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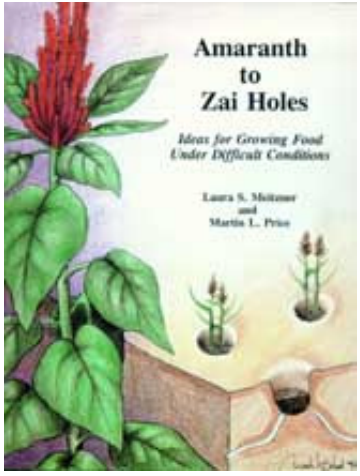


- Amaranth to Zai Holes, Ideas for Growing Food under Difficult Conditions (ECHO, 1996, 397 p.)
  - 5: Farming systems and gardening techniques
    - *(introduction...)*
    - Dryland techniques and mulches
    - Hillside techniques

Amaranth to Zai Holes, Ideas for Growing Food under Difficult Conditions (ECHO, 1996, 397 p.)

5: Farming systems and gardening techniques

Many small farmers must grow their crops on small tracts of marginal land, which may be dry or hilly or remote. These difficult growing conditions require special techniques suited to the situation. This chapter contains some ideas which can be adapted for local circumstances.

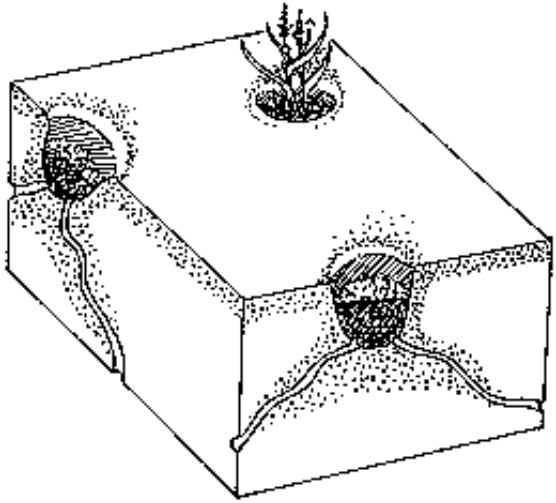
Most of the ideas in ECHO Development Notes are concerned with sustainable agriculture, that which promotes a wise and

creative use of resources to provide food and employment for the long term. People growing in marginal situations can benefit from networking, learning about techniques which have met with success both locally and in distant areas with similar challenges. We list training opportunities and publications which offer guiding principles and ideas to implement for sustainable food production. Please let us know of similar local groups which have been helpful to you.

Dryland techniques and mulches

See the Water Resources chapter for an introduction to farming in semi-arid regions.

ZAI HOLES HARNESS TERMITES TO INCREASE CROP YIELDS.



zai holes using termites to increase crop yields

Tony Rinaudo in Niger wrote of his experience using zai holes [see picture]. "Oxfam, working in Burkina Faso, promotes this method of tillage. This is a traditional practice of digging a 20x20 cm hole 10 cm deep during the dry season and filling it with mulch such as crop residue or manures. This leads to increased termite activity [note termite tunnels] which, in

turn, increases the rate of water infiltration when the rains come [see dotted areas on the diagram]. Millet is planted in the individual holes, which also help protect the seedlings from wind damage (100 km/hr winds at planting time are not uncommon).

"Where farmers are using it, it is making a big impact on crop yields. Soils here are infertile and if farmers have manure at all they just broadcast it on top of their fields. Much of this is baked, blown and washed away. If the manure and organic matter are placed in a zai hole, losses are minimized and nutrients are concentrated where the plant can use them. Crop plants have a competitive advantage over weeds that are not in the zai hole.

"Zai holes also allow greater water infiltration. The technique was originally used for hard pan soils which are uncultivatable using traditional farming methods. We convinced one farmer

to try zais on a small plot of barren land. He did and harvested 100 kgs of corn and 15 kgs of sorghum. The next year farmers in 20 villages dug over 50,000 zai holes! We urged farmers to also try zai holes in their sandy soils. The results were so convincing that many are now digging holes on their own initiative." Tony also wrote of one area in which millet yields were often less than 350 kg/hectare; with zai holes, the yields reached 1000-2000 kg/ha. Farmers in 87 villages dug almost two million zai holes for their millet.

"For some time we have been trying to re-establish cassava as a major crop in the district. There have been more failures than successes because of the harsh climate and poor soils. ...In 1993 we only received 1/3-1/4 of the average rainfall (130-240 mm). In spite of this, because we insisted that farmers dig zai holes, 80% of the 44 ha planted survived. Even in good years we have never had such a high success rate using other planting practices."

Tony also added, "Keep an eye on developments in the food use of Australian acacias. I believe these trees will be very important in semi-arid to arid subsistence agriculture in the future. Last year farmers here planted over 4,000 trees with a view to food production. They did this with no promise of food or money payments from us."

Chris Reij of the Free University of Amsterdam presented to the Club du Sahel some of his findings on zai holes in Burkina Faso, where they are an adaptation of a traditional planting method. The following is a summary taken from an article sent to ECHO. The zai or planting pockets are generally 25-30 cm across and 15-20 cm deep, spaced 80 cm or so apart. They are often dug on land so badly degraded that water cannot infiltrate, so the holes collect and concentrate runoff. Organic matter added in the hole provides nutrients for the plants and stimulates termite activity, which can improve the hole. In one area, farmers with zai holes harvested 960 kg/ha of sorghum,

while others harvested 610 kg/ha. Tree seeds have also been successfully established in zai holes. A major advantage of these planting pockets is their ability to efficiently harvest rainfall and reduce runoff, thus improving overall soil moisture and fertility. Farmers in Burkina Faso also spread straw on their fields to achieve the same benefits.

Note that different species of termites behave differently, so a technique you read about in EDN may not work where you live. Victor Sanders showed me termite nests high up in trees in Haiti. He tried painting the trunk with neem leaf tea, which was reported to stop termite damage in Mali. It had no effect in keeping this kind of termite from nesting in the tree. The zai hole technology described above is used where the "composting" species of termites is present, able to convert and enrich organic matter into good soil for the seedlings. However, the water harvesting and other benefits of this idea could be helpful even where there are no such termites.

GRASS MULCH: AN INNOVATIVE WAY OF GARDENING IN THE DRY TROPICS (by Scott Sherman). When I visited Jamaica, I learned that farmers in south St. Elizabeth Parish were growing a good crop of scallions. What was unique is that they relied on rainfall in an area that is normally too dry for intensive vegetable production without irrigation. In fact, they were growing tomatoes, cucumbers, carrots, green beans etc. where traditionally yam, cassava, tree crops and a few drought tolerant legumes predominated. Working with the Jamaica Agricultural Foundation and the University of Florida, Mac and Pat Davis set out to study this indigenous system of growing vegetables in a guinea grass mulch. The following is based on their two-part study of scallion production.

Rainfall averages 125 cm (50 inches) annually during two brief periods in the spring and fall. In addition warm temperatures and high winds combine to rapidly dry the soil after the rains. Farmers have found that mulching with guinea

grass (Panicum maximum) not only conserves moisture, but offers other benefits as well.

In the study, all critical steps (i.e. mulching, planting, cultivation, and harvest) were carried out by local farmers in accordance with local practices. Replicated plots were all treated identically (weeded, mulched with a layer of guinea grass and planted) except that after planting the mulch cover was removed from half the plots. Undisturbed fallow plots were left adjacent to each replication for comparison purposes.

Plots mulched with Guinea grass were found to have significantly lower soil temperatures than the unmulched plots. [Ed: Based on a graph in the article, afternoon soil temperatures appear to have averaged about 4 C less with mulch.]

Mulched plots maintained a significantly higher soil moisture

content than unmulched or fallow plots. As the dry season progressed and moisture became limiting, growth rates in the mulched plots were superior to those of the unmulched plots (leaf counts were 40% higher at first harvest).

Guinea grass mulch also greatly reduced the amount of weeds (weed counts being up to five times as great in the unmulched plots). Plots were harvested five times. Total yields, marketable yields, and mean bulb diameters were all greater in the mulched plots than the unmulched. Over the course of the experiment, mulched plots produced 75% more bulbs than unmulched plots.

According to Mac, the mulch system is used by all the farmers in the area and no vegetable production is attempted without it. In addition to providing mulch for the principle crops, the grass is also an important part of the crop rotation, serving as a cover crop and sometimes as food for animals. While most

farmers keep part of their land in grass and part in vegetable production, farmers with very small farms purchase the grass needed for mulch while those with larger farms grow extra for sale.

The second study focused more on soils, which in the area are well-structured, red or brown bauxitic loams with high aluminum content and near neutral pH. In addition to the benefits mentioned above, this study showed a strong correlation between mulching practices and extractable soil phosphorus.

This finely tuned system appears to be well adapted to growing scallions and other vegetables in that climate. The Davises believe that similar grass-mulch systems could be adapted to other dry areas. Guinea grass seems to be a particularly good mulch because it easily reseeds itself, produces a lot of biomass, dries down quickly and decomposes slowly. While

preparing mulch requires extra labor, less time is spent in weeding, watering etc.

Might such a system allow farmers in other dry areas to intensively produce certain vegetables where they may not otherwise be grown? The author believes so. Such a system would not only increase the farmers' profit potential over traditional crops in a region, but also provide a means for improving the nutritional status of a community. Mac suggests "the best approach would be to begin on a small scale with subsistence garden plots until farmers become familiar with the technique and some marketing infrastructure can be developed." We would be interested to hear if any of our readers have run across similar systems. Gene Purvis, now working in Costa Rica, says that he used a grass mulch system in Panama. Normally his garden took daily watering. He reduced the time of each watering AND reduced the frequency to two times a week by running poly pipe with small holes

drilled in it under a cover of chopped paragua grass. He said that any tough, slow decomposing grass, when cut dry, would work well. Rice hulls worked well. Chopping the grass had several advantages.

