EDN

ECHO DEVELOPMENT NOTES

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AN ODYSSEY OF DISCOVERY: PRINCIPLES OF AGRICULTURE FOR THE HUMID TROPICS *by Roland Bunch.* The odyssey of my colleagues and I started in 1982, the day Conrado Zavala, a Honduran villager, sheepishly showed us his experiment. Skeptical about the value of the organic matter we had recommended, he had piled a huge quantity of compost into several rows of his maize field. The last two rows he left as a control untilled and unfertilized. There, before our eyes, stood a field of 2 1/2 m maize, with a last row less than 40 cm tall. That was the day we began to realize the incredible degree to which organic matter can restore soils.

Little by little, work in a dozen countries has convinced us that the vast majority of soils can be made highly fertile. How? By using our first principle: **maximize organic matter production.**

Conrado's particular approach, however, was anti-economic. The cost of using compost on basic grains exceeds the benefit. But intercropped green manure/cover crops (gm/cc's) can produce from 50 to 140 T/Ha (green weight) of organic matter with very little work: no transporting of material and no cutting up or layering or turning over of compost heaps. In fact, sometimes, because of the gm/cc's control of weeds, net labor costs decrease. And soil quality often improves visibly each year.

Then, as often happens, we found we were far from the first to employ intercropped gm/cc's. Gradually, between 1985 and 1992, we learned that villager farmers from Veracruz State in Mexico through Guatemala, El Salvador, and Honduras were intercropping velvetbeans (*Mucuna pruriens*), cowpeas (*Vigna* spp.) and jackbeans (*Canavalia ensiformis*) with their maize and sorghum.

To our amazement, these systems, virtually all of them in the supposedly infertile humid tropics, allow farmers to plant maize every year for decades, with productivity increasing over time up to 4 T/Ha. [(1)] In other words, these farmers have found an answer to slash-and-burn agriculture.
Migratory agriculture is most frequently motivated by decreasing fertility, increased weed problems, or both. In the Mesoamerican gm/cc systems, nitrogen fixation and biomass recycling maintain soil fertility. Mulches of crop residues and fast-growing gm/cc's drastically reduce the weed problem. We had learned a second principle: **keep the soil covered.**

Gm/cc mulches provide a whole series of additional benefits. They protect the soil from irradiation and the heat of the tropical sun, thereby also reducing burn out of organic matter. They save a tremendous amount of work; farmers can sow into the plant residue rather than tilling the soil. They keep the excess nitrogen from acidifying the upper soil horizons. [(2)] And they largely prevent soil erosion, even on slopes of 40%.

In the meantime, we had been reading Fukuoka's book, *The One-Straw Revolution*. [(3)] However, his recommendation of zero tillage failed to convince us. After all, most of the traditional agriculture in Latin America uses zero tillage, yet is far from productive.

In mid-1993, I visited the work of EPAGRI in southern Brazil. Having visited over 160 agricultural development programs through the years, I found this largely unpublicized effort to be the finest of its size I had seen in Latin America. Literally tens of thousands of animal traction farmers were producing harvests approaching those in the USA--with gm/cc's and zero tillage. [(4)]

Valdemar de Freitas, EPAGRI's manager, showed us that the secret to achieving zero tillage is applying massive amounts of organic matter to the soil. Brazilian farmers, after some four years of applying gm/cc's to the soil, are able to quit ploughing. The advantages, in terms of better soil structure, reduced soil compaction, higher fertility, and decreased cost, are impressive. Interestingly, farmers often use non-leguminous gm/cc's to increase biomass in order to quit ploughing sooner. That is, they spend scarce income on chemical nitrogen fertilizer for three or four years in order to achieve zero tillage sooner.

The Brazilians' discovery explains why the zero tillage gm/cc systems of northern Honduras--and Fukuoka's--produce so well, while many traditional zero tillage systems do not. Thus we added a third principle: **use zero tillage**.

