eye-Catching Leucaena (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Eyec)
- The Moringa Tree, *Moringa oleifera,* is Called Mother's Best Friend (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Mori)
- *Moringa stenopetala* (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Sten)

- The Neem Tree *(Azadirachta indica)* for Reforestation and an Effective Insecticide (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Neem)
- Cross-Pollinate to Get Neem Seed (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Cros)
- Neem in Africa (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Afri)
- *Paulownia,* China's Wonder Tree (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Paul)
- *Sesbania aculeata* for Firewood that Grows Under Tough Conditions (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Sesb)
- *Sesbania sesban* Recommended for Alley Farming at Higher Elevations (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Reco)
- *Sesbania grandiflora* (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Gran)
- Tagasaste, *Chamaecytisus palmensis,* a Temperate Counterpart of Leucaena (https://www.echocommunity.org/resources/01e9163a-6a59-4b34-bf20-13a286995d4b#Taga)

THE NITROGEN FIXING TREE ASSOCIATION (NFTA) became part of Winrock International's FACT Net (Forest, Farm, and Community Tree Network) in January 1996. The FACT net is a resource for information on both nitrogen-fixing and non-N-fixing multipurpose trees. They offer a technical advisory service for people with questions about the species, maintain worldwide seed source directories, and produce "FACT Sheets" (6/year) on various species and research reports, among other publications. (In the past we have mentioned NFTA's tree seedbank that was an outstanding resource to development organizations. That service is no longer available.) For membership information, contact FACT Net, Winrock International, 38 Winrock Drive, Morrilton, AR 72110-9537, USA; phone 501/727-5435; fax 501/727-5417; e-mail forestry@msmail.winrock.org. The forestry staff provides a "global extension service" and can answer your questions by mail, phone, fax, and the Internet. This network is one of your best resources for information on many tree species. Some publications are available in Spanish, French, Indonesian, and Chinese; be sure to ask. The full set of about 100 FACT sheets on various species costs US$12 plus postage. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

MULTIPURPOSE TREES AND SHRUBS: Sources of Seeds and Inoculants by Peter G. Von Carlowitz and published by ICRAF is helpful in locating seed sources of MPTs (multipurpose trees) and shrubs. (Another book, *Cornucopia,* is a great sourcebook for hard-to-find food plants. See the chapter on Seeds and Germplasm. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch12.htm))

Chapter 1 is a 40-page table listing: species name, seed suppliers and quantities available, number of seeds/kg, typical germination rates, and seed pretreatments. Chapter 2 is a country-by-country listing of information on the suppliers mentioned in Chapter 1: address, phone, telex, cable and fax numbers, type of institution (governmental, commercial, research, etc.), documentation available, currencies accepted, and forms of payment.

Chapter 3 is divided into thirds: an overview of nitrogen-fixing bacteria and other beneficial micro-organisms, a table of host species and related information, and a listing of inoculant suppliers. Chapters 1-3 end with an annotated bibliography of related readings. Chapter 4 has tables to help match the right tree or shrub with the right climate and use. The rest of the chapter is a comprehensive listing of species profiles from ICRAF's MPT database. Available (US$25 plus US$10 for surface mail; airmail rate supplied on request) from: Head of Information, ICRAF, P.O. Box 30677, Nairobi, KENYA. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

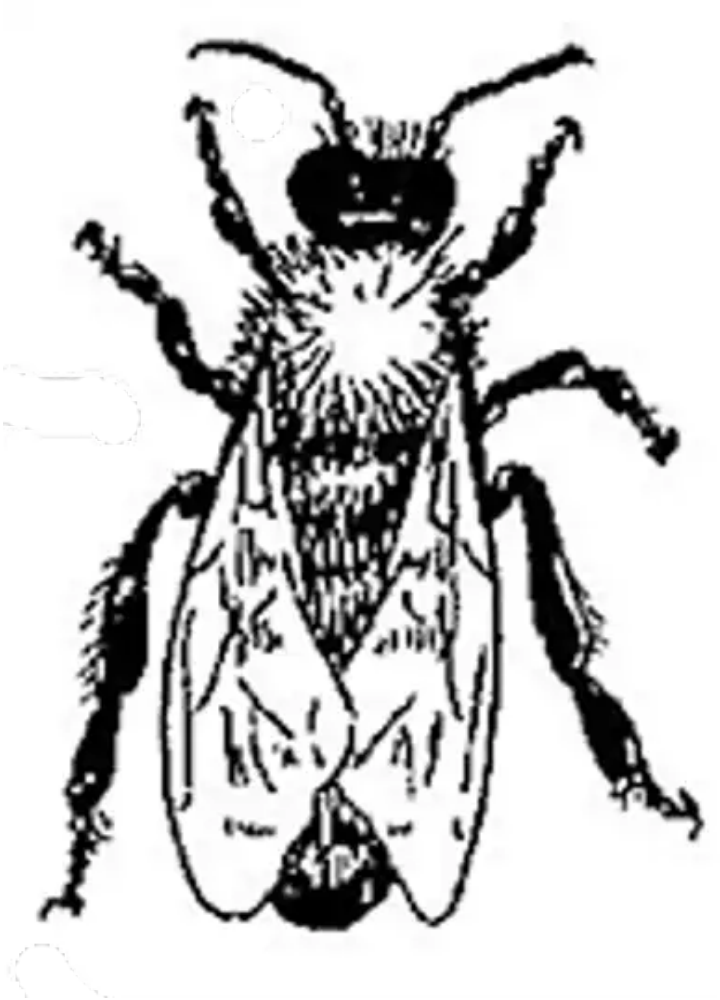
HONEY-PRODUCING TREES SUITABLE FOR MULTIPLE USE. We phoned Dr. G. F. Townsend at the University of Guelph to answer a Peace Corps volunteer's question concerning the pros and cons of the African hive. Dr. Townsend is a leading authority on beekeeping in the tropics. He has been receiving *ECHO Development Notes,* so knows the kind of material we publish. When I asked if there were any things he would like to write up and share with our readers, he quickly volunteered the topic of this note. (I mention this as a hint for others, scientists or development workers. Have you learned something that can be shared with our readers?) The highlights of his notes follow. You can request the Technical Note from (/resources/97d8fe22-bfc0-416a-ba92-bb072cf6ad99)ECHO which contains the entire article. We do not like to feature plants unless we can provide seed, but we have been unsuccessful in obtaining seed of this entire list of trees. Please let us know if you could provide some to us.

What better way is there to solve the firewood problem than by planting fast growing trees that will also produce food and fodder? Some of the most suitable trees for this purpose are also valuable honey-producing trees that have nitrogen-fixing properties which will support grasses. Many of these trees are very adaptable to dryland conditions where the problem is most acute. A large proportion of the honey produced in tropical areas comes from trees, in contrast to the temperate regions where it is produced mostly from forage crops.

The growing of trees could make a community almost self-sufficient. Some of these trees, such as *Prosopis* species will produce food for humans and fodder for livestock within 3-5 years from seed, even in arid regions. They can be thinned for firewood and will support growth of dryland grasses. The beekeeping businesses they can support not only provide a valuable energy food but local and foreign currency from sale of beeswax. Work in Kenya has shown that beekeeping in many cases doubled or tripled the family income with no requirement for land and very little investment. With suitable infrastructure, no investment was needed at all.

The following trees are the most suitable for this purpose. [For additional information consult the book *Firewood Crops* (https://www.echocommunity.org/resources/f07995f0-b60a-4d06-95da-d2bd9cf25ff6) by the National Academy of Sciences; unfortunately it is currently

out of print. If you need more detailed information on these species, write the FACT Net at the address above.]