Martin Gingerich in Haiti learned about a traditional system using Guinea grass in Haiti. This is in an area near La Valee Jacmel at about 800-1000 meters and 2,000 mm (80 inches) of rainfall. He wrote, "Just like the example from Jamaica, the system is used by all farmers in the area and no planting is attempted without it. We couldn't find anyone who remembers when people started using the system. It is older than those using it today."

"Farmers grow mostly corn, beans and some cabbage. There are plots that have only Guinea grass, often owned by larger landholders. Once a year the grass is harvested. A farmer wanting to plant a grain crop in the coming months will

purchase and harvest a plot of Guinea grass, which he spreads over the entire field that he intends to plant. These are not large fields. The next step is to tie an animal in the plot to eat and trample the grass. They use horses, burros, mules, cattle and goats. Pigs are tied near the house and their refuse is carried to the field. After the farmer removes the animal from the field he lets it set 2-3 weeks. He then deeply tills the field with a pickaxe, incorporating some of the Guinea grass and leaving some on the surface. Planting is soon after tillage."

COLORED PLASTIC MULCHES have been found to improve yields and fruit quality in some vegetable crops, according to studies around the US. Black plastic mulches reduce weeds, conserve soil moisture, and warm the soil in cold climates. Colored mulches provide these benefits while also reflecting light up to the plants, giving yield benefits such as larger fruit or earlier maturity. Crops seem to have "preferred colors"; one review (in AVG 2/95) cited yield increases of 14-22%

over black mulch in cucumber (with red mulch), peppers (yellow, silver), squash (blue, red), and tomato (red, brown).

We called USDA researcher Dr. Michael Kasperbauer, who studies plant response to the light spectrum. He explained that not all shades of color have the same effect on yields. The key factors are the amount of reflected far-red and the ratio of far-red to red light, which can only be measured with a spectroradiometer. A high FR:R ratio of the reflected light stimulates above-ground growth, so many fruit crops respond favorably on certain red mulches. Tomatoes on red mulch yield 15- 20% more fruit during the first two weeks of harvest than plants on black mulch. Cotton plants produce more bolls with longer fibers. Pigments which reflect a low FR:R ratio, in contrast, stimulate root growth.

Some colors (such as yellow) attract insects, and growers can use this factor in pest management. In one trial, cucumber

beetles infested yellow-mulched rows first; it may be possible to attract pests to one area of a field for spot treatment. Colored mulches tend to cost more than black plastic, and manufacturers have yet to standardize the color intensity in the mulches for best production. This idea may be worth some experimentation in your fields. Research in this area began by painting black plastic with different colors. Let us know your results.

THICK MULCH FOR NO-TILL GARDENS. I (MLP) first read of this method of gardening in Organic Gardening where it was referred to as permanent mulch gardening. My reaction was that there must be something wrong with anything so easy or everyone would be using it. But our garden has performed so exceptionally well with so little work using this method that we have now converted all of our growing beds to this system.

Ruth Stout first popularized this method in her book No-Work

Gardening (Rodale Press). She noticed that under a small stack of hay that she removed in the early spring, there was no need to till the ground. From that time on, her garden had at least a 6-inch (15 cm) layer of mulch 12 months of the year. At the appropriate seasons she simply removed mulch from a row or spot for a transplant, and planted.

The first season. We began our no-till garden in an area of well-grassed lawn. In several years of continuous production, it was never plowed, cultivated, spaded or hoed. The first season it is necessary to do some extra steps if you start with an uncultivated area as we did. It is described in the March 1981 issue of Organic Gardening in an article by Jamie Jobb called "Tossing an Instant Garden." (ECHO will send a copy of this article to overseas development workers who request it.) A layer of newspapers is spread over the area. They should be no less than 3 sheets thick and well overlapped at the edges. Then organic materials of any kind are placed on top. We use

either chipped wood that is given to us by the power company when they trim along the power lines, or grass clippings. You could experiment with other materials that may be available to you such as rice hulls, sugar cane bagasse, tall cut grass, leaves, coffee pulp, etc. The method works because weeds are not able to push their way up through newspapers and a layer of mulch, but roots can go down through wet newspaper. Wherever a seed is to be planted a small mound of earth is placed on top of the newspaper (or a narrow row of soil about one inch thick is used if seeds are small and to be planted closely together). The mulch is then pulled back against the earth and a thin layer put on top of it to prevent drying of the soil. The seeds must be watered more frequently than when planted in tilled soil because the thin layer of soil can dry out quickly. When we pulled mature plants at the end of the first season we found that some roots had gone through the paper and others had grown along the top of the paper to the first edge, then underneath for normal growth. Transplants do

surprisingly well when simply planted into the sod through a hole cut in the paper.

Subsequent seasons. The procedure with newspapers is for the first season only. Before the season is over you will find that the newspaper and the sod have decayed and turned to compost. From then on if you keep a layer of mulch about 6 inches thick over the area, the soil beneath will be ready to plant whenever you wish. Our garden has been in continuous use since the day it was first planted. We use the word "no-till" because it is analogous to the system of farming by the same name in which herbicides are used just before planting, then seeds are planted directly into unplowed sod. However, this method uses no herbicides.

What are the advantages? (1) Gardens can be started in any area without the need to plough or spade. You can plant in areas that would be difficult to plough, such as around dead

trees or in rocky soil. Grasses and other weeds are better controlled than if the ground had been cultivated. (2) There is much, much less work involved in controlling weeds. But it is a no-till, not a no-work, garden! It can take a lot of time gathering and placing the mulch periodically around the plants. And some weeds will come up that must be removed. (3) Less water is needed for irrigation. (4) The soil is kept cooler. This can be a disadvantage, however, for colder areas. If soil temperatures are too low, the mulch can be raked back in areas to be planted a few days before planting, so that the sun can strike the soil directly. The soil will be dark after a few months of no-till gardening and should warm up quickly. (5) Soil moisture and temperature are more uniform, an advantage for most plants. (6) Nematodes will likely be kept under control. The soil environment is much less suited to nematode growth than, for example, the hot dry sand found in our area. Furthermore, some fungi found in the decaying organic matter will kill nematodes. We have had some signs of

root-knot nematodes in the no-till garden, but they have not been a problem after the first few months of operation. It is almost impossible to garden in the same plot for more than one season here without the heavy use of nematicides with normal gardening techniques. We have not yet had to use any nematicide. (7) The only need for a compost pile is for a small one to put large or diseased plants or weeds. When the mulch decays, it is automatically compost and is already in place! Earthworms will soon help carry organic matter down into the soil. (8) Soil erosion from sloping land should be less of a problem.

We periodically add a fertilizer with complete micronutrients. This is necessary in our sandy soil and high rainfall. If you wish to use completely organic methods, remember that you have a mulched garden but not a composted one until at least one season has passed and the mulch has had time to decay. We have not had problems with acidity in spite of all the wood

chips that we use. If this becomes a problem you would need to use lime.

At first thought you might think that we would run into a nitrogen deficiency by adding so much undecomposed organic matter. As you probably know, adding a lot of fresh organic matter with a lot of carbon and little nitrogen can actually harm plant growth the first season. The reason is that the micro-organisms use up all available nitrogen in the process of decaying the rest of the material. This nitrogen will become available later when the microorganisms die, but it presents a short term problem. The no-till garden does not have this problem because the mulch is not incorporated into the soil. All of the decay is taking place above-ground. So there is no way for microorganisms growing in the mulch to remove nitrogen from the soil. Once the mulch is decomposed it is incorporated slowly into the soil by leaching, mechanical mixing during the planting process and by earthworms.

We have had no unusual problems with insects or other pests. There is always the possibility that in your area there will be some pest that will find the mulch to be an ideal home and may give you problems. People often ask if inks on the newspaper will add toxic heavy metals. Such metals are only found in colored print. Anyhow, such a small amount of newspaper is used, and only once, that we consider it perfectly harmless.

I believe that the no-till gardening method may give you far better gardens with much less work. Some ECHO visitors who could no longer garden for health reasons are gardening with the no-till method! But as with nearly everything that we suggest, it is presented as an idea with which you can experiment under your conditions. Only you can evaluate its potential for your area. It should certainly be thoroughly tried before introducing it into the community. We will be very interested to learn of your success or problems with it. Please

let us hear from you if you try it.

There is only one disadvantage that we have found to this heavy use of mulch. It tends to frost on top of mulch at a few degrees higher temperature than elsewhere. Possible problems we had worried about, such as more insect damage or fungal diseases, did not materialize. Be sure not to make a thick, dense, layer of mulch that prevents air penetration into the soil as it can kill trees. I do not know just how thick that would need to be, but would presume a foot of packed, matted grass clippings would be dangerous for example. If you are using this method, we would like to hear how it is working for you.

By the way, a graduate student at Purdue University studied farming methods of early Mayans. He discovered that Mayan farmers spread banana leaves over the land to retain soil moisture and keep out competing weeds. Planting was done through individual holes dug through the banana-leaf mulch!

RICE HULL MULCH. Ralph Kusserow in Tanzania wrote with an interesting observation. Some of the beds were mulched with grass and some with rice hulls. He noticed that chickens did considerable damage in the beds mulched with grass but seldom bothered those mulched with rice hulls. He was intending to mulch everything with rice hulls the next time.

