EDN ECHO Development Notes

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Edited by Martin Price
and Dawn Berkelaar

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

Issue Highlights

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Traditional Techniques to Improve Plant Performance

By Dawn Berkelaar

An article by Francis Hallé in *Nature and Resources*, Volume 32, Number 3, 1996, explains several techniques used to "improve, select, propagate or preserve plant growth." These techniques are called "phytopractices." Most of them are inexpensive and simple to use but labor-intensive. The practices generally apply to individual plants, and most need to be repeated each growing season. Hallé, a professor of Botany at the University of Montpellier II in France, has compiled a great deal of information about phytopractices. We have summarized a few of these techniques. Each technique is labeled with the plant species to which it applies. Note that, in most cases, neither an explanatory hypothesis nor scientific confirmation for the technique is given. ECHO cannot guarantee the accuracy of these reports, but they would be interesting to experiment with. If you try any of these, please let us know the results.

Mango. In Sulawesi, Indonesia, some farmers **knot the trunk of a mango tree** when it is at a young stage. Apparently this **trauma induces flowering at an early age.**

Jackfruit. "The…jackfruit (*Artocarpus heterophyllus*) usually bears its large fruit (up to 80 cm in length) on the trunk and main branches, high up in the tree. In the Songkhla Province of Thailand, the young jackfruit is planted over a large stone or metallic plate, thus **blocking the growth of the tree's tap root**." As a result, **fruits grow in clusters** around the base of the trunk.

Citrus. In China, citrus growers facilitate fruit collection by **rolling the roots of a fruit tree** around themselves before planting. The technique reportedly allows for **better uptake of fertilizer** through the superficial fine roots. It also results in **reduced tree height**, making fruit collection easier.

Banana. In Thailand, one of the tall-growing banana cultivars is too frail for farmers to access fruit by ladder. Sometimes a farmer will gently **bend the fruiting stalk to the exterior of the stem**, first using a machete and then inserting a blade of bamboo as a wedge

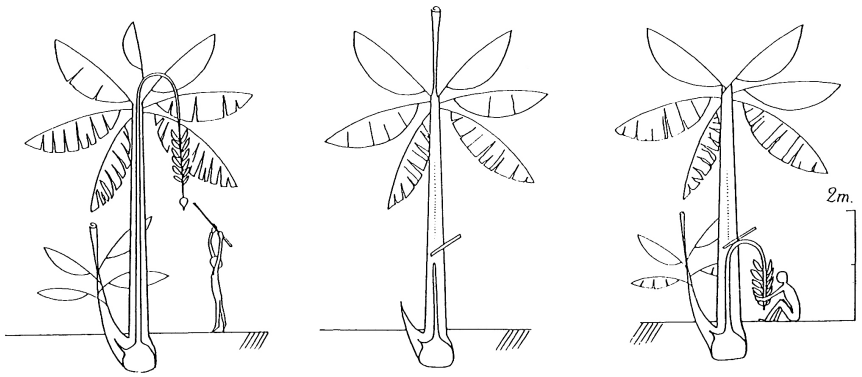

Figure 1: Using a blade of bamboo as a wedge, the fruiting stalk of a banana was bent to the exterior of the stem, making fruit easier to harvest. Figure extracted from an article by Frances Halle published in Nature and Resources, Volume 32 Number 3 (1996), page 5 © UNESCO.

(Figure 1). "The leaves of the plant are unaffected and the fruits are of the same size and flavor as when growing upright but they are now **more easily harvested**."

Yam (*Dioscorea* sp.). In Madagascar, farmers sometimes drive a section of hollow banana stem into the ground and insert the bud of a yam tuber. Decomposition of the banana stem results in a rich and humid environment that can **increase the growth of yam tubers**. Apparently tubers may reach 1 m in length [the normal length of yam tubers was not stated]. [Staff member Larry Yarger suggests that increased growth could also be due to added potassium from the banana.]

Cassava. In Java, Indonesia, a peasant farmer named Bapak Mukibat **grafted two species of cassava** in 1952. One species was a tree and the other was a bush that yielded tubers (Figure 2). The **result was a vigorous plant that produced tubers**. "Unlike classical graftings of this kind, it is the rootstock and not the scion that is considerably modified. The result is a tree with giant tubers, with a growing period extended to 18 months and a yield that can reach 96 t/ha/year, ten times normal production." [Ed: ECHO can send more detailed information on the Mukibat System from our files, including the unusual grafting technique Mr. Mukibat used (necessary because of the thick stems). The tree to which he refers is the ceara rubber tree (*Manihot glaziovii*). We tried the technique once but the plant froze. We plan to try again.]