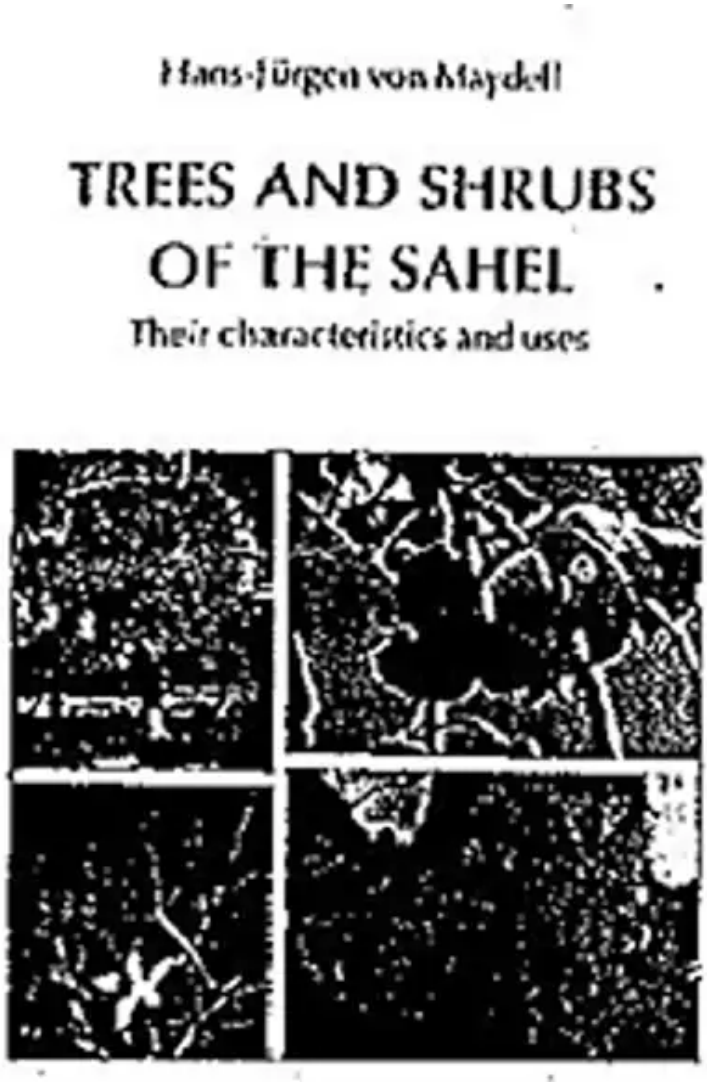
HONEY-PRODUCING TREES SUITABLE FOR MULTIPLE USES

TREE	OTHER USES
A. Humid Areas	
1. *Calliandra calothyrsus*	Firewood, animal fodder. Fast-growing.
2. *Gliricidia sepium*	Firewood, fencing, animal fodder.
3. *Gmelina arborea*	Firewood, timber.
4. *Guazuma ulmifolia*	Firewood, timber, animal fodder, edible fruit.
5. Mangroves	
Avicennia nitida	Excellent charcoal.
Laguncularia racemosa	Resins, tannin, pulp.
6. *Syzygium cumini*	Firewood, shade.
B. Tropical Highlands	
1. *Eucalyptus fistulata*	Firewood, tools, poles, pulp.
2. *Grevillea robusta*	Firewood, cabinet wood, shade for coffee or tea.
3. *Inga vera*	Firewood, furniture, shade, food, seed pulp.
C. Add Regions	
1. *Acacia senegal*	Charcoal, poles, implements, gum arabic, fodder, food: dried seeds.
2. *Acacia tortilis*	Firewood, fence posts, animal fodder. Fast growing.
3. *Albizia lebbek*	Firewood, furniture, animal fodder. Tolerates salt.
4. *Albizia chlodora*	Firewood, poles, railroad ties, citronella.
5. *Eucalyptus camaldulensis*	Firewood, excellent charcoal, termite-resistant wood, pulp.
6. *Eucalyptus citriodora*	Firewood, posts, general construction, fodder, food: pods.
7. *Pithecellobium dulce*	Firewood, posts, general construction, fodder, food: pods.
8. *Prosopis* spp.	Firewood, fence posts, fodder: leaves & seeds, food: seeds, erosion control.
pallida	Fast growing, tolerates salt, arid conditions, up to 300 m.
juliflora	Tolerates very arid regions up to 1500 m. May be weedy.

(The table "Other Important Tropical Honey-Producing Plants" is included in the Technical Note.) (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

TREES AND SHRUBS OF THE SAHEL: THEIR CHARACTERISTICS AND USES, by Hans-Jurgen von Maydell, 1990. Someone in our network in Mali brought this book to our attention. This beautiful 525-page book is still relatively compact (15x21 cm) for ease of carrying with you into the field.

(/resources/f68ce214-3087-4b43-9639-5ecbfdd77215)The most striking feature is the large number of color photographs. Color photos illustrate the entire tree as well as such closeups as bark, foliage, flowers, fruits and/or seeds. For each tree,



one page is devoted to photos and one to a written summary of key points (scientific name, family, description, distribution, site requirements, uses and references). Often, presumably for more important trees, additional pages of pictures and text are given. Appendices give vernacular names (in Bambara, Djerma, French, Gourmanche, Haussa, More, Peulh, Serer, Tamachek and Wolof); seed weights, pictures of seeds and fruits; and a list of botanical terms in English, German and French.

Order from Deutsche Gesellschaft f?r Technische Zusammenarbeit (GTZ); Dag-Hammarskjold-Weg 1-5; Postfach 5180; D-65726 Eschborn 1; GERMANY. If you write on official letterhead explaining how you would use it in your work with agricultural development in the Sahel, a free copy may be available. Those who do not qualify for a free copy can order from Margraf Verlag, P.O. Box 105, 97985 Weikersheim, GERMANY; fax 49-(0)7934-8156; about US$49 plus postage. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

SPECIES SELECTION FOR DIFFERENT CLIMATES AND USES. The Nitrogen Fixing Tree Association sent us this helpful list. Species followed by (*) have thorns.

Arid/Semi-arid Plants For Fuelwood/Charcoal. *Acacia acuminata, A. aneura, A. aulocacarpa, A. farnesiana (*), A. nilotica (*), Casuarina cunninghamiana, C. equisetifolia, Haematoxylon brasiletto (*), Parkinsonia aculeata (*), Prosopis pallida (*).* **Ibid. for Animal Fodder.** *Acacia albida, A. acuminata, A. aulocacarpa, A. nilotica (*), Cajanus cajan.* **Ibid. for Green Manure.** *Cajanus cajan.*

Humid Lowland/Midland (0-1000 m) for Fuelwood/Charcoal. *Acacia auriculiformis, A. mangium, Calliandra calothyrsus, Casuarina cunninghamiana, C. equisetifolia, Enterolobium cyclocarpum, Gliricidia sepium, Leucaena leucocephala,*

Mimosa scabrella, Samanea saman. **Ibid. for Fodder.** *Acacia angustissima, Enterolobium cyclocarpum, Erythrina poeppigiana, Gliricidia sepium, Leucaena leucocephala, Sesbania grandiflora, S. sesban.* **Ibid. for Timber/Fuelwood.** *Acacia confusa, A. mangium, Albizia falcataria, Dalbergia retusa, Enterolobium cyclocarpum, Leucaena leucocephala, Samanea saman.* **Ibid. for Green Manure.** *Acacia angustissima, Albizia falcataria, Calliandra calothyrsus, Erythrina poeppigiana, Flemingia macrophylla, Gliricidia sepium, Leucaena leucocephala, Mimosa scabrella, Sesbania grandiflora, Sesbania sesban.*

Tropical Midland/Highlands for Fuelwood/Charcoal. *Acacia mearnsii, Alnus acuminata, A. rubra, Leucaena diversifolia.* **Ibid. for Fodder.** *Acacia angustissima, Chamaecytisus palmensis, Leucaena diversifolia.* **Ibid. for Timber/Fuelwood.** *Artocarpus fraxinifolius, Alnus acuminata, A. rubra, Leucaena diversifolia.* **Ibid. for Green Manure.** *Acacia angustissima, Leucaena diversifolia.*

The Kenya Forestry Seed Centre seed catalog has the most complete listing we have seen. Nine pages of the catalog give "Climate Zones and Species Suitability" based on humidity/rainfall, altitude, and mean annual temperature. These charts provide an important guide before you purchase seeds; for example, there are relatively few species suitable for over 2400 m altitude, but these lists give you a place to start. (We were not able to contact them at their Nairobi or Kikuyu addresses, so ECHO can send you the listing.) (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

THE NEW FORESTS PROJECT provides packets of tree seeds, technical information, and training materials free of charge to groups interested in starting reforestation projects with fast-growing, nitrogen-fixing trees. Available for distribution are seeds of *Cajanus cajan* (pigeon pea), *Leucaena leucocephala, Gliricidia sepium, Robinia pseudoacacia* (black locust) and *Prosopis juliflora* (mesquite). Write The New Forests Project, 731 8th St. SE, Washington, DC 20003, USA; phone 202/547-3800; fax 202/546-4784. Include an environmental description of your area, including elevation, rainfall, temperatures, soil type, and the purpose of the tree planting. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

"FODDER TREE LEGUMES: Multipurpose Species for Agriculture" is a six-week course (offered in Nov/Dec in 1996) in (/resources/bac92348-30c8-4f5c-bbe3-edebf09955f3)Queensland, Australia. Participants learn about the range and characteristics of fodder tree species available and evaluate roles in animal production and soil protection. Cost in 1996 is A$12,000 (about US$8760) plus airfare to and from Brisbane. Write to Fodder Tree Legumes, Course Secretariat, Dept. of Agriculture, The University of Queensland, St. Lucia, Queensland 4072, AUSTRALIA; phone 61 7 365 2062; fax 61 7 365 1188. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

ACACIA ANGUSTISSIMA* AND *CALLIANDRA CALOTHYRSUS. Lloyd Rowlands in Zaire wrote: "Another thing I am trying is Acacia angustissima. It out-performed 10 other species of trees from our NFTA trial. After 2 1/2 years it is 5 meters tall and about 6 cm thick! It is far better than leucaena in this area. I want to try incorporating it into an alley-cropping system. [Ed: In alley cropping, crops are planted in "alleys" between rows of trees that are planted a few inches apart and kept cut back to a

few feet in height.] I have no other information on the species. Even NFTA, who sent the seed, has little information." (Neither does ECHO; please send us what you know.)