EPAGRI's investigation and dissemination of over 60 species of gm/cc partly to avoid diseases and insect pests, confirmed another, more widely known principle: **maintain biological diversity.**

The last principle was discovered by Martha Rosemeyer, a Cornell doctoral candidate working in Costa Rica. For several years, agronomists working with a low-cost, traditional, mulched-bean (*Phaseolus vulgaris*) system had been trying to solve a phosphorus deficiency problem. With highly acid (pH = 4.0 to 4.5) soils, virtually all the phosphorus applied became tied up almost instantly. Farmers' harvests averaged 500 kgs/Ha. [(5)]

Martha and a group of farmers tried broadcasting the phosphorus on top of the mulch. The results, since

confirmed in numerous additional experiments, were astounding. Bean yields rose to between 1.5 and 2.5 T/Ha. [6]

This phenomenon has not yet been validated with other crops. Yet it would help explain the success of Mesoamerica's gm/cc systems, and coincides with the fact that plants as diverse as maize, manioc, and tropical trees tend to develop a heavy mass of feeder roots immediately under thick mulches. [7] Furthermore, it makes simple sense: when soils are as hostile to plant growth as are the humid tropic's acid soils, feeding plants through a mulch would seem a much more promising alternative. The fifth principle is undoubtedly the most unconventional: **feed plants through the mulch.**

These five principles enjoy a nice synergy. For example, if we are going to feed our plants through a mulch, we certainly cannot plough our fields. Nevertheless, the most important relation between these principles is precisely the one that took us the longest to figure out: they describe quite well the way a humid tropical forest functions. That is, all we discovered in our 12-year odyssey is something we should have guessed all along. **In order for humid tropical agriculture to be both highly productive and sustainable, it must imitate the highly productive, millions-of-years-old humid tropical forest.**

Three months ago, I searched the computerized agricultural data system in the United States for information on the nutrient dynamics in mulches and the feeding of crops through a mulch. I found virtually nothing. The above principles mean we are going to have to develop agricultural systems totally different from those agronomists have tried, for so many years, to "transfer" from the temperate nations.

The possibilities are enormous. A study from northern Honduras shows that the gm/cc/maize system there is 30% more profitable than the high-input maize system nearby. [8] It may well be we are just beginning to fathom the full potential of low-input agriculture in the humid tropics.

NOTES:

l. Elio Duron, presentation made to CIDICCO's First Interchange of Ideas on the Role of Leguminous Plants in Today's Agriculture, Tegucigalpa, Honduras, April 1990.

2. Bernard Triomphe, personal communication on the results of his doctoral dissertation research on the long-term effects of a Honduran gm/cc/maize system on tropical soils, 1994.

3. Masanobu Fukuoka, *The One-Straw Revolution. An Introduction to Natural Farmers* (Emmaus, Pennsylvania: Rodale Press, 1978).

4. Roland Bunch, "EPAGRI's Work in the State of Santa Catarina, Brazil: Major New Possibilities for Resource-Poor Farmers". Photocopied.

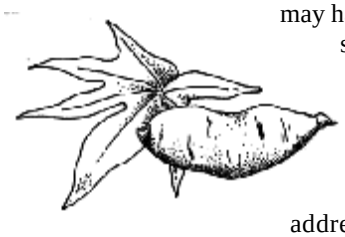
5. Martha Rosemeyer, "Yield, Nodulation and Mycorrhizal Establishment in Slash/Mulch vs. Row-cropped Beans," in H. David Thurston, *et al*., eds., *Tapado. Slash/Mulch: How Farmers Use It and What Researchers Know About It* (Ithaca, NY: CIIFAD and CATIE, cl994), pp. 169-178.

6. Kenneth Schlater, personal communication on the results of his doctoral dissertation research on the effects of applying phosphorus to the mulch of slash/mulched beans, 1995.

7. Rattan Lal, "Conservation Tillage for Sustainable Agriculture, Tropics vs. Temperate Environments," in N. C. Brady, ed., *Advances in Agronomy*, vol. *42* (San Diego, California: Academic Press, c1989), and P. M. Vitousek and R. L. Sanford, Jr., "Nutrient Cycling in Moist Tropical Forest," *Annual Review of Ecological Systems* vol. 17, 1986, pp. 137-167. Also, Bernard Triomphe, personal communication (see above).

8. Milton Flores and Nicolas Estrada "Estudio de Caso: La Utilizacion del Frijol Abono (*Mucuna* spp.) Como Alternativa Viable para el Sostenimiento Productivo de los Sistemas Agricolas del Litoral Atlantico," paper presented to the Center for Development Studies at the Free University of Amsterdam, 1992. Mimeographed.