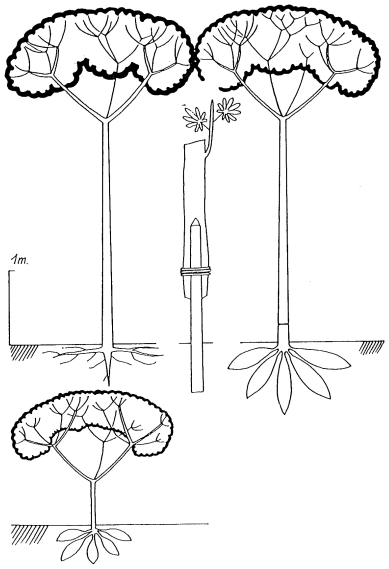

Figure 2: Two species of cassava were grafted together, resulting in a tree that produced very large tubers. Figure extracted from an article by Frances Halle published in Nature and Resources, Volume 32 Number 3 (1996), page 12 © UNESCO.

Cassava. In Malang, eastern Java, Indonesia, farmers are able to **increase the number of tuber roots** produced by a cassava plant. After initial tuber growth, they girdle the stem about 10 cm (4 inches) above soil level, and then cover the base of the plant with rich soil. The mounded soil encourages root growth, and the roots become a new set of tubers above the first set (Figure 3). [Note that once the stem is girdled, the bottom tubers will not grow anymore. The ring around the outside of the stem (containing the phloem) is severed when the stem is girdled, so no more products of photosynthesis will reach the bottom tubers. It would be interesting to know when the older roots are harvested and if the quality diminishes if harvest is delayed after growth stops.]

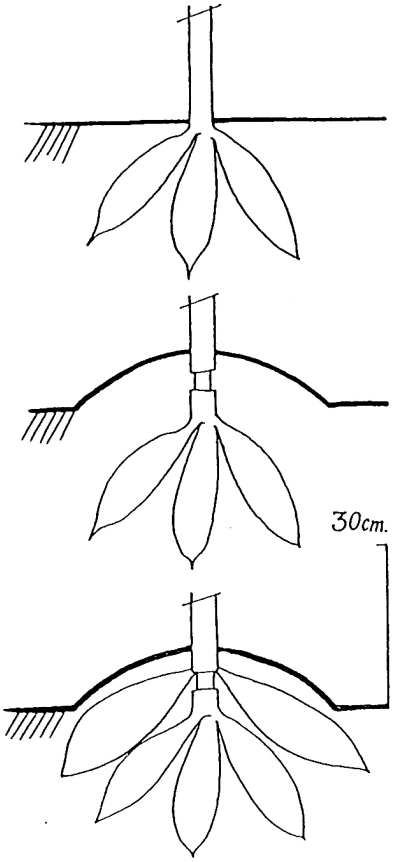

Figure 3: Farmers girdled the stem of a cassava plant, then covered the base of the plant with soil to encourage root growth. More tubers resulted. Figure extracted from an article by Frances Halle published in Nature and Resources, Volume 32 Number 3 (1996), page 10 © UNESCO.

Fruit trees. In Thailand and Indonesia, several seeds of the same tree species are sown close together (less than 20 cm/8 inches apart). When the young seedlings are about 80 cm (32 inches) tall, the bark is rubbed off one side of the **stems and they are tied tightly together. The tissues fuse** and the tips of stems of weaker plants are removed, resulting in a **vigorous tree with several root systems**. Fruit trees treated in this way apparently reach sexual maturity more quickly. Many different fruit trees treated this way are seen in Bangkok markets, including citrus, durian, mango, jackfruit, tamarind and star fruit. [Be careful not to rub the bark off the whole circumference of the tree, or the tree will die.]

Potato. Here is a method to **increase the number of harvestable potatoes** produced by a potato plant. The plant is surrounded with a circular chicken wire grill that is gradually filled with soil as the plant grows. Young leaves must not be covered. Covering older leaf axils with soil triggers the growth of axillary stolons. These stolons then produce new tubers. Up to 100 kg (220 lbs) of potatoes can be harvested from the plant at the end of the growing season.

Gourds. In the dry zone of Sri Lanka, gourds require watering in order to grow to normal sizes. Instead of watering the whole plant, "**a jar of water is placed near the gourd and the two are connected by a piece of cloth** which passes through the fruiting stem. **The cloth acts as a wick** and water rises by capillary action and is taken up by the fruit which grows rapidly to a large size."

Location-specific trees. This technique involves **using the whole tree to catch water that condenses from mists**. In the Canary Islands, the endemic laurel (*Ocotea foetens*) grows in areas that have frequent mists but little rain. Water from the mists condenses on the trees and runs down to the base of the trunks where it is collected in wells or in bowls. In this dry area, the technique is used by both passing travellers and resident villagers. In Cape Verde, fourcroyas (*Agave fourcroydes*) can capture 20 liters of water per day when used as 'fountain trees.' Olive trees in Oman can produce 60 liters of water per tree per day. [Ed: we have noticed it "raining" under the *Casuarina* tree near ECHO during a heavy fog.]