"The trial also included *Acacia auriculaformis, A. melanoxylon, A. mearnsii, Calliandra calothyrsus, Casuarina cunninghamiana, Chamaecytisus palmensis, Leucaena diversifolia, Mimosa scabrella* and *Sesbania sesban.* Due to drought, weeds and termites, only the first 5 species survived two years. After planting, the trees received no special treatment, as I was trying to do nothing that local farmers would not provide."

In a later letter, Lloyd wrote, "About 5 weeks ago a fire swept through the trees. Although all were killed above ground, *A. angustissima* are re-sprouting from the base and already average 55 cm high. Some are almost a meter tall. "This would seem to indicate that this species has good coppicing ability [i.e., ability to resprout from the base]. So they should be well suited to an alley cropping system.

"*Calliandra* is showing some signs of recovery with some shoots about 10 cm tall. Some nearby *Leucaena leucocephala* trees also burned. These are showing very poor signs of recovery. I cut down one tree. The wood is very hard, difficult to whittle with my rather sharp knife. I expect it will make good firewood or charcoal."

ECHO received a few seeds from NFTA and some from the International Livestock Research Center in Ethiopia. Seeds must be scarified by placing in hot water in the morning and left there while it cools and perhaps most of the day. Seeds are

available only to our overseas network.

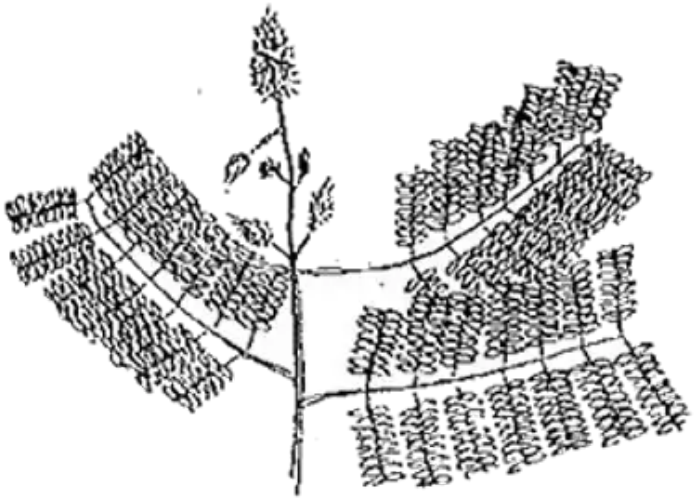
Robert Brook at the Lowlands Agricultural Experiment Station, Papua New Guinea, wrote: "In a past EDN, Lloyd Rowlands shared his experience with *Acacia angustissima* in Zaire. Here in Papua New Guinea we have been testing this tree alongside other leguminous species.

"At both sea level and at 1650 meters (4900 feet) it outperformed all other species, including *Leucaena leucocephala* K8 (and other varieties of leucaena). At sea level it grew at an average rate of 35 cm per month and after 8 months had a stem diameter of 5 cm. At 1650 meters it grew in 22 months to 2.6 meters tall with a stem diameter of 4.3 cm. Both are well watered sites. I have also planted at 2200 m, but have no results yet.

"The Royal Botanic Garden, Kew, England passed on the following information about this species. It comes from Texas, Mexico and Central America and is found from sea level to 2600 m. It prefers open sites, but is adapted to a wide range of habitats. It has a tendency to be something of a weed (an important point).

"Concerning the 'weediness' of *A. angustissima,* at our 1650 meter site naturally sown seeds do not germinate for a year or so, which indicates a dormant period. After this period seeds seem to germinate readily. It does not seem to set seed readily at sea level. For germination in the nursery, scarification (soaking in 90 degree C water for 30-60 seconds) is necessary. I have experienced no problems germinating it in a sawdust medium at sea level, but it does very poorly when sown directly in the field at low elevations; at higher altitudes it grows readily when field sown. Its fodder quality is reported from Australia to be poor, with low digestibility of nitrogen.

"Calliandra houstoniana is similar to the better known *C. calothyrsus,* but produces foliage even more profusely and naturally forms a more dense hedge. It looks like a good prospect for alley farming and erosion control barriers. *C. calothyrsus* is



(/resources/a0330e91-6aee-4fd5-97eb-e0f34c069289)reported to have a high tannin content in the foliage, which makes it a problem for use as a fodder. I do not know if *C. houstoniana* has the same characteristics. It flowers profusely and butterflies love it, so it might be useful for bee keeping. Its glossy green foliage and

relatively compact form (2.5-3 meters at sea level) make it a good ornamental.

"Our work with these and numbers of other species continues at a wide range of sites, so readers may like to write to find our latest results." His address is Lowlands Agricultural Experiment Station; P.O. Keravat; East New Britain Province; PAPUA NEW GUINEA. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

GLIRICIDIA SEPIUM. *Gliricidia* is a fast-growing leguminous tree for frost-free tropical regions with 450- 3500mm rainfall. It is used for fodder, living fences, green manure, contour plantings, fuelwood, etc. It is fairly termite resistant. This species is native to Central American and Mexico. See Chapter 8 on Plant Protection (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch8pla.htm#Succ) for information on using this tree to kill rats. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

LEUCAENA LEUCOCEPHALA. "I want to plant *Leucaena,* but which type should I choose?" *Leucaena leucocephala* is a (/resources/b8d28a5a-5c18-491b-a2ad-26a7af9250ce) fast-growing, leguminous tree that nearly all of you have heard about. It has been used for reforestation, for firewood, and as a forage crop that can equal alfalfa in nutritional value. Researchers have given it much attention in recent years. We have compiled the following recommendations from various sources in our files, especially from material provided by Dr. James Brewbaker, professor of horticulture and genetics at the University of Hawaii. There are three basic types of leucaena trees: Hawaiian, Salvador, and Peru. There are also crosses between these. You need to chose the type that best fills your needs. The **Hawaiian** type is short and bushy. Because its yield of wood and foliage is low compared to the other two types, this would probably be a poor choice. The **Salvador** type (Hawaiian giant) is tall and tree-like. The trees can grow 60 feet in height in 5 years. The best varieties of this type are K28 and K67. K67 is the best variety for projects that need high seed production. The **Peru** type is tall with extensive branching. The trees are good for forage; K6 is a good variety. An excellent forage-type leucaena is the Cunningham (K500) which was developed in

Australia. It is a cross between the Salvador and Peru types.

Dr. Brewbaker has strongly recommended that we distribute more than one variety. He says, "...this is a self-pollinated, pure-line species, and it is a long-lived tree. We want to avoid spreading one variety over very large areas." (We presume this is because there is less danger of total loss from an insect or disease outbreak if several varieties have been planted.) His (/resources/b72004fd-fb79-4b32-bc0d-52dfc185e9ac)particular recommendation is that we distribute K28, K67 and K500. ECHO has these types among others and will be happy to send you several small packets for trial. If you want larger quantities or different varieties, write to us requesting a list of leucaena suppliers. We have addresses for suppliers in Asia, Australia, North and South America. We can also send a practical, two-page write-up by Dr. Brewbaker on how to germinate, transplant, collect and store seeds, etc.