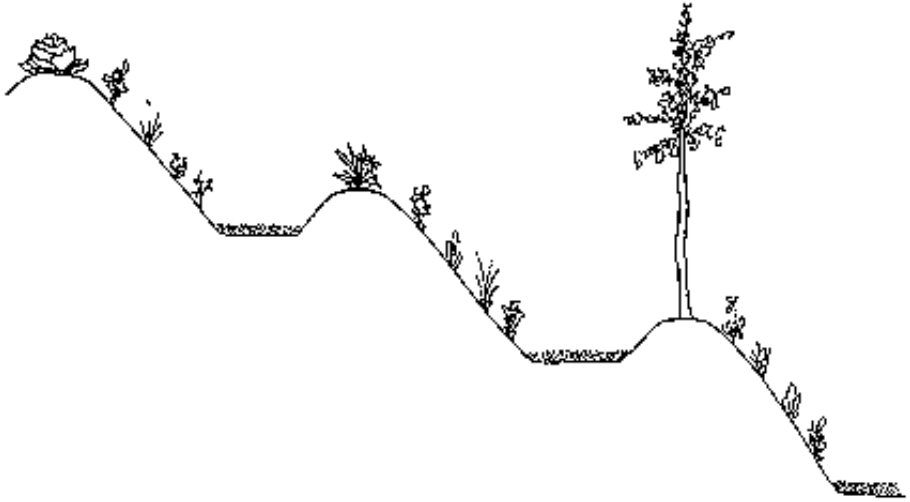
More recently he wrote, "The red glow on this paper is a reflection from my face." This year the chickens ravaged the beds mulched with rice hulls. He attributes the difference to the weather. "Last year was very dry and the mulch quickly formed a crust over the top. Although we have not had a large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

chickens have not bothered coming into the garden at all."

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

Hillside techniques

INNOVATIVE METHODS OF TERRACING.

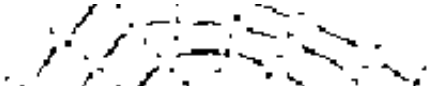


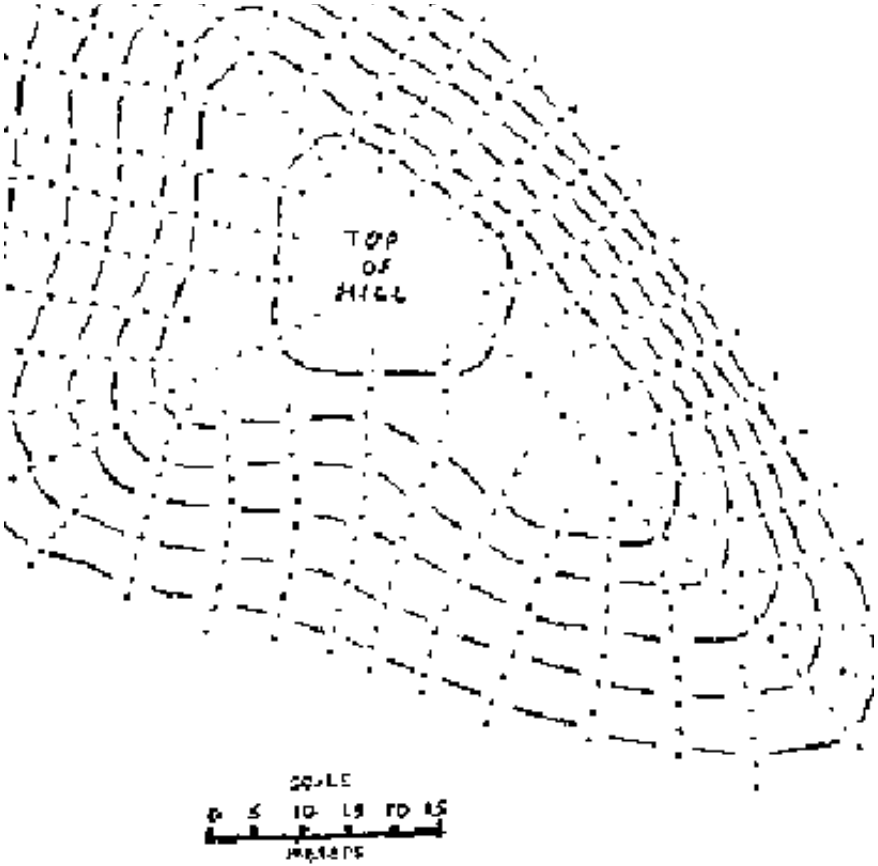
digging trenches along level contours and form elevated ridges for tree planting

I made a special trip to Haiti about a year ago to meet Victor Wynne and to see his interesting small farm in the mountains. After walking through eroded hillsides and unimpressive "fields," we suddenly came to a beautiful productive area that seemed like the Garden of Eden by contrast. Victor has

experimented with better methods of terracing for some time, combining his training as an engineer and his love of plants. He has at least three distinct systems. He has written a description of one to share with our network, which follows.

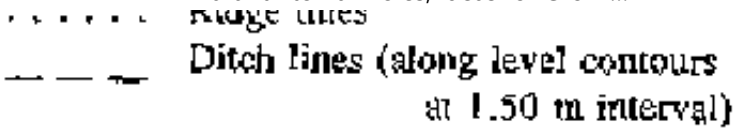
"There can be no viable long-term agricultural cropping or reforestation on hillside or mountain slopes, unless these slopes are first protected from soil erosion in heavy rainfalls. Protective measures to conserve soil must come first. The scheme which we have found to be entirely satisfactory consists not of terracing, but of digging trenches along level contours and using the material from the trenches to form elevated ridges for tree planting. The ridges are always made at right angles to the level contours. The work must always commence at a drainage divide and proceed downward. Otherwise runoff from above may destroy your work.





LEGEND

Olives Trees



accompanying contour map of a section of hilly terrain

"The accompanying contour map of a section of hilly terrain illustrates the scheme. The level contours, shown by dashed lines, are laid out so that there is a 1.5 meter difference in elevation. This has been found to be a satisfactory spacing on most slopes for intercepting and temporarily holding runoff from heavy rains. In practice there is no need to make a map. A few level lines are staked out on the ground, starting just below the hill summit, at the stated 1.5 meter vertical elevation difference between them. A small inexpensive line-level hung onto a nylon string provides an easy way of laying out these level lines. With taller stakes readily visible, one chooses and marks the ridge lines roughly perpendicular to the direction of the trenches and spaced six or seven meters apart. This rather close spacing eliminates the necessity of any

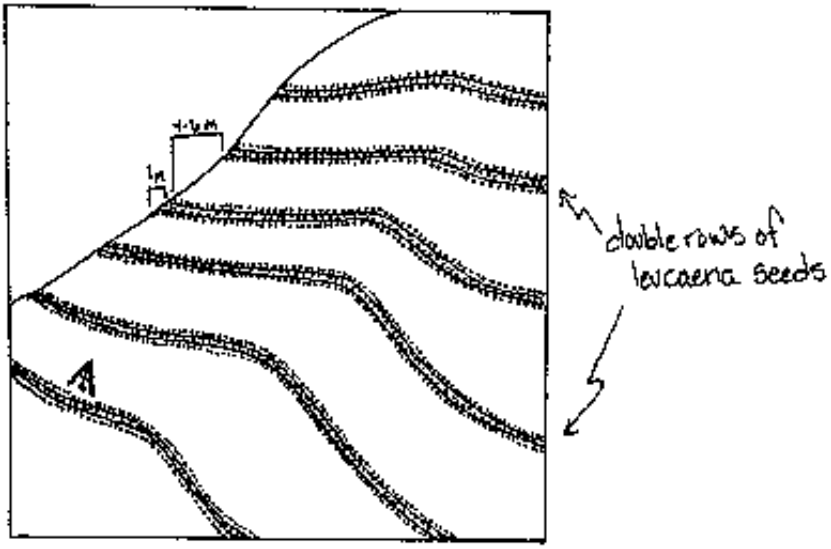
hauling of excavated ditch material, as all can be thrown by shovel from trenches to ridges. The ridges are represented on our contour map by the dotted lines. Trenches should be at least 30 cm in depth, and a minimum of 60 cm wide, with a level bottom. Of course, where the ridges are to be the trenches need not be dug out. Thus the trenches consist of short sections of ditch. Very careful leveling is less important than it would be for a long extended ditch.

"The hillside is now ready for agroforestry plantings. In general the ridges will be reserved for tree planting because of the greater soil depth. The rectangular plots between ridges and ditches can be used for annual cash or subsistence crops." He is having great success with Mimosa scabrella trees. This species might be the higher altitude equivalent of the leucaena. It is dying out where the roots encounter limestone. These trees are planted on the ridges with Andean blackberry plants growing on wires strung between the trees. He likes

this berry because it produces year round. The juice he served from the berry was outstanding. Victor says it will only grow at higher elevations, over 4000 feet.

"Well, that is all there is to it. Simple isn't it?-but fully effective. So let's save our mountain soils!" For his complete description, plus my own description of two other distinctive methods he has been using, write for our Technical Note "Terracing on the Wynne Farm in Haiti."