Fruiting vines. In the Asian tropics, the fast-growing snake gourd liana [*Trichosanthes cucumerina*] is planted for production of very long fruits. In Sri Lanka, the fruiting liana vines are wound around a frame about 2 m (80 inches) above the ground. A stone is tied to the end of each developing gourd. The **weight of the stone pulls the fruit downward and substantially increases its size**. As the fruit grows, stones of increasing weight are used. The technique may specifically be used to produce straight fruits instead of spiral or twisting ones, but it also seems to induce higher production. Hallé writes, "The weighted gourd absorbs greater amounts of water and nutrients, and may attain a length of 2 m. The same technique has been observed in Java and is used in fruit orchards in Europe where bending branches downwards produces a similar increase in crop." [No details were given regarding the increase in length and weight of the fruit.]

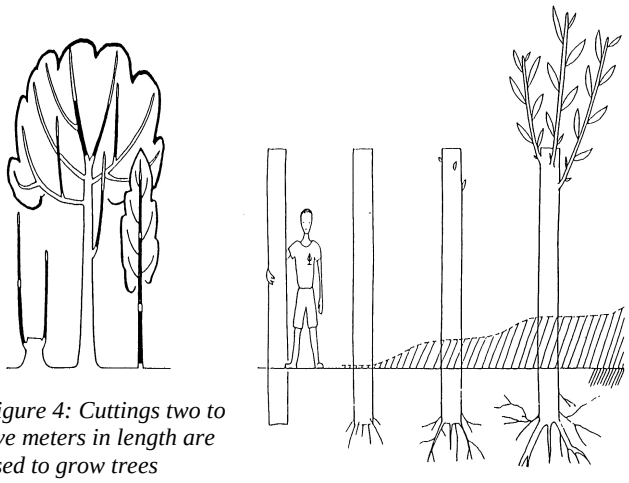

Figure 4: Cuttings two to five meters in length are used to grow trees quickly. The left side of the figure shows the best locations from which to take cuttings. Cuttings that take root grow quickly, unimpeded by other vegetation (shaded area on top right part of figure).Figure extracted from an article by Frances Halle published in Nature and Resources, Volume 32 Number 3 (1996), page 15 © UNESCO.

Trees. The use of **pole cuttings** to multiply trees results in **high success rates and rapid growth**. The cuttings are 2 to 5 m (80 to 200 inches) in length and 10 to 30 cm (4 to 12 inches) in diameter (Figure 4). Each cutting is placed vertically in the soil where it quickly roots and grows into a fast-growing tree, without being impeded by adventitious vegetation….Little maintenance or weeding is required." [There are a few disadvantages to this technique. For example, a tree will only yield a few cuttings when they are this large. Cuttings in general tend to have weaker root systems (and no tap root) compared to plants grown from seed. Also note that only certain species have this ability to grow from cuttings.]

Understanding Why/When Cassava Can Cause the Disease Konzo

Abstracted by Martin Price from "Food Safety and Amino Acid Balance in Processed Cassava Cossettes," J. Agric. Food Chem. 2002, 50, 3042-3049.

Konzo is an irreversible disease that appears suddenly and causes spastic paralysis of both legs. Konzo affects mainly women and children, afflicting thousands in the remote rural areas of Bandundu Province in the Democratic Republic of Congo. It has also been reported from remote rural areas in Central African Republic, Mozambique and Tanzania.

We mentioned this disease in our book *Amaranth to Zai Holes: ideas for growing food under difficult conditions*, pages 265 to 268. "Epidemic spastic paraparesis occurs mainly among women and children. It permanently cripples the victim 'from one day to the next' by damaging parts of the spinal cord that transmit signals for movement. Muscles are not flaccid, as in polio, so the legs usually support affected persons sufficiently to let them stand, especially if supported by a stick. Walking is often uncontrolled jerks."

This laboratory study measured the content in processed cassava of both cyanide and cyanogens. Cyanogens are compounds in cassava that can produce cyanide. The particular processed cassava product that they studied is called cossettes, but similar results might be obtained with other processing methods. Cossettes are produced by soaking or immersing fresh bitter (high cyanide content) cassava roots, whole or peeled, in a stream or standing water for at least three days to allow them to ferment until they become soft. The fermented roots are then taken out, peeled, and sun dried on mats, racks, roofs, etc. Depending on the weather, this takes two to five days. This form of cassava product is preferred because it can be stored for a long period and traded over greater distances. If for some reason the roots are processed for a shorter period, the remaining cyanogen content will be much higher than normal.

