International Institute for Environment and Development

Sustainable Agriculture and Rural Livelihoods Programme

GATEKEEPER SERIES No. 23

Low Input Soil Restoration in Honduras:
The Cantarranas Farmer-to-Farmer Extension Programme

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This Gatekeeper Series is produced by the International Institute for Environment and Development to highlight key topics in the field of sustainable agriculture. Each paper reviews a selected issue of contemporary importance and draws preliminary conclusions of relevance to development activities. References are provided to important sources and background material.

The Swedish International Development Authority (SIDA) funds the series, which is aimed especially at the field staff, researchers and decision makers of such agencies.

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LOW INPUT SOIL RESTORATION IN HONDURAS:

THE CANTARRANAS FARMER-TO-FARMER EXTENSION PROGRAMME

Roland Bunch

Soil Restoration: A Step Beyond Soil Conservation

Increasingly throughout the developing world, the most important limiting factor for small-scale, villager farmers on rain-fed lands is that of soil quality. As population pressures, commercial agriculture, and environmental deterioration have forced villagers to reduce fallowing periods, farm more intensively, and use increasingly marginal or hilly lands, villager farmers worldwide have found soil quality to be an increasingly serious problem. Often their only solutions have been either to apply increasing quantities of chemical fertilisers to lands with rapidly decreasing natural fertility (until the fertilisers provide so little response that they become uneconomic), adapt to below subsistence yields by looking for supplementary off-farm employment, or give up and migrate to the cities.

Before anything else could be done about the problem, it was necessary to learn about the control of erosion. Over a period of about 20 years, several development agencies have found some highly successful technologies that can and are being used widely by poor villager farmers. While bench terraces and similar large structures were found to require too much labour for farmers to adopt without subsidies, simpler technologies have, singly or in combination, stopped erosion on slopes of up to 40%, while requiring far less labour. Among these are contour ditches, contour grass or leguminous tree barriers, in-row tillage, and cover crops (World Neighbours, 1976,1984,1989). Contour grass barriers are presently being used by at least some 7,000 farmers in Guatemala, Honduras, Haiti and Mexico, while in-row tillage, a more recent discovery, has already been adopted by about 1,000 villager farmers in Honduras and Nicaragua. In none of these cases were any subsidies or incentives provided to the farmers.

Nevertheless, even when very good soil conservation techniques are in place, soil fertility continues to decrease wherever long-term fallowing is no longer feasible. Furthermore, the world very much needs not only the means of maintaining soil quality, but of restoring soil quality in areas where it has already deteriorated badly. This is the challenge World Neighbours' sustainable agricultural programmes in Central America, Mexico, and Haiti have been addressing during the last seven years.

The Technological Challenges

All too often, development literature has overestimated the potential of various sources of organic matter for villager producers of subsistence food crops. Composting, while often valuable for vegetable gardens and cash crop producers, is generally uneconomic for basic grain producers. Animal manure is feasible if animals are kept in relatively small corrals, but this is often not the case. Even then, the vast majority of the world's villagers have too few animals to fertilise well more than about 30% of their land. Outside sources of natural fertility, such as commercially produced chicken manure or urban trash, are scarce, and their transportation costs prohibitive for the more isolated, poorer farmers. Alley cropping, the most widely used agroforestry system, is promising, and may well produce better results as the technology is refined. But indications are that presently known alley cropping systems cannot, by themselves, produce sufficient quantities of organic matter to increase soil fertility during intensive cropping. And lastly, green manure production often requires the use of land that poor villagers need to use for food crops.

In 1983, the World Neighbours/ACORDE/Young Foundation Programme at El Rosario, Honduras, began experimenting with green manure crops that could be grown while incurring no cash costs, using no land that has an opportunity cost, and requiring a minimum of additional labour. Such systems could include growing them during the dry season, or intercropping them with traditional maize crops. By 1987, it was obvious that farmers preferred the intercropping alternative, and that velvetbean (*Mucuna pruriens*) was the best adapted species for most of Honduras (for semi-arid to heavy rainfall areas between 0 to 1,700 metres above sea level). However, management practices for the intercropped velvetbean still had to be developed and tested.

The Cantarranas Programme

Aspects of Technology

In January of 1987, World Neighbours, together with Catholic Relief Services and ACORDE (a Honduran NGO), founded the Cantarranas Integrated Development Programme. Early on, this programme identified soil restoration as its most important challenge. The programme personnel therefore adopted as a goal the tripling of farmers' traditional basic grain yields through the use of entirely on-farm sources of fertility. That is, the programme would try to triple traditional yields of maize (*Zea mays*) without using either chemical or organic fertilisers that originated outside the villagers' farms. A base-line survey established that maize yields averaged just under 850 kg/ha even though a few of the farmers were already using chemical fertiliser.

Programme personnel knew from past experience that the quantities of organic matter needed to restore the soil while it was being farmed would be, at least for the first few years, close to 22 tonnes/ha/year (all weights used here will be wet weights), or, to use their terms of reference, about 5 $lbs/m^2/year$[1]. Thus, it was obvious from these observations that the most important source of organic matter was going to have to be green manures.

