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NUTRITIVE VALUE OF NUÑAS (POPPING BEANS). An article by van Beem et. al. in the April-June 1992 issue of Economic Botany addresses this topic. But first, what are popping beans?

Nuñas are varieties of common beans, Phaseolus vulgaris, which burst when toasted. In spite of the common name "popping beans," they do not actually pop. Rather, when heated in hot oil or on a hot dry pan, they expand and split open. This is all the cooking they require. "The resulting product has a powdery texture with a taste between that of popcorn and roasted peanuts." Most of our staff very much enjoyed the very few beans that we could spare for eating as a snack.

Nuñas are cultivated in the highlands of Ecuador and Bolivia between 2,000 and 3,000 meters. In regions where firewood is scarce, the benefit of these beans obviously extends much beyond their unique taste. Most beans must normally be boiled for a long time to be adequately softened. This time is even longer in the mountains where the boiling point of water is well below 100°C. Nuñas require only 3-4 minutes of cooking.

The plants are the "pole bean" type. They seem to be susceptible to common bean diseases. We can only keep the plants alive in the winter months here in southern Florida. So I doubt very much if you would succeed with them in any area where common beans do not grow well. They are also day length sensitive. ECHO sent seed to several gardeners across the United States. Although the plants often did well, they bloomed and produced only in those few locations where they were still alive in late fall and winter when the days were short.

"The unique texture and taste of popped nuñas appears to be related to their high starch content. The high starch levels may also explain the 'filling effect' [appetite satisfied] nuñas have after consuming 15-20 seeds, as bean starches have been reported as being less digestible than cereal starches." [ED: His thinking may be that materials that cannot be digested remain longer in the gut so the person feels full.]

There is no difference in moisture content between nuñas and other common beans, but in nuñas there is less space for steam to diffuse upon heating. "The steam forced expansion of these [limited] spaces is thought to contribute to the popping mechanism."

Protein content is slightly lower in nuñas than in other common beans (20.0% vs 22.2%); starch (40.9% vs 35.5%) and amylose (18.1% vs 17.2%) are higher. The percentage of protein which can be digested was slightly lower in popped than in boiled nuñas (76.6% vs 79.1%).

"Nuñas stored at optimum conditions retain indefinitely their ability to pop. However, under market place conditions, nuñas lose their popping ability 2-3 months after harvest due to seed hardening. ... shop owners then will try to sell them as a dry bean cultivar. However, when nuñas are boiled, they take a long time to reach an edible state and the broth in which they are cooked is 'watery' when compared to the thick broth of dry bean varieties."

The authors were concerned as to whether the short cooking time might be inadequate to destroy the antinutritional factors in common beans, especially tannins and lectins. Tannin levels in beans are low, though they do slightly reduce digestibility of protein. Lectins, the principle toxins in common beans, are more worrisome, as they interfere with absorption of nutrients from food. Lectins are themselves proteins, comprising about 10% of the total bean protein. Fortunately lectins appear to be denatured by the higher temperatures of roasting because popped beans had a similar or lower level than boiled beans.

Individuals working in areas where common beans are an important crop might well want to take a look at nuñas. They probably have some export potential to the States because of the publicity they have received in recent years and the limited locations where they can be grown. In fact we purchased the seed that we are offering from a health food store in California. Although we hope one day to have distinct varieties to offer, at least we can be sure the ones we bought were of commercial quality. Germination is good. A trial packet of seeds is free to those working with peasant farmers, urban gardeners or research stations in the Third World. Others please send $2.50 per packet. If you work where these beans are common and have helpful insights (especially as to how varieties may differ from each other), please write.

ANOTHER USE OF BUCKWHEAT: EAT THE LEAVES. In EDN 10-3 we mentioned the experience with buckwheat, Fagopyrum esculentum, reported by John Trossel. He said this quick maturing crop can be harvested two months after planting. Seed that we sent to a lower elevation (4,000 feet?) in Honduras also reportedly did well. The newsletter HortIdeas quotes from an Indian journal that the leaves of this "broad-leaved 'grain' with remarkable soil-building abilities are edible. In fact, they are eaten regularly by people living in the higher ranges of the Himalayas. They are simply cooked with seasonings in boiling water for a short time. The leaves contain 4.5% protein on a fresh weight basis and are reasonably high in calcium and iron."