EFFECT OF INTERCROPPING ON YIELD OF SWEET POTATO. *By Martin Price.* You may have noticed that sweet potato vines will tolerate considerable shade. You may have wondered, "If I intercrop sweet potato with taller plants, how much will that reduce the productivity of the sweet potato?"



This question was addressed by scientists Ladokun, Ogunkeyede and Tewe at the University of Ibadan in Nigeria. (*Tropical Root and Tuber Crops Bulletin, March 1997, Vol 9, #2, pp. 6-8).* They intercropped sweet potato with corn (maize), with cassava, and with both corn and cassava.

Fresh weight of tuber for a local variety of sweet potato grown by itself was 4.24 tonnes/ha. This dropped 46% when intercropped with corn, 26% with cassava, and 77% with both corn and cassava. The comparable figures for an improved cultivar called TIS 80/733 yielding 1.43 tonnes/ha alone were decreases of 58%, 21% and 38%.

They also measured the effect of intercropping on weight of vines (which make good animal feed). The local variety gave 9.3 tonnes/ha alone and *increased* by 10% with corn, by 55% with cassava and *decreased* by 16% with both corn and cassava. Comparable figures for the improved cultivar, which yielded 22.4 tonnes/ha alone, were a *decrease* of 87% with corn, 59% with cassava and 80% with both corn and cassava.

What effect did the intercropping of sweet potato have on corn or cassava yields? The authors did not measure either, though they reference three studies which have shown that "maize reduces the yield of base crops grown with it while its own yield is hardly affected".

The authors also measured a few indicators of nutritional value. Crude protein in the leaves was the same for both varieties under all conditions; likewise for the vines. "Interestingly, the crude fiber of vines is similar to that of leaves, which makes it a unique forage source…. The vines also contain very high amounts of [the essential amino acid] lysine, suggesting usefulness as a supplement to grain products."

More details for those with special interest. In the study

sweet potato cuttings were planted at a spacing of 100x50 cm, maize at 100x100 cm with 4 seed per hole thinned to 3 plants. The experiment included 10 treatment combinations replicated three times.

TARO TUBER PROCESSING FOR ANIMAL FEED. Taro (*Colocasia esculenta*) is a root crop grown widely in the tropics. Its use as animal feed was studied by N. M. Anigbogu at the Federal University of Agriculture in Nigeria (*Tropical Root and Tuber Crops Bulletin*, March 1997, Vol 9, #2, pp. 13-16).

Taro is popular with farmers for several reasons. "It grows relatively well in poor soil, is easy to plant, requires little attention, withstands droughts and short periods of floods, and yields well compared to many other crops." One use of taro is as a livestock feed. "The average tuber yield of taro is about 6t/ha. Despite its low yield, it produces more per hectare ***per day*** than cereals.

The taro used in the study was sliced and dried on metal roofs for three days. While drying it was periodically turned. The nutritional values of dried taro root compared to corn (maize) are impressive:

Proximate composition (%)	Taro	Maize
Crude protein	28.3	12.5
Crude fiber	18	4.0
Metabolizable energy (Kcal)	18,560	4,718
Ca	0.66	0.028
P	1.27	0.41
Lysine	37	3.8

WORLD BANK OFFERS USE OF PHOTOGRAPHIC ARCHIVES TO NGO'S. R. Craig Hobbs, Video Production Officer with the World Bank, wrote the following. "Over the years the World Bank has assembled large archives of photographic stills, film and video material for use in its many [productions]. While we have traditionally made this material available to others in the production of their own supplemental and promotional material, we feel there is room to increase cooperation with non-governmental organizations in delivering messages to their audiences. We encourage you to access these resources in compiling your print, broadcast and multi-media products."

The brochures states that, "Where there is a charge … fees are minimal and are intended solely for the purpose of covering handling costs of the material." "Staff can provide a catalog of documentary and informational videos, an archive list, and a list of prepared B-rolls upon request."

You can contact Hobbs at 1818 H Street, N.W., Washington, DC 20433, USA (phone: 202/473-2149, e-mail: chobbs1@worldbank.org, or fax: 202/522-2632).