It is generally assumed that cyanogen content of 10 mg or less per kilogram of cassava is safe. All cossette samples had less than 10 mg/kg (the highest from Cameroon was 9.37 mg and the lowest from RondPoint was 1.45 mg). So why is there sometimes a problem?

Konzo is normally brought about by a combination of exposure to cyanide *and* malnutrition from a low-protein diet. The risk of developing the disease is even greater when that low amount of protein is deficient in sulfur-containing amino acids (amino acids come from protein after it is digested). The cassava in the study was very low in protein and especially low in sulfur-containing amino acids. It is this combination of a nutritional problem and toxicity that causes the problem.

In the *Amaranth to Zai Holes* article about how/when cyanide in food becomes a problem (see above) we wrote the following about what happens to cyanide after it is eaten.

"The body is protected from cyanide in two steps. The blood contains a substance that can, within minutes, bind up to 10 mg of cyanide. This is then taken to the liver and detoxified in a process that takes a few hours.

"If more than 10 mg of cyanide is consumed, but not enough to be fatal, it is converted to a far less toxic substance called thiocyanate. The thiocyanate is eventually excreted in the urine. This detoxification process requires the element sulfur, which is obtained from protein in the diet. In protein deficient diets the detoxification process ceases to operate. So lack of protein in the diet accentuates the toxicity of cassava. "It should be noted that considerable amounts of fish are consumed in areas of the Amazon, the Congo basin and southern India where cassava has been established as the dominating staple for centuries." If other food is not available, an adult will consume daily about ... 0.5 kg dry (1.5 kg wet) weight of cassava."

Fish contain abundant protein and sulfur-containing amino acids, so fish-eaters would be less likely to become ill from eating food with over 10 mg of cyanide/kg than would people who eat mainly cassava roots and other foods low in protein. Konzo is not found in the cities, perhaps because urban diets typically contain more protein. It is also possible that the cyanogens in cassava react to form cyanide (which evaporates; see next article for more detail) as the cassava is transported to a city and stored, but that it is eaten much sooner in rural areas.

Other diseases caused by cyanide toxicity develop only after exposure to moderate amounts over a period of time. A physician visiting ECHO mentioned his puzzlement over the prevalence of goiter in a particular Pacific island, even though there was iodine in the diet. This too is likely caused by cyanide. Quoting our book again, "The thiocyanate produced when cyanide is detoxified (see above) interferes with uptake of iodine by the thyroid gland. Fortunately this interference can happen only when iodine intake is already low, below 200 micrograms per day. Populations in northern Zaire with very low iodine in the diet and who regularly ate inadequately processed cassava suffered from severe endemic goiter and a high prevalence of cretinism [a condition resulting in growth retardation, developmental delay and other abnormalities]. When iodine supplements were used the goiter problem decreased considerably even though the cassava was still not adequately processed due to adverse conditions." If you suspect this may be occurring where you work, do a search on the web for cassava and goiter and you will be led to several articles on that topic.

Treatment to Reduce Cyanide Content of Cassava Flour

By Dawn Berkelaar

In *Cassava Cyanide Diseases News* (*CCDN*), Issue 4, December 2004, Dr. J. Howard Bradbury wrote about a method of processing cassava that could substantially reduce the cyanide content of flour.

With the traditional practice of sun drying cassava, a large amount of linamarin [the chemical name of the substance that produces cyanide when it breaks down] remains in the flour, and 25 to 50% of the cyanide is retained. Cassava roots contain about 63% moisture, while cassava flour contains less than 10% moisture. This means that the cyanide is much more concentrated in cassava flour than in cassava roots. The concentration of cyanide in cassava roots, even those that are processed, must be low (12 to 16 ppm) in order for the resulting flour to meet the WHO standard of 10 ppm [10 mg per kg].

Bradbury wrote, "In practice, the WHO safe standard of 10 ppm can only be achieved by sun drying roots of sweet cassava [i.e. not bitter cassava]. The average cyanide level in cassava flour in Indonesia, Ghana and in Mozambique in a good year is about 45 ppm. In a year of low rainfall the average cyanide content of flour in Mozambique exceeds 100 ppm, which causes acute intoxication and konzo."

A technique called heap fermentation can help. It involves piling peeled roots in a small heap for about four days, resulting in some fermentation and loss of cyanide. Then the roots are sun dried, crushed and sieved. The resulting flour has a cyanide content roughly half of that produced by sun drying cassava.