Buckwheat does best in cool and humid climates and is definitely not suited for the tropical lowlands. If you work at an appropriate site, we can send you a small packet to get started. Poultry can eat the seeds whole, but for other animals it must be ground. Some of our readers, wanting to make a flour for human use, have given up on buckwheat because it is difficult to prepare into a pure flour when grinding. (If you have had experience preparing buckwheat flour, please share it with us.)

STORING COOKED EGGS. Just because eggs can be stored for some time without refrigeration does not mean the same is true of cooked eggs, according to Science News (August 10, 1985). "In its raw state, the egg has several antimicrobial defenses. The cuticle, or outside portion of the shell, protects the eggs from bacterial invasion as long as this layer remains intact." The shell membrane may be an even more resistant barrier for bacteria. Furthermore an enzyme called lysozyme in the shell membrane and in the egg white destroys many bacteria. Cooking not only inactivates the egg's lysozyme, but also enlarges the shell's pores. But the most important breakdown in defenses may occur when boiled eggs are cooled in water. The contraction of the egg during cooling creates an air pocket which produces a vacuum which can draw in bacteria present in the cooling water.

Eggs that were cooled in water that had been inoculated with botulism spores resulted in the toxin being produced in the eggs. Because botulism bacteria thrive in the absence of oxygen, eggs stored in complete absence of oxygen spoiled first (2-3 days), those in tightly sealed plastic storage containers in a week and those in open air about 8 days.

So keep these three facts in mind: (1) Hard-boiled eggs spoil more quickly than uncooked eggs and should be refrigerated. (2) Cooling in the air may be preferable to cooling in water, especially if the water is not pure. (3) It is better not to store them in air-tight containers.

TOXICITY AND FOOD SECURITY: A review of health effects of cyanide exposure from cassava and of ways to prevent these effects.

For several years I have been on the lookout for something that could provide a perspective on this important question. A million thanks to Dr. Hans Rosling for sending the 31 page booklet with the above title that he wrote for UNICEF. It is just what I had hoped to find. The subject is so important that I have summarized much more of the material than in a normal review. I include the extra detail so you will be able to anticipate when conditions such as dietary limitations, economic changes or social turmoil might

cause a problem to suddenly appear.

Dr. Rosling does not like the statement "cassava contains cyanide." A food that contained pure hydrogen cyanide could be easily detoxified (it would be driven off as a gas by cooking). If any free cyanide is present in cassava, it can easily be driven off into the air by temperatures over 28°C (82°F)

The "cyanide" in cassava is actually a complex and very stable molecule called linamarin, one part of which is a cyanide molecule. If that part of the molecule is broken off it will become cyanide. Compounds such as this that produce cyanide when broken down are called "cyanogenic" compounds. Some cyanogenic compounds are broken down by boiling. For example, although chaya leaves (EDN 18-2) contain a cyanogenic compound, the cyanide is driven off by boiling for 5 minutes.

Unfortunately the cyanogenic compound in cassava is largely unaffected by boiling. Boiling whole pieces of cassava does little to reduce the danger of cyanide poisoning (although boiling fermented or grated cassava will remove most of the cyanide, as we will see later).

Linamarin is not itself toxic. If some of it is absorbed from the gut into the blood it is probably excreted unchanged in the urine. The "cyanide" in linamarin can be liberated in two ways. First, enzymes secreted by microbes in the gut can decompose linamarin, liberating cyanide in the process. Second, certain enzymes in the cassava root itself can liberate cyanide from linamarin. In the intact plant, these enzymes never get a chance to degrade linamarin because they are stored in separate places. But when the root structure is disrupted by grating or fermentation, the two come into contact and cyanide is liberated (and will evaporate at temperatures of 28°C or higher).

I am preparing this review while visiting a major cassava growing area in the Amazon Basin of Brazil. It is interesting to fit observations about farmers' practices into the understanding provided by the book. For example, I am told that the roots are fermented and/or grated (which puts the enzyme and linamarin together), then washed with water and squeezed. Free cyanide is washed out in the water. As the water is left to stand, tapioca settles to the bottom. If a hog or other animal drinks this water, unless it is cooked or considerable time has elapsed, they reportedly can die quickly from the dissolved cyanide. There would be very little cyanide nor linamarin remaining in either the tapioca or the ground, dried cassava, which are consumed in large amounts along with fish.

"Considerable cassava consumption has developed in some areas using processing methods like sun drying, which are very ineffective in removing cyanide. This has probably been possible because initially only the less toxic sweet varieties were used. When these varieties were later replaced by more productive toxic varieties, the established processing practices may suddenly have become insufficient. ... this is probably the case in many cassava growing areas of East Africa. ... sun drying for long periods is not fully efficient, although levels will be lower than after only a few days of drying."