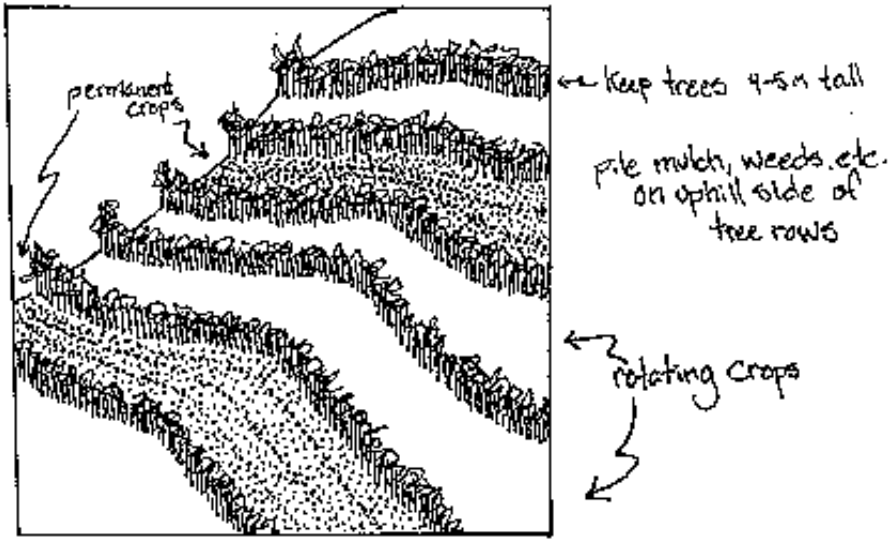
SALT PROJECT (SLOPING AGRICULTURAL LAND TECHNOLOGY). The Mindanao Baptist Rural Life Center in the Philippines has done excellent work with farming sloping land. Harold Watson (the director), Ken Turner, and Peace Corps volunteer Joseph Profitt sent us a description of the technique. SALT has been used at the center since 1979. Its purpose is to protect hilly soil from erosion and to provide nutrients for plants.



protect hilly soil from erosion 1

First lay out the land in contour lines using an A-frame (see next article). Space the contour lines about 4-6 meters apart. Next plow and harrow a 1 meter band along each contour until prepared for planting. Plant two rows of Leucaena leucocephala (or other species) on each band, during the rainy

season, in furrows 0.5 meters apart and about 2.5 cm deep. If a large tree or stone is directly on the contour line, plant the double row around it, one row above and one below the obstacle. Soak the seed overnight in water to speed germination. [Ed: Many people place seeds in hot water then allow to soak without further heating over night.] Discard any seeds that float because they will not germinate. Plant seeds quite densely, about 1 cm apart; cover with fine soil and press down firmly. After germination, replant any spaces in the rows. Weed the seedlings until they are well established. To allow fast growth, seedlings can be gradually thinned out (every other tree) over a 3-4 year period. When the trees are large the final spacing should be 4-8 inches. This will require about 20 kilograms of seed per hectare, depending on the distance between the contour lines.

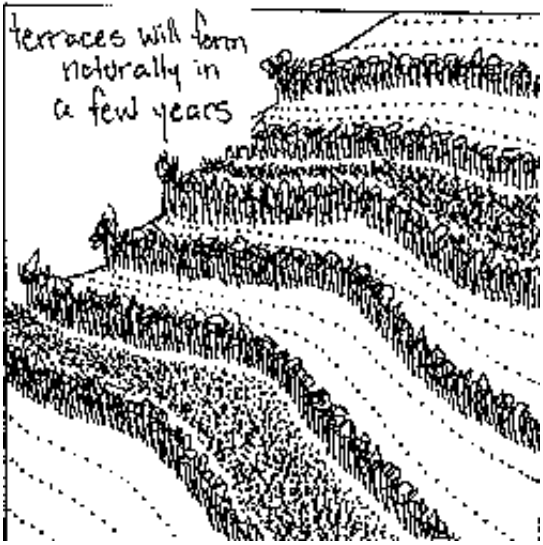


protect hilly soil from erosion 2

The leucaena can be left to grow until it becomes 4-5 meters high, at which time it will form a shade which will kill the grasses and eliminate the need for hand cutting to prepare for cultivation of the soil. If you must cultivate the land to plant crops in the 4-6 meter wide strips between the rows before

the trees reach this height, you must plow alter- nately. In other words, one strip is plowed, the strip between the next higher two bands is left untouched, the next is plowed, etc. The unplowed strips will help hold soil that may wash down from above. When the leucaena is fully grown you can cultivate in every strip. Permanent crops such as coffee, bananas, and citrus can be set out at the same time as the leucaena seeds. The soil should not be plowed for these crops and only ring weeding should be used until the leucaena trees are large enough to hold the soil. Once a month cut down the continuously growing trees, but leave at least one meter of the stem. Pile the leaves and twigs at the base of your crops. This will provide both a mulch and nutrients. As you continue farming the land, gather excess straw, stalks, twigs, branches, leaves, rocks, and stones and pile them at the base of the trees on the uphill side as an erosion barrier. Over the years this will build up strong, permanent, naturally green and beautiful terraces-which will anchor your precious soil in its

right place.

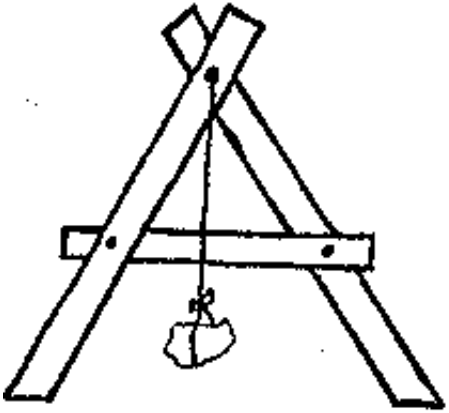


protect hilly soil from erosion 3

Every third strip is planted to a permanent crop such as fruit trees. The two intervening strips are planted to field crops like corn or cassava. The field crops should be rotated. For example, pineapple might be planted after beans have been

harvested. If you want more information on this technique, contact ECHO for the 10-page illustrated Technical Note. The Center has many other demonstrations which integrate forestry, forages, animals, and home gardening techniques. They also sell seed of several species. Contact Mindanao Baptist Rural Life Center, P.O. Box 94, Davao City 8000, PHILIPPINES. [The fertilizer and mulch benefits of SALT are so great that a similar system is used even on flat land where erosion is not a problem. There it is called alley cropping.]

HOW TO MAKE AND USE AN A-FRAME. The A-frame is an accurate and extremely simple tool for measuring and marking level contours on a hillside field. You will need two straight and sturdy stakes or boards about 2 meters long and a third about 1 meter long, 3 nails, a string, and either a rock or bottle filled with rocks. A-frames are alongside the hoe and machete as essential tools on many mountain farms for preserving mountain soils.



making an A-frame used for the sloping land project

Nail the two long boards together at one end with a single nail. Leave the nail sticking out about half a centimeter so the string can be tied to it. Next nail the shorter board to the other two to make an "A", as shown in the drawing. Tie the string onto the nail and hang the plumb at the other end of the string so that it will swing freely, but below the horizontal board.

Next you need to find where the string will be touching the horizontal board when the two ends are on level ground. If you are certain that you have a level spot you can just make the mark where the string is resting. Rotate the A-frame 180 degrees and set it back on exactly the same spot. If the string is not on the same mark the location was not level. A method for any terrain is to drive two stakes about 10 centimeters wide into the ground, spaced so you can hold the A-frame with one leg on each stake. Mark where the plumb line touches the cross member, then rotate the frame 180 degrees and repeat. Place a large mark exactly half way between the two marks. This should be where the plumb line will touch the cross member when it is on level ground. To double check, drive the higher stake lower until the plumb line touches the mark, indicating that the frame is level. At this point you can rotate the frame 180 degrees and the plumb line will still contact the same mark.

To mark out a contour, place a stake into the ground at the starting point and put one leg of the A-frame next to the stake, on the uphill side. Locate the other leg of the A-frame where the plumb line crosses the level mark, then drive a stake by the leg, on the downhill side. This becomes the new starting stake. Continue in this way across the hillside. [This is based on a verbal description by Larry Sell in Honduras.]

There is nothing new under the sun. Someone sent us the book Ramesses the Great about ancient Egyptian civilizations. On page 140 is a picture of an A-frame. The caption said it is made from wood and limestone and was one of the tools selected for burial in the tomb of "the Servant in the Place of Truth Sennedjem."

SEMBRADORES DE ESPERANZA: CONSERVAR PARA CULTIVAR Y VIVIR, by Monika Hesse-Rodrguez. 252 pages, Spanish only. This exceptionally well-illustrated book arose from the

experiences of agricultural transformation in mountainous southern Honduras. It details the practical techniques implemented to promote soil conservation in a community-oriented development program.

The author advocates a cautious and flexible approach to agricultural change, and the reader is constantly reminded that a successful method is one which works for an individual farmer in the family field. For that reason, the author presents many alternatives and ideas for site-specific adaptation. The introduction to the techniques used to conserve soil on sloping land, covers the theory, methods, advantages, and drawbacks of the following areas: the construction and multiple uses of an A-frame, many forms of terracing, vermiculture, agroforestry, green manures, low-tillage systems, intercropping, living fences, and windbreaks.

This book will be useful to community leaders and extension

agents, who can benefit both from the insights into implementing agricultural change in a rural community as well as the various techniques discussed. The book constantly references the farmers' own experience, complete with testimonies from individuals about the use of each technique in his or her own field, clear photographs of over 30 unique applications of the conservation measures in farmers' plots, and questions for reflection in a group training course context. The reader can visualize the end results through numerous line drawings and photos throughout the text. The format would seem to be easily adapted for teaching and extension. The many illustrations make this a great book for non-Spanish speakers who want to work on their agricultural vocabulary.