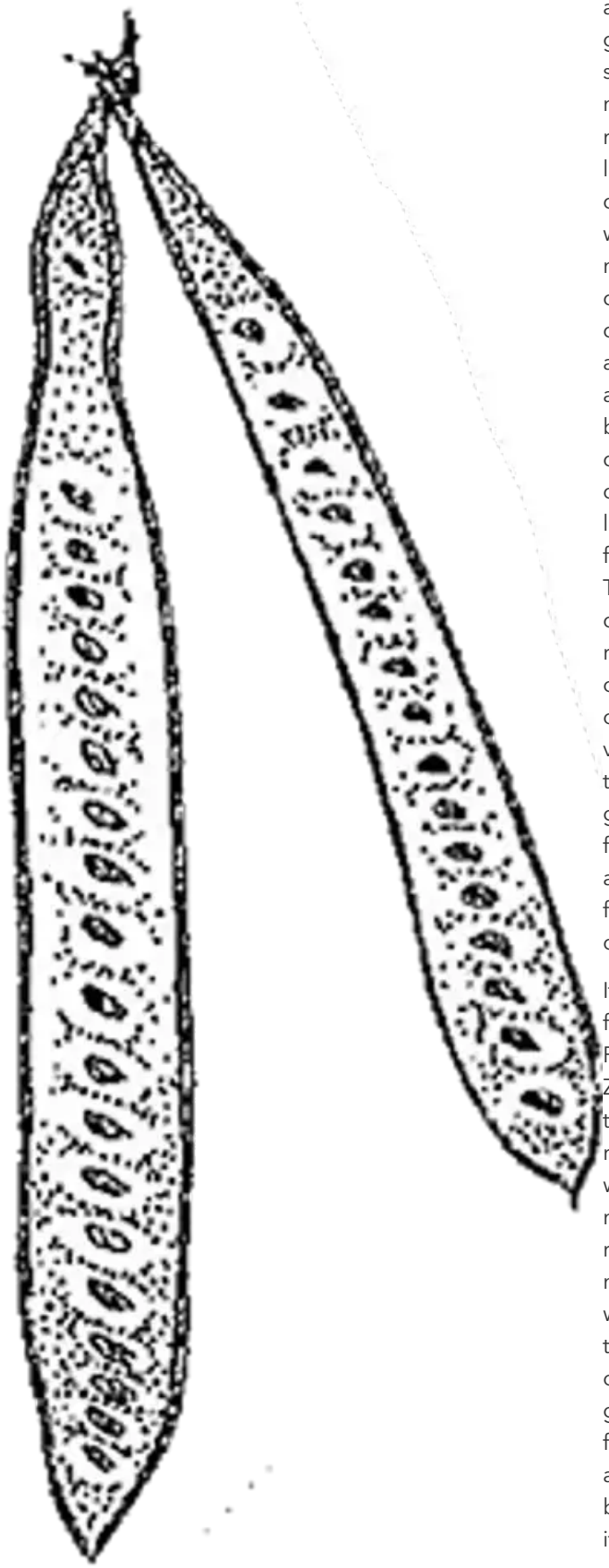
Varieties K4 and K743 (hybrid) are low in mimosine, a chemical present in leucaena which can be toxic to animals when eaten in large quantities. *Leucaena diversifolia* is better for higher altitudes (500-2000m) than *L. leucocephala;* ECHO usually carries two varieties of this species.

See Chapter 8 on Plant Protection for information on the psyllid problems (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch8ins.htm#Leuc) in *Leucaena.* (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

EYE-CATCHING LEUCAENA. Terry Waller wrote from Equatorial Guinea: "The velvet bean you sent before we were transferred to Bolivia was the most prolific and several church members were growing them in villages. The K8 variety of leucaena also grew great and we were able to introduce the concept of agroforestry. A recent letter from one of the farmers mentioned a surprising result: the aesthetic influence of agroforestry. He said that people from all over his neighborhood were coming by his garden (he lives in a very crowded slum area) and having pictures taken. Then they would get interested in the more practical aspects. Poor people like to feel good about their surroundings too." (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

THE MORINGA TREE, *MORINGA OLEIFERA,* IS CALLED MOTHER'S BEST FRIEND. That is one way they sometimes refer to this tree in the Philippines where the leaves of the malunggay, as they call it, are cooked and fed to babies. Other names for it include horseradish tree and drumstick tree (India) and benzolive (Haiti). Moringa is one of the most successful plants in ECHO's (/resources/758e2036-4dc1-4527-9ff4-f517963ff56f)seedbank. Moringa tree leaves, pods, and roots are eaten; flowers are loved by bees; and seeds are powdered and used to purify water from murky rivers. I believe it is one of the most exciting and versatile plants that we have in our seedbank of tropical plants.

The leaflets can be stripped from the feathery, fern-like leaves and used in any spinach recipe. Small trees can be pulled up after a few months and the taproot ground, mixed with vinegar and salt and used in place of horseradish. Very young plants can be used as a tender vegetable. After about 8 months the tree begins to flower and continues year round. The flowers can be eaten or used to make a tea. They are also good for beekeepers. The young pods can be cooked and have a



taste reminiscent of asparagus. The green peas and surrounding white material can be removed from larger pods and cooked in various ways. Seeds from mature pods (which can be 2 feet long) can be browned in a skillet, mashed and placed in boiling water, which causes an excellent cooking or lubricating oil to float to the surface. The oil reportedly does not become rancid and was once sold as "ben oil." The wood is very, very soft, though the tree is a good living fencepost. It makes acceptable firewood but poor charcoal.

It is an extremely fast-growing tree. Roy Danforth in Zaire wrote, "The trees grow more rapidly than papaya, with one three month old tree reaching 8 feet. I never knew there would be such a tree." The tree in our organic garden grew to about 15 feet in 9 months, and had been cut back twice to make it branch out more.

It is well to prune trees frequently when they are young or they will become lanky and difficult to harvest. Where people begin breaking off tender tips to cook when trees are about 4 or 5 feet tall, the trees become bushier.

The folks to whom we have sent the tree in Africa have been pleased at its resistance to dry weather. Rob Van Os rated its growth, yield and potential as exceptional and added that it "can be planted after the other crops, even near the end of the rains." He has introduced it into several villages already. The first plants grew so well for Gary Shepherd in Nepal that he had us arrange for sending him 1,000 of the large seeds. He reports that at five months one was 12 feet tall and most were 6 feet.

There is more good news. The edible parts are exceptionally nutritious! Frank Martin says in *Survival and Subsistence in the Tropics* that "among the leafy vegetables, one stands out as particularly good, the horseradish tree. The leaves are outstanding as a source of vitamin A and, when raw, vitamin C. They are a good source of B vitamins and among the best plant sources of minerals. The calcium content is very high for a plant. Phosphorous is low, as it should be. The content of iron is very good (it is reportedly prescribed for anemia in the Philippines). They are an excellent source of protein and a very low source of fat and carbohydrates. Thus the leaves are one of the best plant foods that can be found." In his *Edible Leaves of the Tropics* he adds that the leaves are incomparable as a source of the sulfur-containing amino acids methionine and cystine, which are often in short supply.

It responds well to mulch, water and fertilizer. It is set back when our water table stays for long at an inch or two below the surface. We planted one right in the middle of our vegetable garden for its light shade. The branches are much too brittle to support someone climbing the tree. It is not harmed by frost, but can be killed to the ground by freezes. It quickly sends out new growth from the trunk when cut, or from the ground when frozen. Living fences can be continually cut back to a few feet.

CULTIVATION. I quote Alicia Ray, who wrote a booklet on the benzolive in Haiti some time ago. "It seems to thrive in impossible places--even near the sea, in bad soil and dry areas. Seeds sprout readily in one or two weeks. Alternatively one can plant a branch and within a week or two it will have established itself. It is often cut back year after year in fence rows and is not killed. Because of this, in order to keep an abundant supply of leaves, flowers and pods within easy reach, "topping out" is useful. At least once a year one can cut the tree off 3 or 4 feet above the ground. It will readily sprout again and all the valuable products will remain within safe, easy reach."

Scott Josiah writes that the Pan American Development Foundation in Haiti planted many kilometers of moringa as a living hedgerow on the contour of steep slopes, with mixed results. "In some cases, the growth has been excellent, nearly comparable to that of *Leucaena leucocephala.* However, *M. oleifera* has generally been a moderate performer, and seems rather sensitive to droughty sites and/or limited rainfall."

Beth Mayhood with Grace Mountain Mission wanted to establish a model vegetable garden on a small piece of land. "It was windswept and sunbaked with no natural barriers or trees in the area. Soils were poor and very alkaline. The salt content was also high. We started in January to prepare large quantities of compost. In April holes were dug in the poor soil and filled with compost. Benzolive trees planted in seedbeds germinated in 3-4 days. In 9 weeks they were transplanted in between the garden beds, around the edge of the 200 x 250 ft area and in a double row about 5 ft apart in the middle. The trees protected against the prevailing winds." I saw slides of this spot later. It was impressive. The light shade of the tree is a considerable help to most vegetables.