Bradbury continued, **"We have developed a new simple wetting method that reduces the cyanide content of flour to about one third of its previous level.**

"The method involves mixing thoroughly a sample of cassava flour with water in the ratio of four parts flour to five parts water. All the water is absorbed rapidly by the flour and the mixture is left in an open vessel at about 30°C for about 5 hours. The water rapidly swells the flour and allows linamarase to hydrolyze much of the linamarin with evolution of [cyanide] gas. After about 5 hours the damp flour is used for cooking." [Ed (MLP): That probably needs an explanation. In living organisms, the names of enzymes that break down a particular chemical often end in "ase." So the enzyme that breaks down the sugar lactose that we ingest when we drink milk is called "lactase." Linamarin in cassava is not in itself toxic, but it becomes toxic if the enzyme that breaks it down, linamarase, comes into contact with it. Linamarase is stored in a separate part of the cells of cassava to keep it away from the linamarin. When an animal crushes the cells upon eating the cassava, the enzyme and linamarin are in contact and the

animal may die. It is a form of protection for the plant. The process of making flour no doubt releases the enzyme but the enzyme is only active when it is dissolved in water. That is why the wetting procedure is so effective.]

Quoting Bradbury again: "The method works only when there is sufficient linamarase present in the flour. For example, if the linamarase has been inactivated by prior drying of the root at 100°C, then there is no loss of [linamarin] using the wetting method."

Bradbury concluded, "The method is designed so that the flour needed for cooking in the evening is thoroughly mixed with water in the morning and used that same evening. Further work is in progress in Mozambique on the possible application of this promising new wetting method."

Where There is No Refrigeration

By Dawn Berkelaar

Several years ago, Mohammed Bah Abba designed an earthenware cooling system (the "pot-in-pot" method) to preserve foods in countries with hot, dry climates. In Northern Nigeria (where Abba is from), no electricity is available and propane refrigeration is prohibitively expensive.

Abba's design includes two clay pots of different sizes, one inside the other. Sand is put in the space between the pots and is kept wet. As the water evaporates toward the outside of the large pot (and toward the dry outside air), the contents of the inside pot are cooled and preserved for days. Evaporation requires energy, which is taken from the heat in the pot. As a result, the temperature drops and the inner container is cooled. The inner pot is covered with a damp cloth and the whole thing is kept in a very dry, ventilated place.

In trials, eggplants stayed fresh for 27 days (compared to three days otherwise); tomatoes and peppers lasted 21 days. African spinach was still edible after 12 days instead of spoiling after one day.

Abba hired unemployed pot makers to produce his cooling systems. He estimates that in Jigawa State, Nigeria, ¾ of rural families use the "Pot-in-pot" system.

The social and economic impacts of the Pot-in-pot technology are enormous. Farmers are now able to sell vegetables on demand instead of immediately after harvest. Married women can sell food from their homes. Girls are able to attend school instead of selling food every day. The whole community experiences less disease from eating spoiled food.

Read more about Abba's invention in *Food Chain*, issue 29 (online at http://www.itdg.org/?id=food_chain).

Vegetative and Agronomic Technologies for Land Husbandry

By Dawn Berkelaar

In *Overstory Online* #111 (free newsletter about agroforestry; see *EDN* 83-7 for more information), Roland Bunch summarized 35 years of extension in the area of land husbandry, which includes soil and water conservation. In this context, land husbandry refers to "everything a farmer does that conserves or improves the soil." Rather than just a single technology, the whole farming system must be taken into account. In this article we share some key points from Bunch's summary.

Bunch stated that there has been a definite shift from (expensive) structural technologies (*e.g.* terraces, contour rock walls) toward "vegetative or agronomic technologies" (*e.g.* green manure/cover crops). Introduced technologies should be able to pay for themselves within a year of first being used, since farmers' motivation for using new technologies is generally economic. Structural technologies have fallen out of favor because most require maintenance and many are also very expensive.

One of the most important things a farmer can do for his farm is to prevent soil erosion. One way to do so is by keeping soil covered, especially during the rainy season. Vegetative cover and high levels of soil organic matter are key. Below is a brief description of several vegetative or agronomic technologies.

Contour hedgerows

Bunch wrote that contour hedgerows or contour vegetative barriers "continue to be used widely, with many positive, long-term results." Farmers have introduced several modifications. First, they often space hedgerows twice as wide as recommended. Second, they use different species [and more diversity of species] than those that are typically recommended; instead of napier grass, they use plants and trees that also have other uses. Third, they use multipurpose barriers. For example, an intercropped hedgerow might include 100 m of napier grass for each grazing animal; 20 m of lemongrass; 20 to 40 m of vetiver (for medicine or thatch); and sugarcane for the rest.

Green manure/cover crops (gm/cc)

Bunch defines a gm/cc as "any species of plant, often but not always leguminous, whether a tree, bush, vine or crawling plant, that is used by a farmer for one or several purposes, at least one of which is that of maintaining or improving soil fertility or controlling weeds." Many different plants are used, including subsistence crops, trees, and non-legumes. A farmer's intention in planting a species is a key part of the definition.