MANURE MANAGEMENT TO PREVENT PRODUCE CONTAMINATION. Westerners are often cautious about eating uncooked vegetables when traveling in the tropics, and recently several people in the USA became ill after eating imported vegetables, creating increased awareness of food contamination issues.

Many of us probably assume these health problems originate when food is washed with contaminated water or because of poor human hygiene. However, it could also come from the use of manure as a fertilizer in the field.

The increased consumer awareness of this issue has caused concern among organic growers in the U.S. and growers in those countries which export to the West (in addition to their usual concern about the safety of their own food supply). With that in mind, we reprint the following article from HortIdeas, October 1997.

"[The news has resulted] in efforts by extension and agricultural university staffers to educate growers on how to reduce risks due to pathogens commonly found in manure used as fertilizer. According to Cornell University horticulturist Stephen Reiners, several potentially hazardous bacteria are often found in fresh manure:

Escherichia coli typically is killed by summertime temperatures but remains viable under cooler conditions for as long as 77 days in slurry and for as long as 100 days in soil that has been fertilized with manure.

Salmonella species are frequently found in poultry, hog, and ruminant manure. These bacteria can remain viable for as long as two months in slurry and for as long as three weeks in manure-fertilized soil.

The *Campylobater jejuni* is found in both poultry manure and cattle manure; it remains viable for as long as 112 days (but typically less than two weeks) in slurry. Breakdown is accelerated by acidic conditions, high temperatures, lack of oxygen, and low moisture.

Listeria monocytogenes can remain viable for as long as three weeks in fresh manure and two months in slurry and manure-fertilized soil. It has been found on radishes three months following their harvest from contaminated soil. High temperatures accelerate breakdown.

Yersinia species occasionally contaminate manure, remaining viable for as long as three weeks in slurry and 330 days in soil.

"The figures given above on survival of bacterial pathogens are probably worse-case estimates," says Reiners, who recommends the following guidelines for managing fertilizer manure as a minimum precaution.

"Store slurry produced during the summer for at least two months before using; store slurry produced during the winter for at least 90 days prior to using. Be aware that low-oxygen conditions favor longer-term viability of pathogens. Manure should never be applied to crops less than two months prior to harvest, and it should never be used as a sidedressing for food crops. Root vegetables and vegetables that contact the soil and are often eaten raw are most likely to cause health problems. Composting should kill most pathogens within days, assuming that it is done properly so as to achieve high enough temperatures throughout the piles. [Ed: I suspect that compost is seldom so carefully made.]

SUPPRESSING VARROA MITES IN BEE HIVES. *By Darrell Cox.* Preliminary research done by the USDA suggests that varroa mites which parasitize bees can be controlled with the smoke of certain plant species. Smoking has long been used by beekeepers to calm bees. Early results of work done by these scientists suggest that dried grapefruit leaves, when burned, produce a smoke that contains chemicals that irritate or confuse the mites. The mites aren't killed; instead they fall off the bees. Bees are not bothered by the smoke.

A mite infestation can result in the loss of an entire bee colony. The varroa mite attaches itself to the honey bee and feeds on the blood of the bee. Mite infestations have become a major economic loss for beekeepers in several places in the world. The standard chemical treatment has been the use of fluvalinate-impregnated strips that are inserted into the hives. However, this control measure is accompanied by several limitations – it only can be used during times when bees are not making honey, and some mites are beginning to develop resistance to the chemical. These are reasons why an alternative method of control is being sought.

The USDA emphasizes these findings with dried grapefruit leaves are preliminary. They are working to isolate the active chemicals so they can formulate a miticide. However, given that the smoke is harmless to bees, some of our readers may want to experiment with this control method. The article in *Agricultural Research* (Aug. 1997) indicated that after 30 seconds, smoke from the grapefruit leaves knocked 90 to 95 percent of the mites off the bees in the test cage.

WORKING WITH NATURE: FARMER MANAGED NATURAL REGENERATION. [The following is excerpted from a talk given by Tony Rinaudo at ECHO's 4th Annual Agricultural Missions Conference. Tony is a missionary with SIM to Niger, where he has served for 16 years. Interestingly, that is the same year ECHO began its work and Tony was one of the original 37 people to get the first issue of EDN. You may remember reading about his work with zai holes, which ended up in the title of ECHO's book, *From Amaranth to Zai Holes: Ideas for Growing Food Under Difficult Conditions.*]

One of the immediate problems directly affecting agricultural output and quality of life in Niger is the severe deforestation which has occurred, particularly since the 1960's. Simply planting more trees does not solve the problems.

