EPAGRI'S WORK IN THE STATE OF SANTA CATARINA, BRAZIL:

Major New Possibilities for Resource-Poor Farmers

by Roland Bunch

INTRODUCTION

The following is a brief description of a four-day visit I made to see agricultural development work in the State of Santa Catarina, Brazil. It will not delve into the technical details learned (which are much better treated in a couple of books mentioned below), nor details of what we saw and where. Rather, it will attempt to provide a brief over-all picture of what was observed in farmers' fields, how that was achieved, and what the meaning of these achievements could be for agricultural development in the developing world.

THE VISIT

In late May, at the invitation of EPAGRI (a privatized business firm which has been largely financed by the World Bank and GTZ), I spent four incredibly intensive days visiting farmers' fields and experimental stations in the southern Brazilian State of Santa Catarina (just north of Río Grande do Sul). We travelled the length and breadth of the State of Santa Catarina, travelling from Florianópolis, an island just off the east coast, to Chapecó in the west, and Urussanga in the south, including low, flat, coastal areas in the east, montainous areas in the center of the State, and the rolling highlands in the West.

We visited, during this time, some nine micro-watersheds, where we could easily see the adoption of soil conservation and soil recuperation practices by something in excess of a thousand farmers. In between, along the highways, I observed an incredible degree of both promoted and spontaneous adoption of these practices among at the very least another two thousand farmers. The results, in terms of soil quality and productivity, both within and outside the watersheds where EPAGRI had worked intensively, were obvious and impressive. Some of this work had been in place too long to be the results of EPAGRI itself, but even though the programs have changed through the years, the people I met have, within one government program or another, been involved in this work for some fifteen years.

During most of this trip, I was accompanied by Valdemar Hercilio (Salgado) de Freitas, the state-wide Manager of the Microwatershed Project of EPAGRI. Salgado provided wonderful companionship, a deep knowledge of the technical and methodological aspects of what we were seeing, and an occasional translation from Portuguese into Spanish.

realize that nitrogen fixation is a relatively less important factor in the whole picture than we had previously thought.

3. The possibilities for gm/cc's to fit into a wider and wider number of cropping systems was confirmed. We saw farmers using gm/cc's in cropping systems based on corn, onions, cassava (or "tapioca"), and fruit trees, and were shown photographs of systems using gm/cc's associated with wheat, grapes, tomatoes, soybeans, and sorghum. We are still a bit worried that in a few tremendously intensive systems (especially ones involving irrigation, such as Asia's intensive paddy rice systems), gm/cc's will be squeezed out by very intensive cropping. In this case, chemical fertilizers, purchased soil amendments, or even compost will take the place of gm/cc's. But for most of the poorer farmers of Latin America, Africa, and much of Asia, gm/cc's could still have a major role to play, and one largely untouched at this point.

4. We very much need to continue finding new species and varieties of gm/cc's. One of the major recommendations that came out of a conference of agronomists from southern Brazil working in green manures was that, if we are to avoid having more and more insect and disease problems with gm/cc's, we must rotate gm/cc's in any farmer's fields just as we now rotate crops. Furthermore, we must avoid becoming dependent on one or two species, lest we fall into the trap that Leucaena-based programs did in Southeast Asia when a psyllid defoliated thousands of hectares of the world's most successful alley cropping. More specifically, for those many programs in Central America and Mexico that are now totally dependent on the velvetbean for gm, it would perhaps be of interest that in southeastern Paraguay, a fungus has wiped out two of the four varieties of velvetbean that were previously used in the area.

Thus, in order to have back-up species, species that fit into varied agricultural systems, species that work under varied climatic conditions, species capable of use in gm rotations, and species that can be intercropped with dozens of different subsistence and commercial crops, we must learn about a good deal more species and varieties than those we presently use.

5. There is a tremendous need for farmer experimentation to discover these new species and the myriad ways in which gm/cc's can be adapted to differing agricultural systems. For instance, most of the specific systems used in Santa Catarina will not be exactly appropriate in tropical and sob-tropical areas, as they are predicated on having two or three months of frosts in which no other very valuable crops can be planted, thereby creating a space for many of the gm/cc's. Nevertheless, the characteristics of these species will probably make them appropriate for intercropping with cassava, tomatoes, potatoes, etc., in tropical areas. It will take tremendous amounts of research (far more than any conceivable amount of agronomist-staffed research stations will ever be able to do) to investigate and refine all of these possibilities. Once again, the only chance we have of sustainable agriculture becoming

a widespread reality is for hundreds of thousands of farmers to be doing most of the experimentation.