"From the toxicological aspect, strict adherence to the method is as important as the type of method. Soaking in water ... as well as grating and sack-fermenting processes ... are effective as long as the soaking or fermenting steps are not shortened and fermentation conditions are not changed. Sun drying, if performed according to traditional practices, should be extended over several weeks. Populations using prolonged sun drying probably rely on infestation of insects in the roots to achieve a sufficient removal of cyanide.

What if there is an emergency situation in which the water for soaking or some necessary equipment is lacking? A method emerging in coastal Tanzania and Mozambique and Rwanda which "is probably an appropriate and effective way of reducing the cyanide" is called dry fermentation. "A pile of peeled root pieces is covered with leaves or peels for 3-4 days, after which each root piece is completely covered by a black mould growth. The root pieces are dried in the sun and as much of the mould is removed as possible. These pieces are finally consumed after pounding. Unfortunately **this method seems to result**

in a very high exposure to aflatoxins from the mould growth...aflatoxin exposure must thus also be considered as a possible side-effect when cassava provides food security in drought-affected areas." Aflatoxins cause liver damage and are powerful carcinogens.

What happens to cyanide in the body? The body is protected from cyanide in two steps. The blood contains a substance which 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." "**The newly developed high-producing varieties with less cyanide-yielding capacity still contain 50-100 mg of cyanide per kg of fresh weight.** This amount will easily be removed by processing, but if roots are consumed unprocessed, even these varieties may cause intoxication." [I believe "intoxication" is medical terminology for "have a toxic effect." It does not mean "drunk"].

Diseases related to cassava toxicity -- immediate symptoms. Symptoms usually occur 4-6 hours after a meal and consist of vertigo (dizziness), vomiting, collapse and, in some cases, death within 1-2 hours. Antidotes are effective, safe and cheap. Intravenous injection of thiosulfate will increase the sulfur available to convert cyanide to thiocyanate. Nitrite acts more rapidly but must be handled with care as an overdose is itself toxic.

Cyanide intake from cassava is probably a factor in two types of paralysis. In tropical ataxic neuropathy, one of the sensory tracts in the spinal cord is damaged. This results in an uncoordinated gait called ataxia. It occurred in Nigeria, mostly in adult males, with successive occurrences over several years. High cyanide intake with low protein diets were suggested causes.

Epidemic spastic paraparesis occurs mainly among women and children. It permanently cripples the victim "from one day to the next" [in a 24 hour period?] 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. Outbreaks have been reported in two locations in Zaire during the dry season and during a drought in one location each in Tanzania and Mozambique.

In each of these four cases cassava was the only food available in quantity and roots were inefficiently processed. This disease has never been reported from a population that did not consume cassava, nor from populations eating balanced diets.

In Mozambique 1102 people were stricken. Cassava was the only food due to a drought [hence no protein for the body's own detoxification process]. Once other foods were gone, they did not have enough processed cassava to replace them. Also the people wanted to leave the roots in the ground as long as possible to grow bigger. When they finally harvested, they had no time for the lengthy sun-drying process. Studies on this population indicated "that acute intoxication may appear when cyanide intake reaches 30 mg in 24 hours."

Health workers should be aware of the following possible causes of cyanide poisoning: 1) varieties that are normally sweet may produce high levels of linamarin under adverse conditions. 2) a new, but toxic,

variety may be introduced to the market and surprise people. 3) hungry, unsupervised children have been known to eat toxic roots in spite of their bitterness. 4) if cassava is just being introduced without adequate training in processing methods.

Diseases related to cassava -- delayed symptoms. Other diseases develop only after exposure to cyanide over a long period of time. Continuous exposure to insufficiently processed cassava can lead to goiter and cretinism. This problem is especially prevalent in Africa. The thyroid gland, situated in front of the neck, is not normally visible. Its main function is to produce iodine-containing hormones that regulate body metabolism. If the diet contains too little iodine the thyroid gland becomes larger so as to be more efficient in extracting what little iodine is in the blood. Some children born to iodine-deficient mothers suffer from cretinism (mental retardation and stunted growth).

How is inadequately processed cassava responsible? 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. When iodine supplements were used the goiter problem decreased considerably even though the cassava was still not adequately processed due to adverse conditions.