Gm/cc are often intercropped, then cut down and left on the surface as mulch—in contrast to the outdated view of a gm/cc as a monocropped legume that is buried at the flowering stage.

Bunch has seen at least 150 gm/cc systems, with 60% of them developed by farmers themselves. Gm/cc are used for more than fifteen purposes. "The most important, in approximate decreasing order of priority, are: human food, animal feed, weed control, sources of income, improved fallows or the elimination of fallowing, a necessary preparatory stage before

using zero tillage, and the recuperation of wastelands.

"The species most popular around the world are the scarlet runner bean (*Phaseolus coccineus*); pigeon pea (*Cajanus cajan*); velvetbean (*Mucuna spp*.); cowpea (*Vigna unguiculata*); other vignas; and the jackbean (*Canavalia ensiformis*)." Before introducing a gm/cc, find out what farmers' priorities are and what species are locally known.

Bunch lists many advantages of gm/cc systems. "They increase soil organic matter, fix nitrogen (often between 80 to 120 kg of N/ha/year), frequently cost less than the value of the benefits they provide (yes, we are talking, in many cases, about essentially free organic matter), control even the most noxious of weeds, provide soil cover, maintain soil moisture, and allow zero tillage. In an age of threatened globalization of commerce, perhaps one of the most important and least appreciated advantages of gm/cc is that they may be the only way small farmers in countries such as Paraguay or Cambodia will ever compete with the mechanized agribusinesses of the North. Mechanization's greatest advantages come in soil preparation and weed control. Since gm/cc can control weeds and allow zero tillage, they can eliminate both operations. Eliminating weeds is even cheaper than mechanizing their removal."

Dispersed shade

Most crops in the lowland tropics grow best with 10 to 15 percent shade, which can be roughly obtained by planting trees 10 to 15 m apart in all directions. Many small farmers already use this technique, especially in Southeast Asia. Bunch writes, "Those who know of these systems consider them to be probably the most promising agroforestry system known, both in terms of potential farmer acceptance and of the brute number of...trees these systems could get planted around the world." Advantages of dispersed shade systems include an increase in crop yields; protection against too much or too little rain; uses of the trees themselves; and an increase in yields because the shade is distributed fairly evenly (**in contrast to a system like alley cropping, in which the shade is concentrated**).

Improved (or eliminated) fallows

Many farmers crop their land every year with the use of gm/cc, instead of having to let the land lie fallow. Bunch wrote, "Improved fallows could probably single-handedly do more to solve Africa's food shortage, not to mention its problem of deteriorating soils, than any other single technology we know."

ECHOES FROM OUR NETWORK

Dark Green Leafy Vegetables

Larry Kies with Africa University in Mutare, Zimbabwe, wrote, "Thanks so much to Grace Ju for the excellent article on Dark Green Leafy Vegetables. Here in Zimbabwe, kales and collard greens are so important that when people say 'vegetables' they mean the leaves of these plants.

"What Grace didn't mention is that these greens are easily reproduced vegetatively, using the lateral shoots. Especially during the warm season when pests make caring for seedbeds very difficult, this method is easy, inexpensive and fast, especially for home gardens. The 20 to 30 cm (8 to 12 inch) lateral shoots are planted in situ, and harvesting can begin about six weeks later."

BOOKS, WEBSITES & OTHER RESOURCES

African Friends and Money Matters

By David Maranz. Copyright 2001 by SIL International. 224 pages.
Reviewed by Ruth Poglitsh, Swaziland

Westerners working in Africa are often directly responsible for overseeing the use and care of relatively large sums of money and physical resources. This leads to direct and continuing confrontations between African and Western ways of handling these things. In his book, David Maranz shares 90 observations about African economic and social systems. These observations address 95% of the issues that drive Westerners working in Africa crazy. It charitably explains the African point of view and how it differs from the Western perspective. Not all observations will apply in all locations, but this book is a great discussion starter with your African friends, co-workers, and employees.

Maranz maintains that the goal of the Western economic system is to allow people to increase capital (wealth and the means to produce more wealth) in a stable social, political, economic, and physical environment. The goal of traditional African economic systems is to allow people to survive political, economic, and physical disasters. This is done by creating the largest possible network of financially interdependent relationships and by creating intense social pressure for members of society to share money and goods with others.

Out of these separate goals flow very different ways of interacting with money, physical resources, family, friendships, financial accounting, business dealings, debts, and many other areas of life. For Westerners this book helps explain some of the seemingly inexplicable events that occur in their lives every day.