Thanks to Judith Castro for sending a review copy. You can order a copy for US$5 (plus $5 postage, for up to 3 books) from Seor Juan Bautista Meja, Servicio de Publicaciones del Obispado de Choluteca, Apdo 40, Choluteca, HONDURAS.

CUIDEMOS NUESTRA TIERRA: UNA VIDA MEJOR MEDIANTE EL APROVECHAMIENTO DE LOS RECURSOS EN EL CAMPO. Edited by Alberto de la Rosa and Werner Moosbrugger; 69 pages and full-color poster, Spanish only. This short book accompanies a large poster which depicts a mountainous campesino community with ecologically sound agricultural systems. Each page of the book amplifies one area of the poster scene and briefly defines the illustrated technique, explains its advantages and implementation, and suggests discussion questions and activities related to the topic. Among the 28 areas promoted are: soil improvement techniques, water system management, use of native crops, farm inventory, intercropping, school gardens, grazing and use of farm animals, and various erosion control measures.

The poster could be very useful in a classroom and serve as a reference for instruction on the environmental and economic advantages of integrating these ideas into village practices.

The manual is not technical and serves primarily to explain the concepts attractively presented in the poster. The strong point of the book is that it positively outlines how the proposed techniques can address common problems of many campesino communities, offering other incidental benefits as well. The book (US$14) and poster (US$9) are available from Werner Moosbrugger, AA 100409, Bogot 10, COLOMBIA. Also available (for $12) is a brochure describing a simple way to solve the waste problems faced by poor urban communities. Prices include postage.

Intercropping

INTERCROPPING OF SUGAR CANE. The following is quoted from an article "Malnutrition in the well-off farmer" in the World Development Forum (no longer in print), which I believe they got from Ceres. "Researchers in Nairobi, surprised to find malnutrition among the families of relatively well-paid sugar-

cane workers, devised an ingenious corrective." By marginal widening of the row crop spacing, they found "room for two protein-rich, non-cash crops (maize and beans) which could be harvested within three months of planting. As cane takes 22 months to mature, it proved possible to snatch two successive inter-row crops before the spreading roots of the cane feel any adverse effects from the competition." A great side benefit is that the need for cane weeding was reduced. (The reason for the malnutrition among the workers and their families was that the need for cash for buying property, consumer goods, schooling, and physical assets competed with their need for food.)

I believe this has the potential to be one of those innovations that development workers are always seeking: something that can have a large and immediate impact and limited risk. (This assumes, of course, that it is not already a local practice.) So we are dedicating considerable space to the subject of

intercropping with sugar cane.

Many of you work where there is not enough good land to go around. Intercropping on land previously used solely for cane is almost the same as finding new land. It is a way to produce food for local consumption on land that was previously used primarily to earn foreign exchange. It reduces risk of total loss due to crop failure because even if something like a hurricane destroys the long season (several months) cane crop, some financial return will have been realized. Cash flow is improved. It might even slightly reduce the pressure to clear new marginal land.

The Canadian aid agency, IDRC, featured the work of Dr. Govinden on this topic in their magazine IDRC Reports and were able to put me in touch with him for more information. He graciously sent detailed reports of this work in Mauritius. The following is based on his articles.

Dr. Govinden writes, "We have several teams working on intercropping of sugarcane with various food crops at the Mauritius Sugar Industry Research Institute. Intercropping with sugar cane is practiced on a large scale and is responsible for 77% of the potatoes, 60% of the groundnuts and 50% of the maize (corn) produced in the country. Additionally, small planters grow a wide range of vegetables in their sugarcane fields. These include beans, peas, tomato, cabbage, pepper, and okra, to name a few."

Farmers in Mauritius have been intercropping with sugar cane on a small scale for over a century. The practice picked up during the shortages of World War II, but only "took off" during the past 10-20 years. "Intercropping with sugar cane is widespread in India, Philippines, Mauritius, Reunion, and Taiwan.... It is practiced on a limited scale in Brazil, China, Colombia, Egypt and Indonesia."

MAIZE (CORN). Unlike potato, maize reduces the sugar cane yield, due primarily to competition for light by the tall maize plants. The extent of reduction depends on the height, time to maturity, and leafiness of the maize. No evidence has been found of any effect of intercropping on insect or disease damage, either positive or negative. Mechanical harvesting is a problem.

Sugarcane can be and often is grown on lands too steep for maize. Intercropping of sugarcane on such lands allows the production of some maize without leading to soil erosion. In fact the maize confers additional protection to the soil from the erosive action of rain during the establishment period of the cane. In Mauritius there are two cane planting seasons. "In the first season, maize is harvested before and, in the second season, after the cane. The peak labor demands therefore do not overlap."

"The success of intercropping depends on maximizing the complementarity and minimizing the competition between the component crops. ...It has been suggested that maize and sugarcane are too similar for there to be benefits from the intercrop." However, there is still an important difference that can be exploited-the difference in the time at which each crop makes use of the growth resources.

"Sugarcane is planted in wide rows (1.4-1.6 m). It takes 2-3 weeks to germinate, grows slowly for the first few months and does not cover the soil until about 4-5 months after planting. In the case of ratoons, canopy closure occurs earlier, in about 3-3.5 months. [A ratoon crop is a crop that comes up from the roots after a previous crop was harvested.] During the first 3-4 months, the cane makes little demand on the available ... space, light, water and nutrients. These can therefore be used to produce compatible intercrops.

"Maize ... grows fast and achieves canopy closure in 1-1.5 months. Early maturing cultivars can be harvested within 3-3.5 months after planting, before the cane canopy closes."

Because maize is taller than the young cane, it is important to use short and early maturing varieties. "Moreover, a balance must be found between planting enough maize to give worthwhile yields and using higher densities that can lead to competition with the cane. Much of the cane yield reductions from intercropping with maize can be attributed to the use of tall and late-maturing maize cultivars planted at excessive densities."

Dr. Govinden calls the potential row between the rows of cane the "interrow." When maize is planted in each interrow it "does not compete with cane for underground resources. When the cane row width is 1.6 m, the maize plants are 0.8 m away from the cane. Maize roots do not extend that far and

therefore do not have access to fertilizers placed in the cane row. The maize must therefore be fertilized separately."

Maize growth occurs during the first two phases of sugarcane growth: germination and tillering. [Tillering refers to the plant sending up additional stalks.] Germination is not affected by intercropping, but tiller formation is often seriously reduced. "As soon as the [maize] is removed, however, tillering resumes normally and, in time, much of the adverse effects disappear." There is even a name for the ability of sugar cane to overcome initial setbacks: "rattrapage." If rattrapage is to be complete, it is important that there be adequate water, nutrients and no weeds after the intercrop is removed. If cane farmers use herbicides, maize is an especially good intercrop because both crops react similarly to herbicides.

"Once sugarcane is planted, it is usually not replanted for several years; 8 years on the average in Mauritius." Ratoon

crops grow more quickly than newly planted cane and hence are more competitive with maize. However, maize has less adverse effects on the cane when it is a ratoon cane crop. Consequently, Dr. Govinden suggests leaving the interrow between newly planted cane for other crops such as potato, beans, and groundnuts that are less competitive than maize and which themselves do better with newly planted cane than in ratoon cane. The maize would then be intercropped with the ratoon cane. "With time the ratoons encroach upon the interrow space, making [further] intercropping more difficult. Maize is indeed one of the few crops that can be successfully intercropped with 2nd or 3rd generation ratoons."

"In order to create more space for intercropping of 3rd or older ratoons, it has been proposed to plant the cane in paired rows." In Mauritius, two rows of cane were planted at only 0.95 m apart separated from the next pair of rows by 2.25 m. Success was variable. Sometimes cane yield was reduced.

Here are his suggested guidelines to developing cultural practices for maize/cane intercropping in your area.

TIME OF PLANTING. "In order to minimize the adverse effects of maize on cane, the maize should be planted as soon as possible after the cane. This ensures that the cane will have enough time after the maize harvest to offset initial setbacks. In practice, the maize may be planted up to 3 weeks after the cane."

LAND PREPARATION. "The land preparation for plant cane [i.e. not ratoon cane] is adequate for the maize as well. The cane furrows should not be too deep since it is difficult to plant maize mechanically on high ridges. In ratoon cane which is not burned at harvest, the trash must be lined up, usually in alternate interrows. The maize is then planted in the free interrows...".

VARIETIES. "Only short-statured and early-maturing varieties should be used in order to minimize competitive effects on the cane. The plant height should be less than 2 m and the crop cycle from sowing to physiological maturity should be between 85 and 95 days. Since maize yield is a direct function of the length of the crop cycle, the balance between a longer cycle for higher maize yields and a shorter cycle to minimize adverse effects on cane can only be found after experimentation under local conditions."

PLANTING PATTERNS AND PLANT DENSITY. "Various planting patterns are possible. In Mauritius, whether in plant or ratoon cane, one row of maize is planted in alternate interrows of cane [i.e. as you walk across the field you encounter cane, cane, maize, cane, cane, ...]. It is possible to grow one row of maize in every interrow of cane, but shading of cane is more pronounced when the cane rows are bordered by maize on both sides."

"Maize plant population density may be varied between 15,000 and 30,000 plants per hectare (20,000 plants per hectare is recommended in Mauritius). A lower density ensures that the maize has no effect on the cane but the yield of maize is also lower. In areas where the cane growing season is long and where the cane is more competitive, the maize plant density may be increased."