Do all varieties of cassava contain cyanide? The hundreds of cassava varieties are grouped according to taste into bitter and sweet. The bitter varieties generally have more linamarin than the sweet, but there is no clear-cut division into the two groups. "Cassava-growing peasants plant several varieties. The sweet ones in smaller amounts are eaten as snacks or cooked fresh as vegetables. The bitter varieties are grown in large quantities to serve as staple food after processing."

In most cassava-growing areas the bitter and more toxic varieties have been found to be more productive, probably because of the toxicity. For example, monkeys and wild pigs will not feed on toxic varieties. "Peasants often plant small amounts of sweet varieties in the center of a field of toxic varieties" to keep animals from eating the former.

"Breeding programs should continue to take cyanide levels into consideration, but so far no high yielding variety has been found that makes processing unnecessary." "Even 'high-yielding low-cyanide' varieties developed by IITA in Nigeria have a cyanide-yielding capacity of about 5-10 mg of cyanide per 100 g of fresh weight. ...consumption of these new varieties without any processing may still result in considerable cyanide exposure. ... strict adherence to efficient processing methods is still needed if large amounts of roots from these new varieties are consumed."

Dr. Rosling has offered copies of his book Cassava Toxicity and Food Security free of charge as long as they are available. Write him at International Child Health Unit, Dept. of Pediatrics, S-751 85 Uppsala, Sweden.

An update from Dr. Rosling. Three recent articles give additional details on the occurrence of spastic paraparesis in the Bandundo region of Zaire (110 live and 24 dead cases). The start of these outbreaks in 1974 coincided with the completion of a new tarmac road to the capital, which facilitated the transport of cassava and made it the main cash crop. "The affected population consumed flour made from short-soaked (one day) cassava roots and thus had high dietary exposure to cyanide (urinary thiocyanate in 31 children was 757 vs 50 units for a population where cassava had been soaked for the normal three days)."

"The reason for processing shortcuts ... [is that cassava is] exclusively produced and processed by women in very poor households. Roots are short-soaked when women are in a 'hurry' to gain cash."

LIVING SUPPORT POLES FOR YAMS (Diascorea spp). [From "The Garden to Kitchen Newsletter"

quoting Mike Benge with AID.] This process is being used by farmers near the University of Philippines at Los Baños. Fast-growing nitrogen-fixing trees such as leucaena, gliricidia or calliandra are planted ahead of time to shade out grasses. Yams are planted near the base of the tree after weeds are controlled. When the tuber begins to form, the tree bark is removed about 40 cm from the ground. This causes leaves to drop, giving full sun, mulch, fertilizer and support for the vine and eventually provides firewood. One strong sucker is left from the new tree growth below the girdled area to produce another tree.

EDN reader Peter Afekoro in Nigeria writes that a lot of farmers have developed the habit of using the growing branches of the moringa tree as a source of stake material for yam vines. The interesting aspect to him is that when you cut the young tree for the stake, it sends up 6-10 new trunks for use next year. [It tends to be weak, fast rotting wood however].

We discovered quite by accident here at ECHO that yams love to grow right up living moringa trees. The light shade does not seem to harm them at all, nor do the vines seem to harm the moringa tree.

The April 1990 issue of Agroforestry Today reports that farmers in Kenya's eastern highlands are using a local tree, Commiphora zimmermannii, (local names: mutunguka, mururi, kitungati) as stakes for both yam and passion fruit. It is drought tolerant, easily rooted from green stakes, slow growing with few lateral roots that might compete with crops, no large, dense canopy to shade crops, and it thrives under frequent pollarding. (Pollarding is cutting back severely to a certain height, then letting new branches form near the top). "Heavy vines would kill many trees, but Kenyan farmers claim that the mururi, once established, is permanent." A picture shows a farmer with yams on living stakes that appear to be about head high that were planted 20 years ago. "Few species could survive under these dense and heavy vines." It is also popular as living fences and is legally recognized as boundary markers because it is so permanent.

If any of our Kenyan readers can supply us with enough seed (if it makes seed) to make up 30 or so packets to offer to our network in other countries, send details including postage costs and any insights you may have about growing the tree. We would need to send you an import permit before you shipped the seed. We will announce availability of the seed in a future EDN if we are able to find seed.

GROW SMALL FRUIT TREES IN CIRCLES. (Excerpted from an article on permaculture in India in the International Agricultural Development magazine, April 1992). "A novel idea has been to grow some fruit trees, like bananas and coconuts, in circles about 3 meters in diameter. Inside the circle a thick layer of humus builds up. Circle planting makes it easier to water the trees. Normally when trees are planted in a line they have to be watered separately, but in a circle they can be watered once from the center. There is also less shading of adjacent crops."