Many millions of dollars have been spent unnecessarily in Niger because of incorrect assumptions. Organizations doing projects tend to assume that massive loss of vegetation is due to goats, droughts, the Sahara desert moving south and overpopulation leading to heavier cutting of trees. While these things have an effect, inappropriate farming practices and unsuitable tree ownership laws are, in my opinion, largely responsible for the disappearance of Niger's tree cover.

Farmland cleared in the traditional manner.

Farmers also had misconceptions. They considered trees on farmland to be weeds competing with their precious food crops. They believed that only their children or grandchildren would ever benefit from planted trees. (They also thought that people would steal their trees, and this, unfortunately, turned out to be true.)

In the last 12 years it is estimated that over 60 million trees were planted in Niger but only 50% survived. Millions of dollars were spent but few, if any, projects continued once the funding ended. Reforestation in Niger was based on an expensive western model needing a fenced-in nursery, irrigation, vehicles, and guards or wire to protect the trees. This model was impossible to copy on a village level and farmers felt that they were being forced to plant trees which would not benefit them. Despite the large amounts of money spent, vast areas have not benefited from tree planting schemes. Only a minuscule percentage of the trees planted were planted by individuals through their own initiative.

In the initial stages of our reforestation work I was frustrated and ready to give up. No matter which direction we drove, for hundreds of miles the land was stripped of vegetation. The people did not value the tree work we were doing. Results were poor and it soon seemed obvious that even if we worked for a decade with an unlimited budget, we could not reforest the Maradi district, let alone Niger.

One day in the dry season, I was sitting in the car, looking over the barren farmland, wondering if I had made a mistake in coming to Niger. The Lord opened my eyes to what had been there all along. Covering the farmland were thousands

of what I had thought of as insignificant desert shrubs. Each one in fact was regrowth from a stump of a tree. The trees were already alive and growing. There was no need to run an expensive nursery. All we had to do was convince the farmers to leave a sprout or two growing from the stumps when they cleared their land. If they protected a certain percentage of the stumps, the stumps would become trees, and they would have firewood, a source of diverse products and greater protection of their crops at no extra cost.

Acceptance of this idea was slow at first. A few individuals tried it but at high personal cost in terms of ridicule. Theft of the trees was a problem because the wood was a scarce, valuable commodity and the farmers growing them were such a tiny minority. A break came in 1984. Radio coverage of an international conference on deforestation had increased peoples' awareness of the link between deforestation and the climate. This was followed by a severe nationwide drought. Through a food-for-work program we encouraged people in 100 villages to at least give farmer-managed natural regeneration (FMNR) a try.

For the first time, farmers in an entire district began to allow trees to regrow from the sprouting. Many were surprised that their crops did well amongst the trees. All benefited from having extra wood for home use and for sale.

Unfortunately, once the food-for-work program ceased, over two thirds of the 500,000 trees protected were chopped out. But immediately farmers experienced the very problems that had plagued them previously: strong winds, high temperatures and infertile soils, plus they again had no wood. Over the years, more and more farmers started leaving trees on their land. Today there are over two million trees being left at any one time. There are several benefits. While trees have been cut down, in many cases they have not died. A program of protecting what is already there, rather than one of replanting seedlings can bring about rapid, cheap reforestation to vast areas.

Woman carrying firewood out of stand of 8-month regrowth.

As it turns out the “useless scrub” provides many products including: timber, firewood, fiber, medicines, foods, fodder and dyes. We have found that regrowth can be very rapid.