I cannot emphasize enough how important it is to use pruning of some sort. If left to itself

the tree becomes quite tall and lanky. This method of cutting it back to 4 feet each year sounds good. One method I tried with some success was to cut each branch back a foot after it had grown 2 feet until it was a multibranched shrub. Alternatively, normal harvesting can have the same effect if begun while the tree is young. Beth Mayhood wrote, "We liked them so much we began picking the growing tips to boil as a spinach several times a week. This picking of the growing tips caused the tree to branch. Our constantly pruned trees became thick-limbed and many-branched."

I am told that when grown for its roots, the seeds are sometimes planted in a row like vegetables.

COOKING THE LEAVES. Alicia Ray writes, "Of all parts of the tree, it is the leaves that are most extensively used. The growing tips and young leaves are best. [Ed: However, we sometimes pull the leaflets off in our hands and cook them without regard to age.] Unlike other kinds of edible leaves, benzolive leaves do not become bitter as they grow older, only tougher. When you prepare the leaves, always remove them from the woody stems which do not soften. [Ed: We did not know this the first time we served them. It was like having wire in the dish.]

"The leaves can be used any way you would use spinach. One easy way to cook them is this: Steam 2 cups freshly picked leaves for just a few minutes in one cup water, seasoned with an onion, butter and salt. Vary or add other seasonings according to your taste. In India, the leaves are used in vegetable curries, for seasoning and in pickles. Let your imagination be your guide."

Ross Haliburton in Pakistan wrote, "We planted moringa seeds in April and, with hand watering, they have grown well. The tender leaves from six plants have been regularly used like spinach since July. A group of Afghan refugee men (chiefs and nurserymen caring for small nurseries in the refugee villages) visited us. When they saw the moringa trees they immediately asked for seed. We believe this tree has potential as a green vegetable in refugee villages, where there is a general lack of greens, especially through the summer."

Dr. Warwick Kerr wrote from Brazil that while he was the president of the State University of Maranhao, he organized a group of students and professors to carry out an extension project. They planted 25,000 moringa seedlings (all descendants from one small packet we sent him in an envelope a few years ago). "I like the moringa omelet that my wife prepares almost every morning. Collect a bowl of leaves, wash and fry for five minutes with sliced onions, garlic and salt. While this is cooling, minced tomato and onion are lightly fried then mixed with the fried moringa. Half a cup of this mix, two eggs and a spoon of any bullion soup mix are stirred and then cooked. It is delicious!" [He added that the chaya cuttings we sent made it fine and he has now distributed many plants in the community. "My wife is cooking it at least once a week and prepares it in many ways. This was the most sensational introduction: 8 small stalks in a regular airmail envelope!"]

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 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.

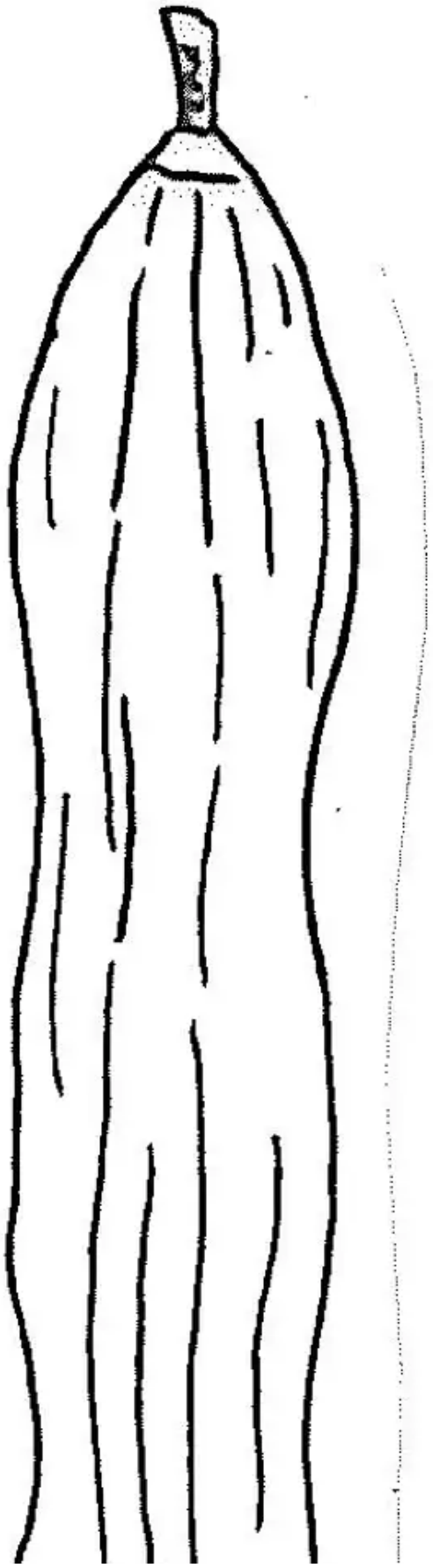
We have printed many success stories with the moringa tree. But cultures differ. Mr. C. N. Okonkwo in Nigeria ran into problems with acceptance. "All the seeds germinated and some are providing pods. Unfortunately I have not been able to convince any of the farmers to eat the leaves, except myself. The reasons are three: (a) the leaves have no eye appeal, (b) the leaves have a foul smell, (c) the growing tips have no commercial value. I am not disputing the claims regarding moringa. But in a community where so many broad-leaved vegetables thrive abundantly and some fetch good money, it is not hard to see why farmers look at this scanty small-leaved tree with some doubt."

COOKING THE PODS. Alicia Ray writes, "When young, horseradish tree pods are edible whole, with a delicate flavor like (/resources/3eb97c3f-e5bf-4e20-bd6b-ad56408bea1e)asparagus. They can be used from the time they emerge from the flower cluster until they become too woody to snap easily. The largest ones usable in this way will probably be 12 to 15 inches long and 1/4 inch in diameter. At this state they can be prepared in many ways. Here are three:

1. Cut the pods into one inch lengths. Add onion, butter and salt. Boil for ten minutes or until tender.
2. Steam the pods without seasonings, then marinade in a mixture of oil, vinegar, salt, pepper, garlic and parsley.
3. An acceptable "mock asparagus" soup can be made by boiling the cut pods until tender, easoned with onion. Add milk, thicken and season to taste.

Even if the pods pass the stage where they snap easily they can still be used. You can cut them into three inch lengths, boil until tender (about 15 minutes), and eat as you would artichokes. Or you can scrape the pods to remove the woody outer fibers before cooking."

COOKING THE PEAS. Alicia Ray writes that the seeds, or "peas," can "be used from the time they begin to form until they begin to turn yellow and their shells begin to harden. Only experience can tell you at what stage to harvest the pods for their peas.

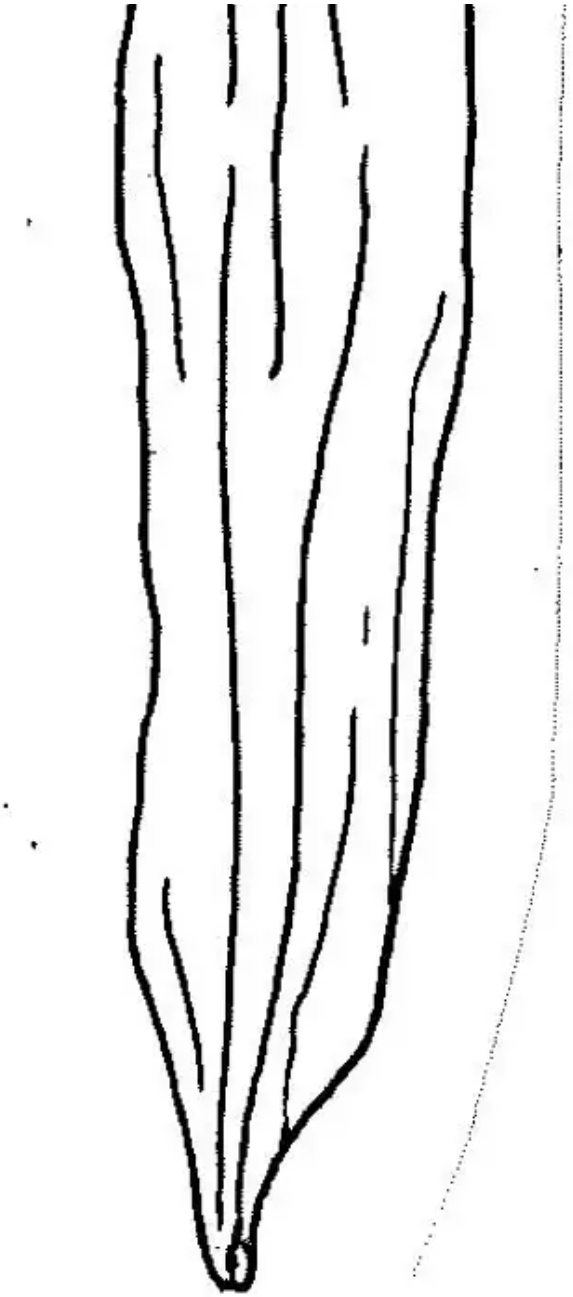


"To open the pod, take it in both hands and twist. With your thumbnail slit open the pod along the line that appears. Remove the peas with their soft winged shells intact and as much soft white flesh as you can by scraping the inside of the pod with the side of a spoon. Place the peas and flesh in a strainer and wash well to remove the sticky, bitter film that coats them. (Or better still, blanch them for a few minutes, then pour off the water before boiling again in fresh water.) Now they are ready to use in any recipe you would use for green peas. They can be boiled as they are, seasoned with onion, butter and salt, much the same as the leaves and young pods. They can be cooked with rice as you would any bean.