PIGEON PEA AND CHICKPEA RELEASE PHOSPHATES. (Based on an article in International Agricultural Development, April 1992). We all know that legumes such as these two plants add nitrogen to the soil. Now scientists at ICRISAT in India have shown that they make available more phosphates. They do not add phosphate to the soil, but rather break up phosphate compounds in such a manner that phosphate that was already present but unusable by plants is now available. If you work where phosphate is one of the most limiting nutrients (a common situation in tropical soils), you might want to work these crops into your rotation.

How do they work? Studies show that the roots of pigeon pea exude acids (piscidic acid) which release phosphorous when it is bound up with iron. Chick peas release another acid (mallic acid) from both roots and shoots. In calcareous soils (alkaline soils with high calcium content), this acid breaks up insoluble calcium phosphate. Normally this release would only occur if the Ph of the soil were lowered.

Both plants "are deep rooted, so their ability to release more phosphates means that valuable nutrients are being brought up from the deeper soil layers. Residues from both crops are adding extra phosphates

which will benefit the crops which follow in the rotation. It is possible that some varieties ... exude more acid than others. So this trait could be another characteristic for selection [by plant breeders]."

UPDATES FROM PAST ISSUES

We forgot to include the following address for the appropriate technology brochures offered by World Vision in EDN 37. Here it is: Mrs. Jennifer Evans, Development Services Assistant, World Vision Australia, GPO, Box 399C, Melbourne, Victoria, 3001, Australia

Comments on sunn hemp seed by Fr. Ruper in Tanzania. In EDN 36-7 we mentioned that Fr. Ruper would send seed for Crotalaria ochroleuca for $7 per kg plus postage and that no phytosanitary certificate would be available. Somehow we got our information wrong. Fr. Ruper says that the $7 includes postage and that he always offers phytosanitary certificates. He adds that "this year our farmer stopped cutting sunn hemp, instead allowing his 120 cow herd to feed freely in fields after first spending an hour in a grass field. The cows even ate dry stems."

UPCOMING EVENTS

Apprenticeship in Ecological Horticulture. The University of California at Santa Cruz offers this residential apprenticeship April 5 through October 1, 1993. Tuition is $1700. Application deadline is December 1, 1992. See EDN 27-4 for more detailed information from a previous offering. Phone 408/459-2321.

ECHOS FROM OUR NETWORK

Cheru Tessema in Ethiopia asked local farmers how they keep monkeys out of their fields, after reading our request for information in EDN-35. "They catch one monkey in a trap and paint it so that it is a different color than the other monkeys. When they set the differently colored monkey loose it runs to join its group. The whole group runs in fear of the different looking monkey approaching them. The released monkey doesn't know that it looks different and keeps on following its group, thus driving them far from a given farm.

Neem disease in West Africa. Mike Benge with USAID sent a copy of a telegram he received from scientists working on the problem, which I summarize: "While there are still many neem trees (particularly in plantations) that continue to suffer from decline, many other neems (in villages, along roadsides and in the Majjia Valley windbreaks) have leafed out and gone through a period of unusually heavy flowering. In some cases the same trees have flowered twice in the last several months. While this is a hopeful sign, it is still too early to tell whether the new foliage will be maintained. We are continuing to monitor the situation closely."

The disorder is clearly distinct from neem scale insect problem reported in the area. No evidence was found supporting earlier reports that a verticillium fungus is causing the disease. In fact there is no evidence for any "primary infectious disease." Three fungi have been isolated at ICRISAT, but are believed to play only a secondary role. There are no signs of either viruses or mycoplasma-like-organisms. "Hodges, Beatty and Boa have concluded that the disorder resembles a type of disease commonly known as 'decline' and is most likely caused not by a pathogen but by one or several types of abiotic environmental stresses."

BOOK REVIEWS

INTRODUCING THE CAMEL, by Peter Grill. Lamar Witmer in Kenya sent us a copy of this unique book. He wrote, "I've read a number of books about camels. The one I am sending you is the one I believe to be the most useful as a single guide for development workers among pastoralists who herd

camels. It emphasizes practical concerns rather than purely scientific ones. It was written from the perspective of eastern Africa, which may limit its usefulness in other regions.

"One of the problems is that it was printed by special project money in 1987 and only a limited supply remains." Well, we agreed that it was a practical and unique book that should be easily available. So it was reprinted by the Mennonite Central Committee Office in the USA for distribution by ECHO.