The greatest challenges in managing the intercropped velvetbean were:

1. how to keep the velvetbean from growing up over the maize and smothering it;
2. how to incorporate or use the velvetbean without causing the farmers to use too much labour;
3. how to use the velvetbean to control weeds, thereby reducing labour requirement during the growing season.

Farmers were taken to see velvetbean experiments in El Rosario. Once convinced they wanted to try it, they were told that the programme did not have already-established solutions, but that there were several alternatives, and they might come up with some others themselves. To prevent smothering of the maize, the programme suggested planting the velvetbean anywhere from one to three weeks after the maize.

However, when the velvetbean was planted three weeks after the maize, it failed to grow well enough to produce 5 lbs/m^2 of organic matter or to control the weeds. Earlier plantings still allowed the velvetbean to cover the maize. Some farmers decided the only way to control the velvetbean was to pull its tendrils down to the ground. Others felt it was easier to prune it. Once they saw it could be controlled very well by heavy pruning, a few farmers tried planting it simultaneously with the maize in order to achieve more biomass and better weed control.

After scores of experiments and the cross-fertilisation of ideas between experimenting farmers in Cantarranas and El Rosario, most farmers now plant the velvetbean and maize simultaneously (thereby saving labour) and prune back the velvetbean twice to about knee level. There is still much debate as to the relative value of either turning the velvetbean under the soil or leaving it on top and injection-planting the next crop through the resulting mulch. Impact on the following crop is, surprisingly, approximately equal with each method. The mulching is considerably easier, but complicates the control of a slug which destroys local bean crops.

Results have been very promising (Bunch, 1990). Soil colour, tilth, and drought resistance of crops have visibly improved where velvetbean has been used. The velvetbean grows well on the very poorest and thinnest soils in the area, and, even under drought conditions that heavily stunt maize, produces 35 tonne/ha or more of green matter. Where weeding was done by hand, labour requirements for weeding have been cut by about 75%; where herbicides were used, they have been eliminated.

The velvetbean can fix as much as 150 kg nitrogen/ha, and the increased organic matter has made it unnecessary to apply any additional phosphorus or potassium. So far, about 90 of the 150 farmers who have been with the programme at least two years have harvested over 2,550 kg/ha of maize, in spite of abnormally severe droughts in two out of three years.

Nevertheless, the programme may not succeed completely in its goal of eliminating the use of all outside sources of fertility. Villager farmers are finding, through their experiments,

1. 5 lbs/m^2 is equivalent to 2.2kg/m^2

that they are getting very good yield responses to additional applications of urea of up to 125 kg/ha. This practice of adding a side-dressing of urea seems to be advisable, as even farmers in northern Honduras' rainforests who have been planting velvetbeans for over 20 years are still getting good responses to once-a-year side-dressings of nitrogen (Avila, 1990). Thus, even though many of the programme's farmers are producing yields equivalent to those of more technically oriented farmers on better soils who are using more than three times the chemical fertiliser, we will very likely not succeed in ending fertiliser use completely.

Agricultural Research in the Programme

As described above, the research process used in the Cantarranas Programme is very participative, similar in most respects to the "land to land" approach advocated by Robert Chambers (Chambers et al., 1989; Chambers, 1989). Even well-tested, widely adopted technologies are never introduced as sure-fire bets; they are introduced as technologies that have been useful to other villager farmers. Technologies with a shorter history, or for which a good deal is as yet unknown (as in the case of the velvetbean), are introduced along with frank admissions of the programme's ignorance and its need to learn from the villagers.

No farmer is ever motivated to use a technology on his or her entire piece of land; all technologies are to be tried out on a small scale. Thus the programme is not only teaching farmers a new technology, it is teaching them a tool by which they can try out many new technologies and adapt them to their own environment and needs. The farmers are thereby learning a more scientific approach to innovation. They are learning a tool that can make them capable of carrying on the process of agricultural development by themselves, long after the programme has terminated. That this is possible is now evidenced by past programme areas where dozens of innovations never thought of by the programmes have been developed and spread among the farmers long after the programmes themselves had closed.

Agricultural Extension in the Programme

The extension aspect of the Cantarranas Programme is virtually the same as that described in *Two Ears of Corn* (Bunch. 1982), and used successfully by a series of institutions in some fifteen different countries (see, for instance, Chapin, 1989; Gow, 1979; Comision Nacional, 1989).

Absolutely no subsidies or give-aways are provided to the farmers. Adoption occurs only if farmers can see and understand clearly the advantages of a technology according to their own value system. These advantages should come as quickly as possible (what we call "rapid recognizable success"), in order to stimulate among the farmers the enthusiasm for change that will necessarily be the driving force behind future innovation.

In this respect, the green manure technology has a problem. For people in those cultures in which the advantages of organic matter are not already known, its results are not evident until after it has been applied to the soil and the next crop has begun to grow. Therefore, while introducing green manures among such peoples, we have found it useful to have them experiment on a small scale with animal manure, leguminous tree leaves, or some other high-nitrogen organic matter. Their learning about organic matter will continue to be useful to them; the results will be almost immediate; and the green manure can be promoted as a plentiful, *in situ* source of organic matter that will produce similar results.