FERTILIZATION. "A good rule is to base the recommendation on the response of sole-cropped maize and to apply as much fertilizer per plant as in pure stands." [And to likewise fertilize the cane as a sole-cropped plant.]

IRRIGATION. "In areas where surface irrigation is used, the cane furrows should not be too deep, otherwise the ridge in the interrow on which the maize is grown may not be properly watered." In drip irrigation systems, a separate drip line is needed for the maize.

WEED CONTROL. [I usually assume that few readers work with farmers who have access to agrochemicals. Because this technique might be done by peasant farmers but on large commercial farms, such may not be the case. In fact, it is quite likely that the cane field has already been treated. This may present a problem with some potential intercrops that are unrelated to cane.] Grasses and broad-leaved weeds are controlled with a pre- emergence application of "Primagram" (a mixture of atrazine and metolachlor). [Imagine what that would do to a subsequently planted intercrop of beans!] If grass is not a problem, use atrazine alone. Nutsedge can be controlled with "Basagran DF" or 2,4-D amine which should be applied underneath the maize canopy after it has grown to knee height.

HARVEST. "In pure stands, maize may be left to dry in the field, but in sugarcane interrows, it should be harvested soon after physiological maturity in order to minimize shading of

the cane. The grain must then be dried."

MAIN PROBLEMS. "Sugarcane is sometimes called the lazy man's crop. The management of sugarcane intercropped with maize is more difficult; careful attention must be paid to details. Timeliness of operations is important. Main problems relate to mechanization and to pests and diseases." Mechanization of planting is easy, with one row maize planters. Harvesting is more difficult and is still done by hand in Mauritius.

"Perhaps the major objection to intercropping sugarcane with maize is the fear of increasing pests and diseases common to the two crops." Especially downy mildew, sugarcane mosaic virus and maize streak virus. "In South East Asia where downy mildews are a problem, intercropping ... is possible so long as resistant maize cultivars are used." [There appears to be little information on the subject, but no reported serious problems.]

"Sugarcane and maize have several pests in common, mainly borers. ... One report from India indicates that when sugarcane is intercropped with maize, the difference in borer infestation was negligible." "The fact that insecticides are not used in cane certainly helps to maintain the activity of biological control agents."

POTATOES. Potatoes are the most successful intercrop. Potatoes do not reduce the yield of the cane and conversely sugar cane does not affect potato yields. Each crop is fertilized separately according to its recommended needs.

GROUNDNUT (PEANUT). Groundnuts resemble potatoes in that they do not adversely affect cane yields. They differ from potatoes in that fertilizer requirements on cane lands are very low; so low that most growers do not use any fertilizers. Work is underway to determine to what extent groundnuts may provide fixed nitrogen to the cane.

BEANS. Dry beans do not reduce yields of cane. Recent results indicate they may be able to grow beans in the interrows left free when maize is intercropped with sugar cane. (Remember that cane does better if maize is not grown on both sides of the cane row.) An advantage over many crops is that beans have a relatively short life and require less water than most crops.

GENERAL COMMENTS. In contrast to what is commonly observed in other countries, intercropping of sugar cane with food crops in Mauritius is much more popular with the corporate sector (sugar estates) than with the small holders. In some cases the estates produce the maize, potato and groundnut themselves. Others rent the cane interrows to planters for a few months. The reason may be that small landholders have two jobs and lack the extra time to do intercropping. The timing of some food crops cultivation may be complementary to sugar cane in terms of labor use.

In many countries the large plantations "have the best lands and infrastructure and have access to inputs such as fertilizers and irrigation. They should therefore also share the burden of producing food. This they can do by intercropping their sugarcane with food crops.... They need not do it themselves, but could rent out the interrows or make them available freely to landless peasants for the purpose of intercropping as is commonly done in Mauritius."

Thanks to Dr. Govinden for sharing this information. ECHO is very interested to hear about your own experience if you try intercropping with sugar cane, or details of local practice if it is already done. EGUSI CAN REDUCE WEEDS IN CORN. A recent article on weed control by the International Institute of Tropical Agriculture (IITA) in Nigeria says, "In most parts of West Africa, farmers grow egusi, Citrullus lanatus, a spreading herbaceous plant grown widely for its seed, at a wide spacing to maximize fruit size. Studies at IITA and elsewhere show

that crops such as maize and cassava interplanted with egusi need to be weeded only once (within 2-3 weeks) after planting if the melon is grown at densities of 20,000 plants per hectare." Without egusi the field had to be weeded 2-3 times. "Ground cover by egusi suppresses weeds until the melon is harvested, by which time the crops have developed a canopy cover of their own." [Ed: Egusi, related to watermelon, looks and grows much the same way. Vines do not climb.]

STRIGA CONTROLLED IN PEARL MILLET BY INTERCROPPING WITH COWPEA. The parasitic weed Striga hermonthica is a major problem in African millet fields. International Agricultural Development (Jan/Feb 1994) reports that dense intercropping of cowpea in millet stands can reduce Striga emergence. Farmers in Mali commonly plant the two crops together, but the cowpea is only sparsely planted out of concern for reduced millet yields. A denser planting of cowpea cools and shades the soil and increases the relative humidity

of the soil surface. Researchers were unsure which effect of intercropping reduced weed emergence.

Cowpea roots are known to stimulate Striga germination underground, but the close intercropping reduced the weed's emergence from the soil. Researchers achieved best yield results by high-density intercropping of cowpea with local short-cycle millet. Long cycle (120-day) millet had reduced yield in dense intercropping.

Sustainable systems: resources and training opportunities

EDUCATIONAL AND TRAINING OPPORTUNITIES IN SUSTAINABLE AGRICULTURE, 8th ed., 1995. This USDA educational booklet lists over 100 programs for those interested in studying or gaining experience through university programs, farms, and other organizations in the

U.S. and Canada. The institution, contact person, and a brief description of the programs offered are listed. The booklet is available at no cost from Alternative Farming Systems Information Center, National Agricultural Library, Room 304, 10301 Baltimore Blvd., Beltsville, MD 20705-2351; telephone: (301) 504-6559; fax: (301) 504-6409.

A RESOURCE LIST FROM APPROPRIATE TECHNOLOGY TRANSFER FOR RURAL AREAS gives addresses and brief information about internships, apprenticeships, and sustainable growing learning opportunities. The 21-page list includes on-farm experience and other training programs all over the USA. Write ATTRA at P.O. Box 3657, Fayetteville, AR 72702, USA; phone 501/442-9824 or 800/346-9140; fax 501/442-9842.

EXTENSION AND EDUCATION MATERIALS FOR SUSTAINABLE AGRICULTURE: Volumes 1 and 2 (edited by James King and

Charles Francis), is a 390-page compilation of ideas and examples of practical teaching materials related to sustainable agriculture. Topics included are cropping systems, nitrogen use, preventative weed management, economics, and lease structures and landlord-tenant agreements. Teaching methods include decision cases, lectures, and discussion topics. A number of curricula from universities and colleges, including lists of topics and references, are given in detail. Cost of each volume is $10, including postage; however, single copies will be supplied free to U.S. addresses while supplies last. Order from Center for Sustainable Agricultural Systems, 225 Keim Hall, University of Nebraska, Lincoln, NE 68583-0949, USA; phone 402/472-2056; fax 402/472-4104; e-mail CSAS003@UNLVM.UNL.EDU.

FARMING FOR THE FUTURE: AN INTRODUCTION TO LOW-EXTERNAL-INPUT AND SUSTAINABLE AGRICULTURE (250 pp.) was written to help development workers assist resource-poor

farmers develop productive, sustainable farming systems using locally available resources.

The main themes are: LEISA (low-external-input and sustainable agriculture) and PTD (participatory technology development). The first is an approach that seeks to maximize the use of locally available resources, both human and natural, in ways that are economically, ecologically and socially sound. External inputs are seen as complementary rather than foundational. PTD stresses the combination of indigenous and scientific knowledge to find solutions to farmers' problems. PTD is seen as a stepping stone to LEISA. The book provides background theory, practical ideas, and sources of up-to-date information. Field examples liberally sprinkle the text to illustrate key principles and techniques of LEISA.

Chapter 1 explores the need for sustainable agriculture.

Chapter 2 considers the farm as a system and decision making at the farm level. Chapter 3 is titled "Technology development by farmers" and focuses on traditional farming systems, farmer experimentation, farmer innovation and farmers' limitations. Chapter 4 introduces basic concepts of agroecology. Chapter 5 deals with principles upon which to build productive, "site-appropriate" forms of LEISA. Chapter 6 deals with developing LEISA systems in the Tropics. Chapters 7 and 8 deal with PTD and linking farmers and scientists in developing LEISA technologies.

Both missionaries and ECHO's interns have found it a helpful resource. It is often checked out when we look for it and our first copy is already dog-eared. There are many helpful photographs, graphs and drawings as well as numerous boxes giving examples from the field to illustrate key points. What I find particularly helpful is the 72 pages of appendices which alone make it a valuable resource. Appendix A lists specific

promising techniques such as: composting, green manuring, use of trap and decoy crops, natural medicines, water harvesting techniques, etc. Appendix B is a glossary of key terms. Appendix C contains a list of suggestions for further reading, an annotated bibliography on sustainable agriculture in the tropics and addresses of organizations concerned with sustainable agriculture. There is also a very good index. This book is thorough and filled with good ideas. The down side to any book that seeks to be exceptionally complete and detailed is that a lot of words are sometimes used to state the obvious for the sake of completeness.