It is a 149 page, spiral bound book. Chapter titles include: habitat of camels; camel adaptations to heat stress; reproduction (reproductive habits, rutting behavior, signs of oestrus, oestrus cycle, coitus, pregnancy testing, parturition); raising camel calves; establishing a camel breeding herd; products from the camel (milk production, composition and products, meat, blood, hides and wool, misc.); the riding camel (uses, selecting, pace, selecting by age, training, handling, weight bearing, breaking the lead, riding saddle), camels as beasts of burden (potential uses, capacity, age for training, moving a camel train, loading a camel, types of baggage saddles, making a baggage saddle, draft camels, plowing with the camel, other uses as a power source); buying camels (marketing system, difficulties, selecting, determining the age); feeding and watering camels (eating habits, feeding management, watering, drinking rate); common camel health problems in Kenya (general health, signs of a sick camel, examining the camel, common health problems, diseases [protozoal, bacterial, viral, internal parasites, external parasites, other problems]); developing a record system.

An excerpt from the feeding chapter follows. "Camels are primarily browsers. This gives them an advantage over cattle because they will eat leaves from trees in addition to grass much more readily than cattle will. ... [this] makes them ideal animals to add to the livestock mix of commercial ranches. Some ranchers in Kenya have added camels to their cattle and small stock ranching system so that they can use the camels to open up new pasture areas for the small stock. In dense brush the camels are brought in to browse the bushes. This breaks up some of the dense brush so that the goats can come in and browse the lower branches. The goats thin out the foliage so that the sun can reach the grasses. The additional sunlight increases the growth of the grass so that the cattle and sheep have more to eat. ... they increase the carrying capacity of the land for cattle and sheep in addition to the meat and milk from camels who are eating what would normally be unused by the other stock."

You can order from ECHO for $5 plus postage as follows: US $1.50; airmail to Africa and Asia $8.50; South America $5.00.

TREES AND SHRUBS FOR THE SAHEL. Someone in our network in Mali (I lost track of who it was -- sorry!) 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.

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 für Technische Zusammenarbeit; Dag-Hammarskjold-Weg 1 + 2; D 6236 Eschborn 1; Germany. If you write on official letterhead explaining how you would use it in your work with agricultural development in the Sahel, there is a good chance they would send it at no cost. Others inquire as to price.

A TOOL KIT FOR FOLKS INVOLVED IN AGROFORESTRY. (Reviewed by Scott Sherman). IIRR's

Agroforestry Technology Information Kit is just the kind of practical resource we are always looking for. We've been reading about it in various reviews for a couple of years now, but for some reason never ordered a copy until recently. The kit is a collection of practical, well-illustrated summary sheets on various technologies related to agroforestry and sustainable agriculture in the tropics. The kit was originally designed for use by social forestry officers and technicians in the Philippines. Some of the common names of plants etc. will not be familiar to most, but the information contained in the kit would be of interest to a wide range of development workers.

Topics are divided into the following basic categories (followed by a sampling of topics in that section): Soil and Water Conservation Technologies and Agroforestry Systems (SALT-1,

alley cropping, in-row tillage, A-frame use and construction, vegetative barriers, controlling cogon [grass], etc.); Annual Cropping System (cover crop selection, upland rice cultivation, root crops, cultural pest management, etc.); Seeds and Plant Propagation (seed: collection, processing, testing, storage, and pre-germination treatments; tree nursery establishment and management; plant propagation, transplanting, etc.); Trees and Their Management (SALT-3, boundary plantings and shelter belts, pruning, fruit trees for harsh environments, growing bamboos, bank stabilization, species comparisons, etc.); Livestock Production (SALT-2, forced feeding, housing, plant-based medications, intensive feed gardens); and Home-Lot Technologies (medicinal plants, bio-intensive gardening with agroforestry, mini-ponds for dry areas, fertilizer from farm wastes, etc.). There is probably nothing in the kit that ECHO does not already have in our resource center. However, to have it all summarized in a highly pictorial manner, in one neat package, is very helpful. Basically, it is a collection of simple, proven, basic, sustainable technologies with potential for further exploitation by resource-poor farmers. Kits are available for $20.00 from: The International Institute of Rural Reconstruction, 475 Riverside Drive, Room 1270, New York, NY 10115. (Kits are presumably available as well from their office in the Philippines. If you are in Asia, write for specifics to IIRR, Silang, Cavite 4118, PHILIPPINES).

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