The limiting factor in the local agricultural situation should be identified (in Cantarranas, as in many places, it was poor soils), and a limited, appropriate technology used to address that limiting factor. Usually only one or two technological interventions need be introduced in a given agricultural cycle (Oyer, no date; Yang, 1966) and these technologies very frequently require absolutely no cash expense.

All the village teaching is done by villager farmers who have themselves already succeeded in improving their yields. No one else could ever display as much enthusiasm for the technology as a farmer who has just tripled his or her own yields by using it. No one will ever know a villager farmer's way of thinking, or his or her priorities and value system, quite like a neighbouring farmer. No one from the outside can understand what will motivate a farmer to change better than a neighbouring farmer who has just made some major changes. Nor will any professional ever have as much credibility with poor farmers as a neighbour who can show them his or her fields with their greatly improved yields. Competent villager extensionists can undoubtedly do a better job than any of the rest of us.

And competence can come surprisingly soon. First of all, a programme using a limited technology need only require that the extensionist be competent in that limited technology. Usually one to two years of attending a very pragmatically oriented class each week, plus the experience of successfully increasing his or her own yields with the technology, is all the technical preparation he or she needs. Experience at talking before a group and planning classes (or experience at presenting a pre-arranged set of classes) is often the only other 'training' needed.

Some 65 development agencies working in Bolivia, Guatemala, Haiti, Honduras, India, Indonesia, Kenya, Mexico, Nepal, Nicaragua, Peru, the Philippines, and Togo are using villager agricultural extensionists, and finding them very useful.

The Results

The Cantarranas Programme, only three and a half years old, is presently working with just over 600 families. So far:

- 603 families have made contour rock walls or contour ditches to stop erosion (although this technology is also promoted by another agency in the area);
- 583 farmers have experimented with in-row tillage (which is not promoted by anyone else), while more than 300 farmers have grown green manure crops;
- some 90 farmers have already tripled their previous average yields, and another 200 will probably reach that goal within another few months;

- and at least 50 farmers have multiplied their incomes earned on cash crops (mostly carrots, potatoes, and onions) by more than five times.

The use of a limited, simple technology and villager extensionists can decrease dramatically the costs of an agricultural extension programme. Several other farmer-to-farmer programmes in Guatemala and Honduras have managed to triple basic grain yields of villager farmers for less than $200 in total programme costs per family. This is another rather challenging goal the Cantarranas Programme has taken upon itself.

Now at its halfway point, the Cantarranas Programme expects to have spent about $400,000 at the end of seven years' work. By that time, it should have been working at least two years with some 1,300 farmers. If the rains permit, it should have helped approximately 1,000 of them to triple their basic grain yields. Past experience would lead us to believe that another 350 or so farmers will have tripled their yields through spontaneous spread of the programme technology. If so, the Cantarranas Programme will have spent approximately $300/farmer. Since nearly a third of the dollars' buying power was lost because of an artificially low Lempira exchange rate, the Cantarranas will have come close to its overall goal.

Lessons to be Learned

1. The farmer-to-farmer extension approach is much more efficient and less costly than approaches using professional extensionists. Furthermore, it allows the process of agricultural improvement to be much more community-based, provides crucial leadership experience for villagers, provides role models villagers can reasonably aspire to emulate, and give them the feeling at the end that, as the saying goes, "We did it ourselves".

2. If we ever do manage to restore soils through the exclusive use of on-farm sources of fertility, it will most likely be done by teaching farmers to use all the possible sources of fertility at their disposal. As the Cantarranas Programme has worked at this goal, many new possibilities have begun to emerge. Leaf-cutter ant manure can be surprisingly plentiful and helpful. Getting farmers to cut and carry grass grown along contour bunds or ditches is not as difficult as we once thought, and animals can then be kept in pens where their manure is more accessible. Seeds of certain hardy legumes can be spread across uncropped land, and then the legumes cut and carried to people's fields. As we search, and get the farmer themselves searching too, we will undoubtedly find more sources of fertility near at hand.

3. Tremendous technological problems still need to be solved. Can green manures be inter-planted among crops that grow lower to the ground than does maize? If so, which ones? What green manures could we use above 1,800 metres in elevation? Are there some that can be used in arid regions, or in regions where animals roam freely during the dry seasons? Systems using green manures during fallow periods or the dry season must be developed, and more agroforestry systems investigated.

4. "Farmer first" development and adaptation of technologies is not only feasible, but is rapidly proving itself to be both practical and efficient. Nothing in agricultural work will empower villagers as much as knowing that they are able not only to learn new technology and teach it to others, but also to develop and adapt new technologies to their future needs.

It is my opinion that it is very unlikely that the world will ever develop enough "sustainable" technologies for the widely differing conditions of rain-fed farmers unless those same millions of farmers are widely involved in developing and adapting their own technologies. There is just no hope at all that professionals will ever find and adapt to farmers' needs all the technologies the world's millions of farmers will need. If we ever want the villagers of this world to be able to feed themselves, "farmer first" research will have to become widespread indeed.

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The Sustainable Agriculture and Rural Livelihoods Programme

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