"In India the peas are prepared using this recipe:

12-15 horseradish tree pods
4 cups grated coconut
2 inches ginger root
1 clove garlic
salt, pepper to taste
1 medium onion, diced
2 bouillon cubes
4 T. oil or bacon grease
2 eggs, hard boiled

"Blanch both peas and pods' flesh, drain. Remove milk from 2 1/2 cups grated coconut by

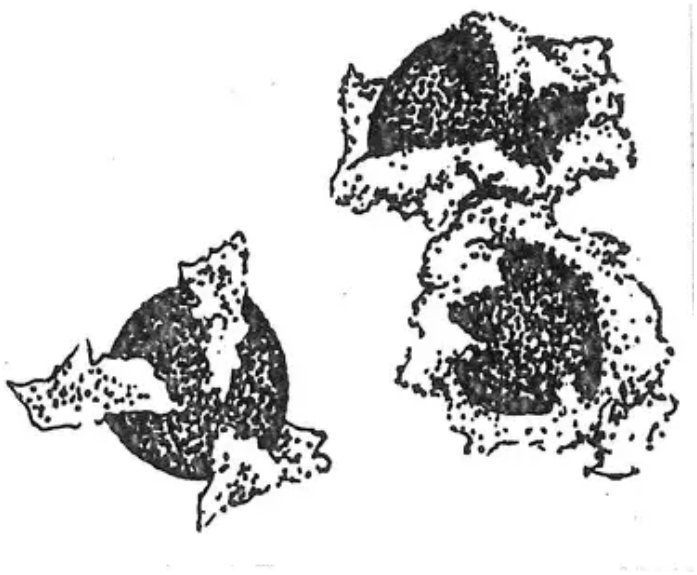


squeezing water through it two or three times. Crush ginger root and garlic, save half for later. Mix peas, flesh, coconut milk, ginger and garlic together with onion, bouillon cubes, oil, salt and pepper. Bring to a boil and cook until the peas are soft, about 20 minutes. Fry remaining coconut until brown. Fry remaining half of crushed ginger root and garlic in 2 T. oil. Dice eggs. Add coconut, ginger, garlic and eggs to first mixture, heat through. Serves 6.

THE DRY SEEDS. The dry seeds are apparently not used for human food, perhaps because the bitter coating has hardened. They are used for their oil, which is about 28% by weight. The oil can be removed by an oil press. I have heard reports that the residual cake is not safe to feed to animals, but I have not seen the results of any studies. Write to me if you have details. If an oil press is not available, seeds can be roasted or browned on a skillet, ground, then added to boiling water. The oil floats (/resources/98bf6dae-d6df-4be6-b209-165522ad1858) to the surface. Alicia Ray says that roasting is, however, not necessary.

Randy Creswell in Mali wrote, "The Khassonkes in Mali have been growing moringa trees for their leaves as far back as anyone's knowledge seems to go. Besides leaves, we have found good profit in a high quality edible oil readily pressable from the seeds. We are planting 1500 moringa seedlings."

THE FLOWERS. A visitor who had spent time in the Pacific area told me recently that the flowers are eaten there. Unfortunately, I do not recall details. Perhaps our readers can help. Alicia Ray says they are used in Haiti for a cold remedy. Water is boiled, then a cluster of flowers is placed to steep in it for about 5 minutes. Add a little sugar and drink as needed. It is very effective!



THE ROOTS. The tree is uprooted and the roots grated like horseradish. Alicia Ray says to one cup grated root add 1/2 cup white vinegar and 1/4 t. salt. "Chill for one hour. This sauce can be stored for a long time in the refrigerator." The following caution quotes from a recent review by Dr. Julia Morton in *Economic Botany.*

"The root, best known in India and the Far East, is extremely pungent. When the plant is only 60 cm tall, it can be pulled up, its root scraped, ground up and vinegar and salt added to make a popular condiment much like true horseradish. ...The root bark must be completely removed since it contains two alkaloids allied to ephedrine -- benzylamine (moringine), which is not physiologically active, and the toxic moringinine which acts on the sympathetic nerve endings as well as on the cardiac and smooth muscles all over the body. Also present is the potent antibiotic and fungicide, pterygospermin. The alkaloid, spirachin (a nerve paralyzant) has been found in the roots.... Even when free of bark, the condiment, in excess, may be harmful." (The key words are "in excess"--the body can detoxify small amounts of a great many things.)

USE AS AN ANTIBIOTIC. A study at University of San Carlos in Guatemala is summarized. Herbal applications are commonly used to treat skin infections in developing countries, although few investigations are conducted to validate (/resources/ac30d348-1a09-440b-9f71-005e953ee769)scientifically their popular use. A previous study had showed that moringa seeds are effective against skin infecting bacteria *Staphylococcus aureus* and *Pseudomonas aeruginosa in vitro* (i. e. in a test tube). This study showed that mice infected with *S. aureus* recovered as quickly with a specially prepared aqueous extract of moringa seed as with the antibiotic neomycin.

This study proves only the effectiveness of moringa *as they prepared it.* That preparation could be done in any country, but not with just household utensils. It was prepared by infusing 10 g powdered moringa seeds in 100 ml of 45 deg.C water for 2 hours. The part that is a bit more complicated is reducing the 100 ml down to 10 ml by placing it in a rotavaporator. This is a very common piece of laboratory equipment which continually rotates a flask containing the liquid. An

aspirator attached to a faucet produces a modest vacuum when the water is turned on. A rubber tube from the aspirator is connected to the rotavaporator, reducing the pressure and causing the water to evaporate rather quickly without boiling it. The ointment was prepared by placing 10% of the extract in vaseline. (We can send a copy of the article to medical personnel.)

Are you in a situation where there is a shortage of antibiotics? This ointment could be prepared for use in the local community wherever there is electricity and running water. Simpler methods, better suited to preparation as needed in the home, might also be effective. I hope someone will devise and test such preparations.

ECHO can provide trial-sized quantities of *Moringa oleifera* from the trees on our farm. For those seeking other potential sources we can recommend the following:

Christas Cactus, 529 W. Pima, Coolidge, AZ 85228, USA; phone 602/723-4185.
Greenleaf Seeds, P.O. Box 98, Conway, MA 01341, USA; phone 413/628-4750 (No telephone orders).
Of the Jungle, P.O. Box 1801, Sebastapol, CA 95473, USA.
Peace Seeds, 2385 S.E. Thompson Street, Corvallis, OR 97333, USA; phone 503/752-0421.
Peter B. Dow & Co., P.O. Box 696, Gisborne 3800, NEW ZEALAND; fax (079) 78 844.
Ellison Horticultural Ltd., P.O. Box 365, Nowra, N.S.W. 2541, AUSTRALIA; phone 6144-214255.

Kumar International, Ajitmal 206121, Etawah, Uttar Pradesh, INDIA.
Samuel Ratnam, Inland & Foreign Trading Co., Block 79A, Indus Road #04-418, SINGAPORE 169589; phone 2722711; fax 2716118.

Tom Post in Belize mentioned that his moringas are growing so well he now needs recipes. The Philippine book *Learn to Eat Malunggay* has 18 pages of recipes; write to ECHO for a photocopy.

Refer to Chapter 11 on Human Health for information on using moringa in water clarification. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch11he.htm#Mori)

If moringa does not already grow in your region, you may request a trial packet of the marble-sized seed. It grows wild in many places (such as Haiti and the Dominican Republic) where people do not know it is edible. The moringa is one of God's abundant resources for the struggle against world hunger. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

MORINGA STENOPETALA. *Moringa oleifera,* native to India, is the number one seed in our seedbank, in terms of number of requests and positive reports. 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. Dr. Samia Jahn shared some seed with us in the past, but our supply is very erratic; if you request seed (FOR OVERSEAS NETWORK ONLY), be aware that you may have to wait a while to receive the seed. If this is your first interest in moringa, please do initial trials with *M. oleifera.* If you have had success with *M. oleifera,* it may be time to try this "new" species.