- Species not seen in years are reappearing (see below).
- Whereas ten years ago one was hard pressed to find a properly fenced compound or a new grain silo, people now have ample wood with which they can construct a fence or silo.
- Livestock have fodder during the long (8 month) dry season. In the past animals were at near starvation levels by the end of the dry season.
- Crops are better protected from the 70 kilometer per hour winds and the 60^0C soil temperatures.
- Crops grown amongst the protected trees consistently give higher yields than those in the open. Where trees are you get more lizards and predatory birds. Away from them there is much insect damage. Also, there is quite a visual difference. Millet plants growing among the trees have a much greater protection from the wind. If fully exposed to the wind, young plants are sand blasted or burried. Protected crops reach a critical survival height sooner, so the plants grow faster and taller. Sometimes farmers must replant 5 or 6 times because of wind/sand damage.
- Farmers have a new source of income because production has gone beyond just meeting domestic needs. “Bush markets,” where wood is sold, have opened up and farmers incomes have increased. Formerly village people would need to go to a distant village, Maradi, to buy firewood. Today several trucks travel from Maradi to markets in these rural villages to purchase wood to sell in the city.

The forest regrowth has even had an effect on rural exodus, as people do not need to leave home in search of work or food as often. A small cottage industry is growing as farmers fashion harvested wood into tool handles and hut roofs, etc.

Best of all, this idea is spreading unaided from farmer to farmer even into areas where no agency is working.

My advice to others is this: if you run a tree-planting project, do not abandon what you are doing. For fruit trees and valuable rare or exotic species, a nursery may be the only way of propagation. However, do not overlook the incredible potential of regenerating the natural vegetation that is already there. You will be surprised at how quickly they grow, (after all, they have a mature root system), at how adapted to the climate and how resistant to native pests they are, and at how many uses the people put them to. I call it the "underground forest." It also comes at minor cost!

We asked Tony to add to a few points:

Q. You had such success because there were so many re-sprouting stumps. But over how much of West Africa would such a situation exist?

A. I have traveled in Benin, Nigeria and Niger and most farms that I have seen have large numbers of living tree stumps in them which are slashed each year. My guess is that this is the norm and FMNR could revolutionize agroforestry practice in the whole region where traditional crops are still planted. Districts where tree stumps have been uprooted and regions where trees have died would require replanting or direct sowing of trees.

Q. You mentioned that species not seen in years are

Farmer selecting and trimming sprouts from tree stumps.

reappearing. What are some of those species?

A. Most of them are fast growing, hardy "survivors," used mostly for wood, e.g. *Bauhinia reticulata* and *Guiera senegalensis*. Species not seen for some time in the district but making a comeback through FMNR, include: Monkey Orange (*Strychnos spinosa*), a much sought-after orange-like fruit; Custard Apple, (*Annona senegalensis*), which produces an edible fruit, wood used for tool handles, and seeds used as an insecticide in grain storage; Zoure, (*Boscia salicifolia*) is today very rare and produces a quite tasty leaf; and Ciciwa, literally "eat, eatable" (*Maerua angolensis*), which produces a highly sought after edible leaf.

Species which are not rare, but are making a come back due to FMNR, include jujube species *Ziziphus mauritiaca*, and *Ziziphus spina christi*.

Other species originally in the area apparently do not regenerate so well and so are only found occasionally. These include edible plum (*Ximenia americana tswada*); Mother of medicine (*Securidaca longipedunculata*), used in medicine (& sorcery); Hanno (*Boswellia dalziell*), bark used for dysentry; Yadiya (*Leptadenia lancifolia*), a highly sought after perennial vine with an edible pod similar to okra and edible leaves that stay green well into the dry season.

CAN YOU HELP US?

The **Association of Evangelical Relief and Development Agencies** is considering whether to prepare materials that would help development agencies teach ecological principles from a Christian perspective to farmers or students with whom they work. Not wanting to "re-invent the wheel," they asked us to inquire first whether some members of ECHO's network may already know of, or have themselves prepared, such materials. Please write ECHO, attention Scott Green, if you know materials that you or others are finding helpful. Your comments about the materials and how you use them, as well as information on the cost of obtaining one set, would be welcome.

ECHOES FROM OUR NETWORK

Eliazar Rose, New Hope Leprosy Trust, India. "I am writing in reference to the article on using tobacco to treat goats and cattle for ticks and lice (EDN 56). Our experience is that a mixture of 100 grams of dried tobacco leaves, 10 ml neem oil, and 10 grams of salt plus a teaspoon of soap powder was very, very effective and had no side effects. We believe that it is essential to spray/wipe only in the evening and/or under shade. "

"We also spray a neem/soap solution on the area where goats rest—to reduce re-infection etc."