My husband and I have found that observation 12 explains a lot of the frustrations that we encounter—"Africans readily share space and things but are possessive of knowledge. Westerners readily share their knowledge but are possessive of things

and space." This also has profound implications for development projects that rely on participants sharing their knowledge and experience with others.

For those involved in management, the remarks about acceptable conflict resolution approaches are insightful. "Difficult issues are not handled through direct confrontation. Therefore, to resolve misunderstandings it is necessary to go to a mutual friend and explain the matter, asking him or her to convey the explanation to the offended party." "The maintenance of dignity, honor and similar personal qualities, and the avoidance of shame and humiliation are extremely important."

If you ask someone a question, it might shame him or her if he or she does not know the answer, so "people will say anything to cover up the fact that they don't know the answer to your question." To cope with this, Maranz suggests comparing the answers from at least two people. Another suggestion I [Ruth] heard was to ask someone else (preferably someone of low status) to ask your question. So you might ask a boy to ask a man who is nearby "Where does Babe Dlamini live?" This indirect request will allow the man to "save face" if he does not know the answer.

There are many observations and insights about making and receiving requests for money and things. The most surprising one for me was observation 31, "Compliments are frequently given indirectly in the form of requests for gifts or loans and are often formulated as questions. Westerners easily misinterpret this and take offense." Here in Swaziland we are frequently greeted by strangers with, "Give me your baby."

"Traditionally there was much fear of evil tongue, evil eye, and evil touch.... In these belief systems, saying something complimentary can be a disguise for wishing evil on the person." He provides helpful ways to respond to such "requests."

African Friends and Money Matters may be purchased from the ECHO bookstore (via the web, telephone, or postal mail) for $24.95 plus shipping.

FROM ECHO'S SEEDBANK

Okra (*Abelmoschus esculentus* (L.) Moench): An Easy-to-Grow Multipurpose Plant

By Grace C. Ju, PhD
Seed Bank Manager

An extension publication puts it whimsically: "If you can't grow okra, we can't help you!"(MJ Stephens, U of FL). I have loved growing and eating this plant since I was a child living in the southern US. The question is, what does okra not do? It provides food, feed, forage, fiber, foliage, fuel and cooking oil. (The ability to turn atmospheric nitrogen into fertilizer is about the only asset it is missing!) Okra is a temperate/tropical plant that can be grown as a perennial in some areas. Even as an annual it can be cut back to about 4 feet and will continue to branch and produce pods until the weather gets too cold. Leaves, seeds, pods, flower buds, shoots, and calices are edible. This member of the Malvaceae family (cotton and hibiscus) is also a good source of nutrition, providing vitamins A and C, protein, calcium and iron. The amino acid composition of okra seed protein is similar to that of soybean. (Aminigo and Akingbala. 2004. *J of Applied Sciences and Environmental Management*.)

The seeds are high in protein and oil (F. Martin). The oil, useful for cooking, is made of unsaturated fats and is easy to process using a hand mill and sieves. The seed can also be roasted and used to make a caffeine-free coffee substitute! The foliage, which varies from broad and full to extremely slender and deeply lobed, provides good biomass, while the stems can be burned as fuel. The fiber can be used to make rope and paper. Our ECHO librarian paints dried pods and uses them as Christmas ornaments!

Figure 5: African Okra Flower and Pods

We have seven okra varieties in our seed bank. African (West African), 'Borneo', 'Burgundy', 'Clemson Spineless' and 'Prelude' are open-pollinated varieties, and 'Ever Lucky' and 'Greenie' are hybrids.

African Okra versus Common Okra. African okra (sometimes called West African okra) is actually *Abelmoschus caillei*. Its distribution is restricted to humid to perhumid climates in Africa (a perhumid climate is the wettest type of climate and has humidity values of +100 and above). African okra is also called "late okra" or "dry season okra" (PROTA). We have seen that it has a longer productive period than other cultivars at ECHO, even though it starts producing later. This is apparently a common feature. Commercial growers often prefer cultivars like 'Clemson Spineless', which is early, productive and has a uniform shape. *A. caillei* performs better in more humid climates than common okra. African okra is also more tolerant of diseases and pests compared to the common okra.

ECHO Variety Trials. We conducted two okra variety trials at the ECHO farm, one in 2003 and the other in 2004. In 2003, we grew 15 varieties of okra. In 2004 we grew six varieties that did well in the 2003 trial. The results showed no

statistically significant differences in total yield over the four months of harvest. However, we did learn that some varieties produce much earlier in the season than others and continue to produce throughout the growing season. The late-yielding varieties were hardier in terms of withstanding harsh weather and insects.