Michael Madany wrote from Somalia 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 8-year-old *M. stenopetala* tree has not yet flowered. We thought it was due to its having been badly damaged by two freezes. 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.* Charlie Forst in Haiti reported that his tree flowered in 15 months, grown from a cutting, which may make the difference. In the central plateau of Haiti, the low-branching, large-leaved *M. stenopetala* has far superior growth in the dry season. It is in full leaf after months without rain, while *M. oleifera* suffers after severe drought.

Michael Madany wrote again, this time from Kenya. "Since I am quoted in EDN with regard to our experience with *Moringa stenopetala* in southern Somalia, I'd like to send a few more comments. The last time I saw the trees we planted in February 1986 was January 1990. They had only flowered once (in 1987 or 1988; only a few flowers) and never set seed. Thus, whenever I wanted to plant more, I was obliged to use cuttings. As far as a source of green vegetable matter in the dry season, the tree surpasses its domestic relative *Moringa oleifera* in that climate (bimodal rainfall of 400-800 mm; 20-40 deg.C). However, for the purpose of producing water-purifying seeds it seems to be not so successful, at least in the first 5 years. I am mystified as to the reasons for this. The provenance for our trees was over 500 km west at a considerably higher elevation." Michael mentions that during the civil war in Somalia the project buildings were destroyed and "all the trees in our garden were cut down."

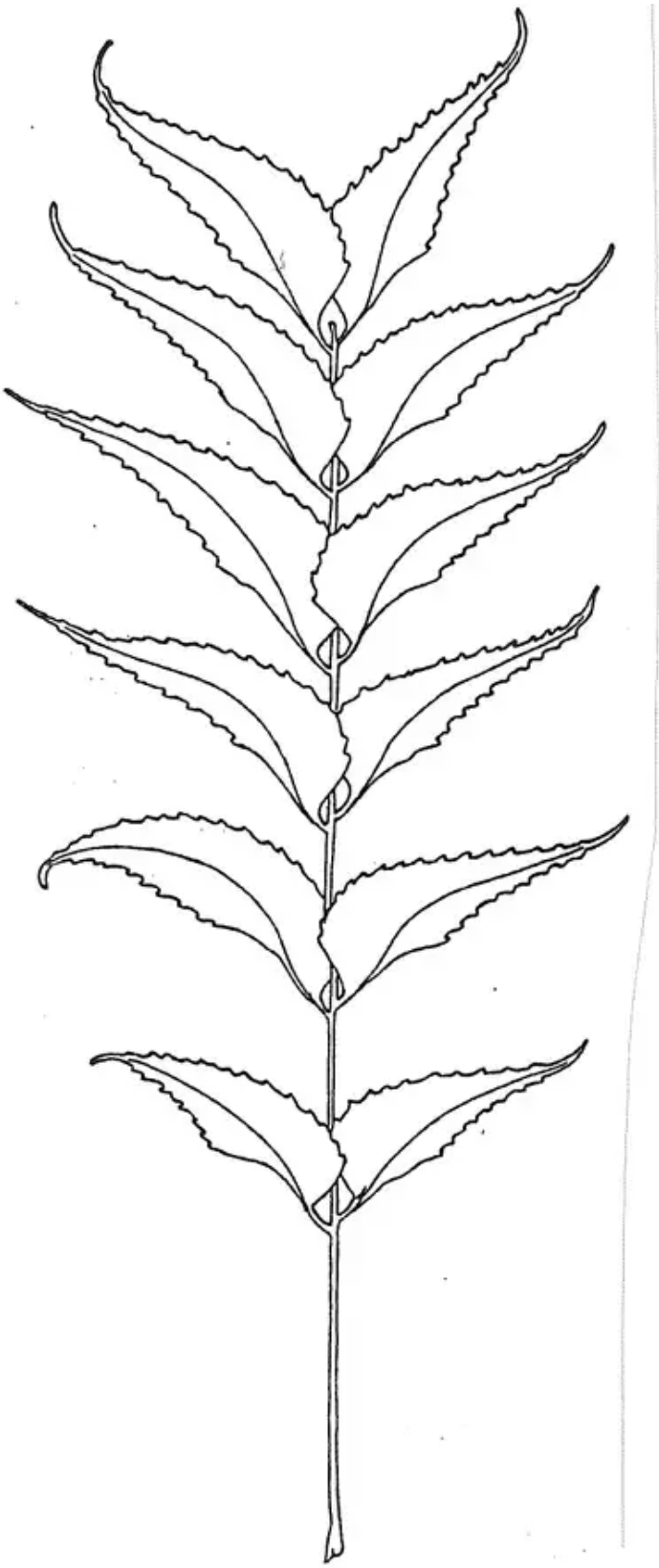
Jay Ram wrote from the Pacific Neem Mission in Hawaii. "My *Moringa stenopetala* tree is now 10 feet tall and growing vigorously. I really share your enthusiasm for this wonderful tree. It is one of the best species we have come across. Fast growing with good form, and high palatability. In fact, I commonly will eat the boiled leaves by themselves, [something I do not do with *Moringa oleifera* which is common on the island]."

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.

ECHO does not have a regular source for *M. stenopetala.* Watch future EDNs for availability, or write to be on our waiting list (send last date we should send seed). (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

THE NEEM TREE *(AZADIRACHTA INDICA)* FOR REFORESTATION AND AN EFFECTIVE INSECTICIDE. I first (/resources/ee57daf2-5ebb-47a6-9dcb-



6a3ff52c3957)encountered the neem tree in Haiti, where hundreds have been planted along highways. I understand that it was chosen in part because it would grow very quickly and encourage the people that reforestation was possible. When

I last visited Grace Mountain Mission in Port-au-Prince, there were 15-20 foot neem trees where there had been nothing a year before! Its seeds contain an especially effective natural insecticide. See Chapter 8 on Plant Protection for more on using neem as an insecticide. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch8pla.htm#Pest)

The tree originated in India or Burma, where it is used widely for its insecticidal and medicinal properties. It is also grown in much of Africa, primarily for firewood. Seeds contain up to 40% oil which can be used for soap or lamp fuel. The residual neem cake is a good fertilizer with some nematicidal properties. (It is the neem oil that is primarily used as an insecticide; water extracts of powdered kernels also can be used in this way.) Neem is fast-growing and drought resistant, excellent for reforestation of semiarid lands. It is an evergreen (except in extreme drought) and valued for its shade--especially in cities--and windbreak protection. It grows best in deep, well-drained sandy areas, but thrives even on acid soils. It may fail in silty or clay soils and in waterlogged sites. To plant, pick fully ripe seeds directly from the tree and plant immediately. The trees may be direct sown or transplanted, and they benefit greatly from tillage, weeding, irrigation, and some fertilization in the first few months of growth (or after transplanting). Neem has been established in many countries throughout the tropics; there is a good chance you may find seed in country if you make inquiries.

A good source of additional information is the National Academy of Sciences publication Neem: *A Tree for Solving Global Problems.* It is available from: **BOSTID Publications**--HA 476, 2101 Constitution Avenue N. W., Washington, D.C. 20418, USA. ECHO now has it available for sale for $19.00 plus $2.00 postage in the USA. If you work with small farmers in the developing world, write ECHO before ordering about how this book would be useful in your work; you may qualify for a substantial discount.

Ordering neem seed can be difficult. The seeds may be viable for less than a month. You are strongly encouraged to find local sources of the seed. When ECHO receives an order, we hold the orders until either our tree produces (which it does not do every year) or we obtain a fresh shipment from overseas. For those visiting ECHO, we often have seedlings available in our nursery. We also refer you to some potential U.S. sources:

EXTRACT:
AgriDyne Technologies, Inc., 417 Wakara Way, Salt Lake City, UT 84108, (801)583-3500; fax 583-2945.
Ringer, Valley View Road, Eden Prairie, MN 55344.
Jim Walter, W.R. Grace Washington Research Center, 7379 Route 32, Columbia, MD 20861, (410)531-4000.

SEED: Seeds are only available on a seasonable basis, as they must be planted within 3-4 weeks of harvest.
Agricultural Research Service (ARS), US Department of Agriculture (USDA), 13601 Old Cutler Road, Miami, FL 33158, (305)238-9321.
The Kerr Center for Sustainable Agriculture, Vero Beach Research Station, 7055 Cherry Lane, Vero Beach, FL 32966, (407)562-3802.
Robert Barnum, Possum Trot Nursery, 14955 S.W. 214th Street, Miami, FL

33187, (305)251-5040.
FLAG Unit, International Livestock Centre for Africa(ILCA), P.O. Box 5689, Addis Ababa, Ethiopia.
The Tree Seed Program, Ministry of Energy and Regional Development, P.O. Box 21522, Nairobi, Kenya.