The authors (Coen Reijntjes, Bertus Haverkort, and Ann Waters-Bayer) are all on staff at ILEIA (see below) in the Netherlands. Individual copies are available for about £7 from the publisher: MacMillan Press, Houndmills, Basingstoke, Hampshire RG21 2XS, UK; phone 44-256-29242; fax 44-256-810526. Available in French (360 pp.; revised francophone

bibliography) for FF170 from Karthala, 22-24 Blvd Arago, 75013 Paris, FRANCE; fax 33-1-45352705.

ILEIA NEWSLETTER ON LOW-EXTERNAL-INPUT AGRICULTURE. ILEIA, the Information Centre for "Low-External-Input and Sustainable Agriculture" (LEISA), changed their name in 1996 to the Centre for Research and Information Exchange in Ecologically Sound Agriculture. They have been sharing information on sustainable agriculture since 1982. Their quarterly ILEIA Newsletter (actually it is more like a magazine) currently goes out to more than 10,000 individuals and organizations worldwide.

Each issue focuses on a central theme, such as natural pest control, agroforestry, farmer's networks, etc. One issue included articles on: raising mushrooms as a means of supplementing women's income, using ewe milk, crossbreeding cattle, biological water purification, starting a local library,

designing a seed system for smallholders, and smallholder beekeeping. Networking is a goal of each issue with articles based on specific cases from around the world. Contributions of articles are welcomed. Whenever possible, sources of additional information are provided. Each issue reviews new literature and highlights other useful resources relevant to sustainable agricultural development. We have found the newsletter to be a great resource. Yearly subscriptions are $13.75 for individuals in the third world and students worldwide and $27.50 for others. Third world organizations may ask for free subscriptions. Write to ILEIA, Kastanjelaan 5, P.O. Box 64, NL-3830 AB Leusden, NETHERLANDS; phone 31-33-4943086; fax 31-33-4951779; e-mail ileia@ileia.nl.

FRENCH BOOKS ON TROPICAL AGRICULTURE. We forwarded this request from Ron Angert in Haiti to Pete Ekstrand in Zaire. We excerpt his reply. You may want to write to these places for current catalogs for books on other topics as well.

"These are the best I have seen. We use them for our teaching here. The ones from the French Foreign Ministry are not too expensive either. Unfortunately one of the best has been out of print for a couple years. It is Precis D'Elevage du Porc en Zone Tropicale. It is excellent! This and a host of other excellent books on agriculture and animal husbandry in the tropics come from the French Ministry of Cooperation and Development. Write them for their complete catalog: Direction De La Documentation Francaise, 29, quai Voltaire, 75344 Paris Cedex 07, FRANCE; phone (1) 40 15 70 00.

[Ed: We obtained catalogs and include the price after each title. US$1=4.9FF in 1/96.] "I have purchased or seen and recommend the following from the French Ministry: Memento de L'Agronome (180FF) is an excellent handbook on everything: soils, climate, crops, husbandry, pathology, etc. Memento Du Forestier (160FF) is an excellent book on forestry. It does not cover reforestation and does cover fish

culture. [None of the following books were in the 1996 catalog; write for current information.] Manuel d'Hygien du Betail et de la Prophylaxie des Maladies Contagieuses en Zone Tropicale is brief and to the point, sort of a field manual. Precis du Petit Elevage is an excellent treatment of poultry and rabbits. Manuel de construction des Batiments pour l'Elevage en Zone Tropicale gives plans for cattle, pork, chickens, and the needs of each. Manuel sur les Paturages Tropicaux et les Cultures Fourrageres is an excellent discussion of pastures and their management. Manuel d'Alimentation des Ruminants Domestiques en Milieu Tropical is an excellent analysis of all foods for ruminants and the needs of these animals, including suggested rations. Precis de Parasitologie Veterinaire Tropicale gives an excellent coverage of parasites found in the tropics.

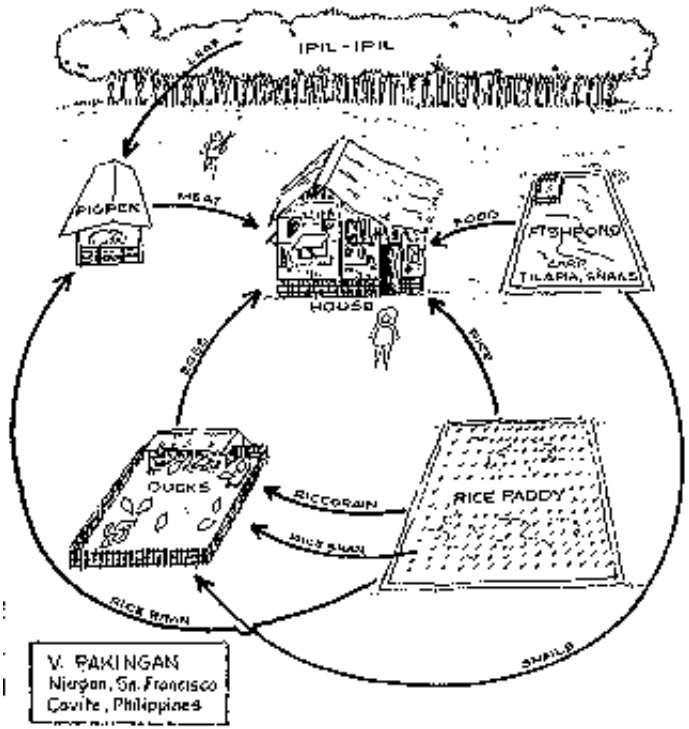
"Les Principales Cultures en Afrique Centrale is an excellent book on the cultivation of ALL tropical crops. It is in-depth and covers all the diseases and the processing of the crops. Order

from Patrimoine Du Musee Royal De L'Afrique Centrale, 13 steenweg op Leuven, B-1980 Tervuren, Belgie-BELGIUM. Agriculture Tropicale en Milieu Paysan Africain (770 FB) does an excellent job on all the basics of agriculture and could be used as a text for the beginning classes without changes. It has incredible pictures on the basics: soils, biology, fertilizers, nutrition, water and its movements, spacings, composting, etc. You may even want to learn to read French once you see it!" (I ordered it. He is right, I sure wish I could read it. The pictures are intriguing.) Order from Terres et Vie, 13, rue Laurent Delvaux, 1400 Nivelles, BELGIUM, or Enda Pronat, B.P. 3370, Dakar, SENEGAL. (Terres et Vie also has the excellent series "Land and Life" which receive comparable reviews. The illustrations make these books very useful. Contact Terres et Vie, Rue Laurent Delvaux 13, 1400 Nivelles, BELGIUM; or CTA, Postbus 380, 6700 AJ Wageningen, NETHERLANDS.)

LES QUATRE SAISONS DU JARDINAGE, an organic gardening magazine in French, is available from the association Terre Vivante in southern France. The publication is a lively mix of practical information on selection and organic culture of featured fruits and vegetables, ideas on techniques and simple equipment of use to the farmer, and articles related to animals, ecology, and cooking. Most pages have good color photos or summary diagrams and charts. The magazine is temperate in focus, but gives new ideas on methods which may be adapted. Six issues per year cost 219FF (about US$42), overseas.

Those who may be passing through France may wish to visit the Terre Vivante European Ecological Center, which has working demonstrations on sustainable living. Those interested in Les Quatre Saisons or the Center can contact Terre Vivante, Domaine de Raud, B.P. 20, 38711, MENS Cdex, France; fax: 76.34.84.02.

IIRR (INTERNATIONAL INSTITUTE OF RURAL RECONSTRUCTION) PUBLICATIONS. We mentioned IIRR's Agroforestry Technology Information Kit as a good summary of proven agroforestry technologies. Four more publications worth mentioning: Farmer-Proven Integrated Agriculture-Aquaculture: A Technology Information Kit($15), Low-External-Input Rice Production (LIRP) Technology Information Kit($17), The Bio- Intensive Approach to Small-Scale Household Food Production($16) and Resource Book on Sustainable Agriculture for the Uplands($15). The first three are along the same lines as the Agroforestry Kit; practical, well-illustrated collections of proven, basic, sustainable technologies for resource-poor farmers. Each is a collection of individual packets in a folder rather than a book.



the IIRR resource bookcd-rom project

The Resource Book is a 200-page collection of articles on topics such as: soil and water conservation, land tenure,

animal production, intensive feed gardens, agroforestry, and agroforestry seed technology. Another title which we have not seen, but may be of interest to some is: Participatory Approach to Rural AIDS Education: A Workshop Manual($16).

Each is available by ordering prepaid from IIRR, 475 Riverside Drive, Room 1035, New York, NY 10115, USA; phone 212/870-2992; 212/870-2981; e-mail iirr@cce.cornell.edu. Prices of each are noted above, postage and handling is an additional 15% for U.S. orders and 20% for overseas orders (surface mail). In Asia, contact their Philippine office for much lower prices due to postage: IIRR Bookstore, Silang, Cavite 4118, PHILIPPINES; phone: 63-969-9451; fax 63-969-9937; e-mail iirr@phil.gn.apc.org.

A GUIDE TO SPANISH-LANGUAGE SUSTAINABLE AG PUBLICATIONS (90 pp.) has English abstracts of 74 easy-to-read publications in Spanish on sustainable farming.

Availability and reading level for each document are listed. Send a check or money order for $10 payable to "U.C. Regents" at University of California Sustainable Agriculture Research and Education Program, Davis, CA 95616-8716, USA.