Charlie Forst (Kenya) visited ECHO recently. "I read in EDN about Fern Yocum's nicotine treatment for killing ticks on goats. Why not use a tea made from castor leaves? They are effective and commonly available in the tropics." Charlie also brought with him a copy of a new book published by FARM-Africa and Oxfam about which he was enthusiastic. *Improving Goat Production in the Tropics: a manual for development workers* (400 pages, 1996) was written for development workers who may or may not have formal training in livestock production. It explains the "underlying theory of goat production and how this can be used to design simple improvements… together with suggestions for how they might be implemented in development programs." A student at ECHO also reviewed the book and was impressed by its up-to-date information, its extensive sections on diagnosing common diseases (and home treatments when available), and its usefulness for development workers. For example, in the chapter on goat health, a section is devoted to the training of "paravets" (local villagers in areas without veterinarians trained to help neighbors with animal health). In the chapter on breeds and breed improvement, a section is devoted to "practical methods of breed improvement for groups and governments." An entire chapter is devoted to goat-improvement programs, as well.

In the chapter on goat health, we find Charlie's treatment for ticks and mange mites:

"The castor bean plant (*Ricinus communis*) is a very common perennial, growing in a very wide range of environments in the tropics. It contains an insecticidal chemical, ricin, in the leaves and stems. Being water-soluble, ricin can be extracted from the leaves and stems, using a simple water-extraction process. A quantity of chopped leaves and stems should be added to 50 times its weight in water. The mixture should be heated to just below boiling point. The residue should be pressed to extract the liquid. The liquid can be used to wash goats, but be careful: **ricin is very poisonous**. [editor's note: the bold type is original. We fully agree. Ricin is one of the most toxic substances to both humans and goats. Wear rubber gloves, if available, when using this infusion.] Under no circumstances should it be consumed. Great care must be taken in handling this chemical. Children should be carefully supervised during the extraction process and during its use. Washing with all chemicals should be done away from the home and water supplies for humans.

The goat should be thoroughly washed. It must be

remembered that the mange mites are buried deep within the skin, so it must be rubbed very hard for the chemical to come into contact with the mites. Pinpricks of blood will be seen if the washing is done properly.

If the case is very severe, wash every 2-3 days until signs of improvements can be seen. If it is not so severe… every 5-6 days. It can be helpful to wash the skin with soap and water before using the chemical, as this softens up the skin and helps the chemical to penetrate it."

Improving Goat Production in the Tropics costs £29.95/$47.50 hardback or £14.95/$24.95 paperback. Order from: Oxfam c/o BEBC Distribution, PO Box 1496, Parkstone, Poole, Dorset, BH12 3YD, UK; Telephone: (44) (0)1202 715555, Fax: (44) (0)1202 715556; E-mail: publish@oxfam.org.uk. Add 20% for postage and packing cost in Europe, 30% elsewhere. Customers in southern Africa, USA, India, Australia may contact Oxfam for regional distributors.

BOOKS AND OTHER RESOURCES

BIOTECHNOLOGY: BUILDING ON FARMER'S KNOWLEDGE. Reviewed by *Daniel Sonke*. Those who read *EDN* are looking for ideas. Usually our readers are looking for ideas in the realm of what this book calls "biotechnology" - techniques of animal health, crop improvement, food processing, and so on. While this book was written primarily for people working in development-related research, those actually working in the field will find it to be a source of many, many ideas. From Educational Training Consultants (ETC) in the Netherlands, the book presents both indigenous and science-based biotechnologies gathered from throughout the world.

The first section of the book, indigenous biotechnologies in animal health, biopesticides, food processing, and crop genetic resources, was the most fascinating to this reader. This section came about as a result of an international contest collecting experiences with rural people's biotechnologies. *EDN* readers may find this section a source of ideas for their own research. I give as an example the following section from the indigenous biopesticides chapter:

"In Africa, for example, several Nigerian tribes are known to mix the dried leaves of a wide range of plants with stored grain to control post-harvest pests. The species used include *Annona senegalensis* Pers. [wild custard apple], *Luffa aegyptiaca* Mill. [loofah], *Hyptis spicigera* Lam., *Ocimum americanum* L. [basil relative], *Afromosia laxiflora* Harms., *Erythrophleum guineense* G. Don., *Butyrospermum parkii* Kots., *Datura stramomnium* [thorn-apple weed] and *Nicotiana* spp. [tobacco]. Stems of *Ocimum americanum* are similarly used, while in the case of *Lantana rugosa* Thimb. [a common tropical weed] the whole plant is employed (Giles, 1964); in Zimbabwe, sap from the bark of *Spirostachys africana* serves as a pesticide in granaries, while the wood is sculpted or used as lintels…"

"It is a common practice in Puerto Rico … to use whole mamey [*Mammea americana*] leaves as wrappings around newly set plants to prevent insect attack at or below ground level (Duarte and Franciosi, 1976). In other cases, ground mamey parts are applied as dust, or mixed with water of kerosene and sprayed. Other commonly used biopesticides in Latin America are *Allium sativum* [onion], *Azadirachata indica* [neem], *Capsicum frutescens* [chili], *Gliricidia sepium* [madre de cacao], *Lupinus mutabilis* [lupin or tarwi], *Melia azedarach* [chinaberry] and *Nicotiana tabacum* [tobacco]…"

"Among the 267 plant species used in [China] are *Tripterygium wilfordii*, aqueous extracts of which are sprayed to control caterpillars, tussock and pine moths, and mustard, melon and rice leaf beetles; *Stellera chamaejasme*, whose roots control soil pests; and *Melia azedarach*, dried leaf blades of which are placed between the mat and supporting board of beds to control lice and fleas (Yang and Tang, 1988)."
The other indigenous biotechnology chapters are equally rich in ideas, giving examples of, among other things, fermented foods, indigenous animal vaccination practices, and selection and dissemination of seeds.

The section on science-based biotechnologies reports some of the most modern advances in agriculture and how they are or might become used in development. Some examples include tissue culture, seed-embryo manipulation, genetic engineering, modern fermentation industries, and vaccines. This gives a good introduction to these modern techniques for readers who have not been able to learn of them from other sources.

The final section of the book suggests a strategy involving scientists, farmers, NGO's, government programs, et al. to identify and enact research which involves both science-based and indigenous biotechnologies and is targeted at farmers' needs. This section will be of most interest to those seeking how to identify research activities for their region. Throughout this section and the entire book case studies from actual research or development projects are given.

Biotechnology: Building on Farmers' Knowledge can be ordered from MacMillan (Houndmills, Basingstoke RG21 6XS, United Kingdom; telephone: +44 1256 29242, fax: +44 1256 842084) for £8.95.

UPCOMING EVENTS

ECHO's Agricultural Missions Conferences in Florida. The dates of the next three conferences are November 10-12, 1998; November 9-11, 1999; November 14-16, 2000.

ECHO's Second Annual Conference for Christian Agricultural Workers in Haiti. The organizing committee is planning a conference for May 26-28, 1998 at the Christian University of the North in Limbe. For details, write Ivan Barineau, c/o MFI-MCA, P.O. Box 15665, W. Palm Beach, FL 33416.

ECHO-sponsored Conference for Christian Agricultural Workers in East Africa. Dr. George Kinoti, director of the African Institute for Scientific Research and Development, has assembled an advisory committee to begin planning a 3-4 day conference in September or October 1998. As at our Florida conference, the emphasis will be both on practical talks by experienced workers and personal networking. (The word "networking" refers to the good things that happen when you have an opportunity to meet many other people who have a common cause, and are able to help each other with contacts, seeds, ideas, information, etc.)

A mix of missionaries, national workers and a few agricultural scientists are expected. There will be some partial and full scholarships. Registration will be limited for logistical reasons, so send an expression of interest as soon as possible to Dr. George Kinoti, African Institute for Scientific Research and Development, P. O. Box 14663, Nairobi, Kenya

Second Pan-African Christian Wholistic Development Course; April 21-May 31, 1998 in Jos, Nigeria. Course content includes: African development realities, Biblical theology of development, participatory development methodologies, strategic development management, social marketing and networking, and appropriate technology. Course fees are $900; to apply contact: The Executive Director, RURCON, Nigeria Bible Translation Centre, Old Airport Road, P.O. Box 6617, Jos, Nigeria.

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