SEEDLINGS:
Saleem Ahmed, East-West Center, 1777 East-West Road, Honolulu, Hawaii 96848, USA; phone 808/944-7111.
Robert Barnum, Possum Trot Nursery, 14955 S.W. 214th Street, Miami, FL 33187; phone 305/251-5040.
John Conrick, Winter Park, FL; phone 407/384-7616.
Chip Gardner, CA; phone 209/674-9543.
Pacific Tree Farms, 4301 Lynnwood Drive, Chula Vista, CA 92010 ($36 per plant, no seeds).
Marlin Huffman, Plantation Botanicals, Inc., PO Box 128, Felda, FL 33930; 813/675-2984, fax: 675-4591, (top quality West African germplasm from Larson, planted mid-1991).
Sandy Mush Herb Nursery, Rt. 2, Surrett Cove Rd, Leicester, NC 28748; 704/683-2014, (root cuttings).

INFORMATION:
The Neem Association, 1511 Oneco Avenue, Winter Park, FL 32789, USA. (May be closed.)
Axel Bosselmann, POB 1166, Charters Towers, 4820 Qld., AUSTRALIA (publishes Neem Notes).

OVERSEAS SEED SOURCES (for those working overseas only please):
Jean Hanson, ILCA, FLAG Unit, P. O. Box 5689, Addis Ababa, ETHIOPIA.
The Tree Seed Program, Ministry of Energy & Regional Development, P. O. Box 21552, Nairobi, KENYA.
Henry Doubleday Research Association, Ryton-on-Dunsmore, Coventry, CV8 3LG, UK; phone 0203-303517.
H.E. Ostmark, Ph.D., Director of Research, FHA (Fundacion Hondurena de Investigacion Agricola, Apartado Postal 2067, San Pedro Sula, HONDURAS; phone 504/68-2078, 68-2470; fax 504/68-2313 (willing to fill requests for Neem from Central America. Available September only).
Rene D. Haller, Baobab Farm Limited, P.O. Box 81995, Mombasa, KENYA; Telex 21265; phone 485729/754/501.
Roy B. McKenzie, McKenzie Agrisystems, Ltd., PO Box 95979, Mombasa, KENYA; phone 433460 Mombasa, 747131 Nairobi; fax 432309 Mombasa.
Tanzania, Forestry Research Institute, Silviculture Research Centre, P.O. Box 95, Lushoto, TANZANIA.
Forestry Research Institute of Malawi, P.O. Box 270, Zomba, MALAWI; phone 522866/522548.
Kenya Forestry Seed Centre, Kenya Forestry Research Institute, P.O. Box 20412, Nairobi, KENYA, phone: 0154-32541.
Regional Seed Centre, Forestry Commission, Forest Research Centre, P.O. Box H.G. 595 Highlands, Harare, ZIMBABWE; phone 47070/46878/9.
Nathanael Ariyo Olonire, P.O. Box 2674, Sokoto, NIGERIA, West Africa (bulk neem seed, leaves etc.).

Professor S.X. Charles, Director, "Thayagam", 172 K.P. Road, NAGERCOIL-629001, Kanyakumari District, Tamil Nadu, S. INDIA.
India Nursery & Seeds Sales Corporation, P.O. Box 4314, 36/962 DDA Flats, Kalkaji, New Delhi-19, INDIA (neem seed bulk).
Shivalik Seeds Corporation, 47 Panditwari, P.O. Prem Nagar, Dehra Dun -248 007 (UP), INDIA; phone 91 135683348; fax 91 135 29944.
Kimberly Seeds, 51 King Edward Rd, Osborne Park 6017, AUSTRALIA; phone (09) 4464377 (neem seed bulk).
Green Gold Intl., 14071/5, Prabhat Nagar, Dholewal, Ludhiana 141003, INDIA; phone 0091(161)535461; fax 009(161)28515, 34793 (neem seed or stem cuttings from superior seeds for rooting under mist).
(https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

CROSS-POLLINATE TO GET NEEM SEED. Norman Siegel in Mexico asked about a neem tree that did not bear seed. They ended up with only one tree from the seed packet we sent. This can easily happen because neem seeds are only viable

(/resources/9c77c293-4e72-4a7a-849c-1af29e6a2c44) for perhaps a month. "We have been reproducing it by cuttings but it has not yet seeded." The problem may be that neem must be cross-pollinated with an unrelated neem tree. We planted two neem trees at ECHO, about 200 meters apart. We waited in vain for fruit to set the first two years after they reached blooming age. The next year we had a small tree in a pot that was blooming, so positioned it on a small platform near one side of the larger tree. That year we had fruits in a circumference of a few feet around where that pot had sat. I have never read of this requirement, but in most real-life situations other trees would be nearby.

We planted a second tree beside our one tree. Last year it bloomed, and both trees produced fruit. We grafted this tree onto the more distant tree. The tiny grafts gave a few blossoms and I believe we got some fruit. Our Edible Landscape Nursery is preparing to sell neem trees with an unrelated graft so that home owners who only have room for one tree can get seed. A veneer graft takes well.

By the way, a 26 deg.F freeze had this effect on our seven-foot neem tree: I had water spraying on the tree that night at about 4 feet. It was fine from there down, but after some weeks the leaves above 4 feet dropped. Eventually all parts that were

not protected with water spray died. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

NEEM IN AFRICA. Ralph Kusserow in Tanzania wrote, "After reading about the neem tree in EDN I really wanted to try it, but was afraid to order seed because it is viable for such a short time. Then I found that we have it here in Tanzania, though not in our area. In case you have anyone else in a Swahili-speaking area, it might help to know that it is called mwarobaini in Swahili. That means the "forty tree," so called because it supposedly makes medicines to treat 40 diseases. ...My main interest in neem is your report that the leaves can make a tea to deter termites. One of our friends has built a house every year for three years because of termite damage to the grass roof. I am anxious to see if neem leaf juice might be used in this situation." (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

***PAULOWNIA,* CHINA'S WONDER TREE.** I asked Zhu Zhachua with the Chinese Academy of Forestry in Beijing, China for *Paulownia* seed after reading about it in *IDRC Reports. [IDRC Reports* is published by the Canadian aid agency, IDRC. Every issue is interesting. Contact IDRC, P.O. Box 8500, Ottawa, Ontario, CANADA K1G 3H9; internet mag@idrc.ca.] Two species of this broad leaf tree, *Paulownia glabrata* and *P. elongata,* are now widely planted in China, where it is adapted to most of their climatic zones. A 15 cm long root cutting can grow 18 feet (6 m) the first season. A 5-year-old tree can reach 17 m and have a 30 cm trunk diameter. Leaves make good animal fodder. It is planted for timber (though not of the highest quality) and firewood. It is intercropped with crops such as wheat, corn, millet and vegetables, to protect against wind, for shade, and as a green manure. Intercropped land in China has increased from 20,000 hectares in 1970 to 1.3million today. For example, using 10 m rows and 5 m spacing in a wheat field, the yield of wheat was the same as in open-field cultivation. When the distance between the rows was increased to 20-40 m, the yield actually increased 7-10%. There are *Paulownia* plantations in the USA for export to Japan. ECHO does **not** have Paulownia seed; we refer you to Dr. Peter Beckjord at the National Paulownia Center, 10908 Dresden Dr., Beltsville, MD 20705, USA; phone 301/937-4635. You must send him US$1 to cover postage for basic instructions, a brochure, and an introductory packet of 500-1000 seeds. He also has much more information available if your trials go well. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch4mul.htm#Table)

***SESBANIA ACULEATA* FOR FIREWOOD THAT GROWS UNDER TOUGH CONDITIONS.** Bob Burns in Bangladesh sent us a few seeds of this plant, also called *Sesbania bispinosa,* prickly sesban and dhaincha. According to the book *Firewood Crops* by the National Academy of Sciences, this is a quick-growing shrub that can produce a low-density firewood in only six months. In Vietnam it is grown in rice fields and its stems harvested for firewood before the rice crop is planted. It is a legume (/resources/0b8c47cb-f943-4f96-a273-a1b229a4e24d)that nodulates vigorously. Its fibers are very similar to birch, one of the best trees for paper. Stems can be processed into a jute-like fiber, used for making fishing nets, sacks and sails. Other uses include for windbreaks, erosion control, cover crop and green manure. The leaves reportedly make good cattle fodder. It is **well adapted to difficult soils.** It will grow on saline and alkaline wastelands and wet, almost waterlogged soils, even in areas that often remain barren for want of suitable crops.