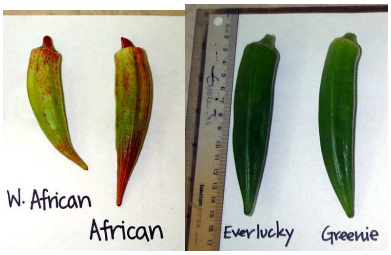

Figure 6: Several of the okra varieties found in ECHO's seedbank. The two on the left are different accessions but the same species. The varieties on the right are both hybrids.

Early/Middle Producers. 'Ever Lucky' and 'Greenie,' Taiwan hybrids from Known-You Seed Company, performed well in both trials. Both showed early to middle production. 'Prelude,' the earliest producer, continued to bear fruit for two months. In the first trial, 'Parbhani Kranti,' an Indian variety that has *Abelmoschus caillei* ancestry and is resistant to yellow vein mosaic virus, was an early producer that continued to produce well over the trial period. In the second trial it did not perform as well. 'Burgundy' (red pod) was another early producer. In the second trial only 6 varieties were tested, among them 'Ever Lucky,' 'Greenie' and 'Clemson Spineless.' Clemson Spineless is the most commonly grown okra in the United States.

Late Producers. In both trials, the African okra was the last to produce. The advantage of African okra is its vigor and its ability to stand up against the winds and rains, as evidenced at ECHO when the plant was confronted by Hurricane Charley on August 13, 2004. One of our past interns found that African okra did the best among the okra varieties he evaluated in the Gambia. Additionally, Dr. Tim Motis found that African okra performed well in a trial at ECHO's Small Farm Resource Development Project that he directs in Haiti. 'Borneo' is another late variety that did fairly well. Planting early, mid and late producers is advantageous because it allows continuous production for consumption and for the market over several months.

African Origins. Okra, also known as quimbombo and gombo, has African origins. Okra may have originated in Ethiopia (www.aggie-horticulture.tamu.edu/PLANTanswers), but is now grown all over the world. It does well in arid areas but thrives in many types of environments (it has made some weedy plant lists). It is the most commonly used vegetable in some West African countries. Pods are picked before they are too tough and fibrous. They do not keep well, although dried okra can be used in the same dishes as fresh okra. It can be cooked several ways: sautéed, fried, added to casseroles, boiled, and used in gumbo. Take note that the pods are mucilaginous (slimy); ECHO's editor, Dr. Martin Price, wrote, "Like many who did not grow up eating okra, I am not fond of the "slimy" feel or the coatings [of flour or cornmeal, for example] that people put on it when cooking to try to disguise this feel. But Pat Lahr in Haiti taught me how to make okra a tasty, non-slimy vegetable without adding a coating. Simply slice thin cross-sections and cook in a lightly oiled pan at a higher temperature than you would normally use. Because of the high temperature, stir constantly. When some slices start to turn quite dark, it is ready to eat. Try it. You might become a new okra fan." Dried and powdered okra can provide a supplementary source of protein and vitamins.

Although okra is a hardy plant, some varieties are still susceptible to nematodes and fungal diseases. Mosaic virus can be a problem in certain regions. The common okra flowers were reported to be susceptible to ant damage in Haiti (Dr. Tim Motis). In general, African okra is much less susceptible to disease and pests. One caution to consider when introducing this vegetable is that the plant can be very prickly. Recently while speaking with a group of visiting agricultural students from Bolivia, Burma, Philippines, Liberia, Burkina Faso and India, I found that they already knew the virtues of this multipurpose, ubiquitous crop in their country. If you are interested in trying this amazing plant, please contact us.

Trial size packets of okra (varieties mentioned earlier in article) are available free to those working overseas in agricultural development. All others may purchase the seeds from ECHO. The overseas price is $3.50/packet and the domestic price is $3.00/packet. Please contact us at echo@echonet.org or go to www.echotech.org.

Seeds Available in Bulk

Please contact ECHO for prices and quantities. For some seeds (those listed with an asterisk), ECHO is one of the few sources, at least in the USA.

Abelmoschus esculentum (African Okra)
Benincasa hispida (Wax Gourd)
Brassica carinata (Ethiopian Kale)
Cajanus cajan (Pigeon pea)
Canavalia ensiformis (Jack Bean)
Canavalia gladiata (Sword Bean)
Daucus carota (Carrot, 'Uberlandia')
Hibiscus sabdariffa (Roselle)
Indigofera hirsute (Hairy Indigo)
Moringa oleifera
Moringa stenopetala
Mucuna pruriens (Velvet Bean, 'Tropical')
**Psophocarpus tetragonolobus* (Winged Bean, 'Day-Neutral')
**Sorghum bicolor* ('Striga-Resistant') [also available from Purdue University and in Kenya]
Vicia villosa (Hairy Vetch)
Zea Mays (Corn, 'Rio Grande Red')
Zea Mays (Corn, 'Hawaiian Supersweet #9')