HOW TO GROW MORE VEGETABLES... by John Jeavons is the basic guide to the biointensive method of food production, which maximizes resource efficiency in sustainable food production. Complete growing guides are given for hundreds of crops, and garden planning and preparation is highlighted. This book is packed full of information. Available in English, Spanish, French, German, Russian, Hindi, and Braille at various prices ($6- 19); write for a current Bountiful Gardens catalog (free to US addresses, US$2 elsewhere) from Ecology Action, 5798 Ridgewood Road, Willits, CA 95490, USA; phone orders 707/459-6410, or see it on the Internet at http://www.olympus.net/gardens/welcome.html.

NATURAL FARMING NETWORK links agencies cooperating to promote working examples of sustainable agriculture in Zimbabwe. They also have some excellent publications. Production Without Destruction (188 pp.) is a primer on organic growing and a manual for teachers of sustainable systems. It would also serve as an excellent handbook for the beginner in tropical agriculture. Clearly-written text, with charts/pictures on most pages, make this a valuable textbook or reference tool on a wide variety of topics. Chapters include: Agriculture and ecological systems, Soil, Water, Plant propagation, Trees, Pests and Weeds, Managing a sustainable farm, Improved gardening practices, Dryland cropping, Integrating animals, and more. See the review of Natural Pest and Disease Control, one of the most practical resources we have seen on this topic, in the chapter on Plant Protection. All prices include surface shipping: Production Without Destruction is US$7 on the African continent; $9 elsewhere; Pest and Disease Control is US$6 within Africa; $8 elsewhere,

from the Natural Farming Network, P.O. Box CY 301, Causeway, Harare, ZIMBABWE; fax 723056.

These books are also available in local currencies through the following organizations, which may be able to help you with other aspects related to sustainable agriculture: BOTSWANA: Attn. R. Clarke, Permaculture Trust of Botswana, P Bag 47, Serowe; KENYA: Attn. J. Ngugi Mutura, Sustainable Agricultural Community Dev't Programme (SACDEP), P.O. Box 44752, Nairobi; LESOTHO: Attn. M. Letela, Berea Agricultural Group, Assumption High School, Bag Box 572, Teyateyaneng 200; SOUTH AFRICA: Attn. C. Nottingham, Planner Bee Plant Care, P.O. Box 3093, Cresta 2118, Johannesburg; TANZANIA: Attn. C. C. Rwechungura, Tanzania Org. of Permaculture Promoters (TOPP), P.O. Box 9421, Dar es Salaam.

ORGANIC FARMING FOR SUSTAINABILITY IN EAST AFRICA is a series of 3-week workshops annually for 4 years (until

1999). Open to NGO or government professional extension and training staff in East Africa. Contact Mr. J. W. Njoroge, Kenya Institute for Organic Farming, P.O. Box 34972, Nairobi, KENYA.

THE PELUM ASSOCIATION (participatory ecological land-use management) works throughout east and southern Africa to promote sustainable resource use. Their practice-oriented workshops (Zambia, Tanzania, and elsewhere) cover course design, training materials development, and facilitation and information sifting skills for trainers in sustainable agriculture. For more information, write the Workshop Coordinator, PELUM Association, PO Box CY 301, Harare, ZIMBABWE; fax 263-4-744470. (In Zambia, also contact Chileshe Chilangwa, Harvest Help, Box 36548, Lusaka; in Tanzania, Cleophas Rwechungura, TOPP, Box 9421, Dar es Salaam.) ORGANIC MATTERS, A NETWORKING NEWSLETTER IN THE PHILIPPINES. Those of you working in the Philippines or abroad will surely

want to receive this publication on Philippine Low-External-Input Sustainable Agriculture (LEISA). The articles are interesting because they deal with farmers' actual experiences with many of the techniques about which we routinely write and correspond. Organic Matters is published three times a year and wants to be a medium for exchange of experiences, information and discussions about LEISA. Recent issues presented a wide range of articles about gender and LEISA, participatory methods, food security, upland LEISA, and using marine organisms as organic fertilizers. Subscriptions are free. Write to Organic Matters, SNV, P.O. Box 7463, Domestic Road, 1300 Pasay City, Metro Manila, PHILIPPINES; e-mail SNVPHIL@misa-pfi.net.

SUSTAINABLE AGRICULTURE AND THE ENVIRONMENT IN THE HUMID TROPICS (702 pp., hardcover, US$49.95 in North America) provides an overview of sustainable land use options, including many forestry systems, for wet zones in the tropics.

Two thirds of the book gives in-depth accounts of population, agronomic, historic, economic, resource, policy, and other factors related to land use planning in seven countries. This book would be particularly useful to those in the countries profiled: Brazil, Ivory Coast, Indonesia, Malaysia, Mexico, the Philippines, and Zaire. Contact National Academy Press, 2101 Constitution Ave. NW, Box 285, Washington, D.C. 20055, USA; phone 800/624-6242 or 202/334-3313; fax 202/334-2451; http://www.nap.edu.

APPRENTICESHIP IN ECOLOGICAL HORTICULTURE is offered for six months each year by the University of California, Santa Cruz. The program emphasizes hands-on learning "with instruction in traditional organic horticulture, stressing ecological interactions between plants, soils, climate, insects and pathogens." Some formal classes are held, but most instruction occurs through the actual work of growing, harvesting and marketing produce. Apprentices gain

experience in organic production on both a hand-dug garden scale and a tractor- cultivated field scale. The program runs from April to October; applications are due early November (earlier for international applicants).

The apprenticeship is held at the University's 25-acre farm and 2-acre garden. The garden is the site where the French-intensive biodynamic method of horticulture first gained recognition in the United States. The 1996 tuition is $2200; some scholarships are available. Graduates receive a "Certificate in Ecological Horticulture" and 15-20 extension credits. (Whether these transfer to other institutions is at the discretion of those institutions.) Students live on the farm in tents. (It does not rain at that time of year.) For an application and further details write to Apprenticeship Coordinator, Center for Agroecology and Sustainable Food Systems, University of California, 1156 High St., Santa Cruz, CA 95064 USA; phone 408/459-2321; fax 408/459-2799.

INTERNSHIPS IN REGENERATIVE AGRICULTURE. The Rodale Institute Experimental Farm hires interns to assist scientists in research plot establishment and maintenance, data collection and report writing. This year they will have about 12 paid openings in the farming systems, new crops, horticulture, and entomology programs. Starting and ending times are flexible, but generally run April through October. Unpaid internships can be negotiated throughout the year. Write Kim Frederick, Rodale Institute Experimental Farm, 611 Siegfriedale Road, Kutztown, PA 19530, USA.

"SUSTAINABLE AGRICULTURE: PRINCIPLES AND PRACTICES" course is offered (June 24-August 16 in 1996) at the University of California-Davis (8 units, pass/fail grading, $613). Lectures, laboratories and discussions are combined with three mornings of practical field experience each week and numerous field trips. Emphasis is on the biology and management of agroecosystems. The social, economic and

political aspects of agriculture are also examined. Most examples are drawn from California agriculture, but international topics are also discussed. Contact Mark Van Horn, Student Experimental Farm, Dept. of Agronomy, Univ. of California, Davis, CA 95616, USA; phone 916/752-7645.

"SUSTAINABLE DEVELOPMENT FOR THE WORLD/Desarrollo Sostenible para el Mundo." Two 14-day intensive courses (one in western Oregon, USA-$750, and one in Tlaxcala, Mexican tropical highlands-$1100) are sponsored by the Zopilote Association. The courses are opportunities to exchange experiences and practical tools for sustainable living. Contact Zopilote Association, Box 123, Cottage Grove, OR 97424, USA; phone 541/942-2005/fax -3021. The Cob Cottage Company at the same address has courses on building earthen houses.

CORRESPONDENCE COURSE ON PLANT PROPAGATION.

Pennsylvania State University offers the undergraduate course "Hort 202: Plant Propagation" (3 credits) by mail. It has received awards in a national competition sponsored by the University Correspondence Course Association. Total cost to take Hort 202 at home is $492.65, which covers the tuition, two textbooks, a study guide and two video tapes. You can register through the Independent Learning Program, Pennsylvania State University, 128 Mitchell Bldg., University Park, PA 16802-3693, USA; phone 1/800/252-3592 in PA, 458-3617 elsewhere, or 814/865-5403.

Poem by Larry Fisher

After 15 years of EDN, I guess it is not too much to include a bit of levity.

Economists, agronomists and planners of late Have discovered a new way to pontificate. Beyond mere jargon, like "Success

Enhancement," "Integrated Development," and "Rural Advancement." Working in all their infinite wisdom They're trying to define a "Farming System." To answer the question for all of you "Why do farmers do what they do?"

At universities and experiment stations 'round the globe, In offices, labs and on farms they probe; Through consultancy surveys in developing nations, Upstream and downstream experimentations, With yield rates, inputs and multiple regressions, Attempting to explain that profoundest of questions With the diverse hypotheses that each eschew On why farmers do what they do.

Variability and generalization, Indigenous knowledge and maximization, The issues discussed, the factors controlled, Computers click, theories unfold. Papers get published, conferences convened, Projects are funded; it becomes obscene When predictably they conclude in the Final Review

That a more generous grant might give them a clue As to why farmers do what they do.

Somewhere farmers plow and plant, Milk their cows, work and chant. After the interviews, trials and calculations The experts retire to their research stations. And the farmers continue to grow their corn While old women die and children are born. The men swap stories and drink their brew, And they scratch their heads and wonder anew, "Why do scientists do what they do?"