6. The three criteria we use in Central America for gm/cc systems are probably widely applicable around the world, as the same three are also used in Brazil:

a) gm/cc systems must involve no cash costs, outside of a possible one-time purchase of seed. Therefore, no gm/cc species can be used that have serious pest or disease problems, and all species must produce their own seed on-farm.

b) the gm/cc's must grow on land that has no opportunity cost for the farmer. We and the farmers in Central America have achieved this by intercropping gm/cc's with the farmers' crops, growing them on fallowed or abandoned land, and growing them during the dry season or under fruit trees or coffee bushes. In Brazil they use intercropping (including one system which intercropped a gm/cc in fields occupied by both corn and squash), and growing them during periods of freezing weather.

c) they must incur little or no net additional labor. This is partly solved by the gm/cc's eliminating or reducing weeding operations, but EPAGRI has also assisted this criterion by developing simple tools that allow farmers to use animal traction for both the planting and application of the gm/cc.

That both the Central American and Brazilian programs discovered these principles separately and have had success in programs that used them, would indicate they should probably be applied rather widely.

I should probably explain here that, though I myself sometimes felt it hard to believe, there is no known historical connection between EPAGRI's work in Santa Catarina and COSECHA's and World Neighbors' work in Central America. The minimum tillage systems, gm/cc work, criteria underlying gm/cc system selection, etc., were all developed independently by each of these two groups (and other groups they worked with in-country).

7. In most cases, gm/cc's are probably best applied to the soil surface rather than buried, especially when used by small farmers. This is so for the usual reasons: savings in labor and/or mechanization, soil cover for protection from erosion and the burning out of nutrients, and water retention. But it is also true because a certain amount of nitrogen volatilization may be beneficial (in preventing acidification of the soil's A horizon) and, perhaps most important, if part of our purpose is to evolve toward no-till systems, we will not be able to bury them, anyway. The one major exception to this rule would be on very poor soils during the first year or two, so farmers could see an immediate benefit accruing from their efforts.

8. Although farmers using gm/cc's in Brazil are still using major amounts of chemical fertilizer, the reduction in the use of chemical fertilizers and herbicides which we have achieved in Central America is widely possible, as both factors were among the successes associated with gm/cc's in Brazil, too.

9. Probably the most important single result of the Brazilian work is that, by eliminating the need for both most of the weeding and all of the ploughing, this work may well be showing us the most feasible way for small farmers to compete in this Neoliberal world of falling national barriers to trade. During the last 40 years, the small, resource-poor farmer was always at a major, almost insurmountable disadvantage when he or she had to compete with the larger, well-capitalized farmers: he/she was unable to carry out the really heavy and expensive labors of ploughing and weeding as cheaply as could the mechanized farmer. Now, however, we are beginning to see the answer to this major problem. It lies not in the mechanization of these jobs (through tractors, microtractors, or even animal traction), none of which he/she has much of a chance to succeed at. It very likely lies in the elimination of these jobs, through the use of heavy mulches (to control weeds) and of no-till systems. That this is possible not only in southern Brazil is illustrated very clearly by Flores and Estrada's economic comparison of a no-till, velvetbean-based system with a neighboring mechanized modern system, both near La Ceiba, Honduras. In this case, the velvetbean system was less productive than the "modern" system, but the costs per ton of corn produced were 30% less under the velvetbean system. (5)

Such a possibility could be especially important for land-rich but resource-poor farmers, such as those in much of Africa and along agricultural frontiers in Latin America, for whom time for weeding is a major limiting factor in their entire agricultural systems.

If the above is true, this fact opens up tremendous new possibilities for small, resource-poor, hillside farmers to compete quite well with "modern," mechanized farmers.

10. The same factors of lower-productivity-associated-with-higher-profits because of greatly reduced unit costs illustrated both by EPAGRI's work and Flores and Estrada's study could also, in the long run, be a plus in grain markets. Right now, huge amounts of chemical in-puts are raising both farmers' costs as well as their output. This fact contributes to world grain gluts and other such factors as the potential failure of the Uruguay round of GATT talks. However, if the elimination of ploughing and weeding can reduce costs so much that farmers can suffer a ten- to fifteen-percent reduction in productivity and still enjoy a larger profit margin, then farmers will be better off not only because they earn more, but there will be an additional upward pressure on the prices farmers receive for their grain because less grain will be entering the markets. Thus the farmer will be doubly benefitted, at the expense, of course, of the agrichemical business. I, for one, could certainly live with that possibility.

directors, sub-directors, etc. Furthermore, farmer experimentation is encouraged and widely used.

Admittedly (and contrary to our philosophy), there is a one-time subsidy given at the beginning of the program to each participating farmer, but it represents much less than five percent, and often less than two percent, of what the farmer eventually invests in soil conservation barriers, gm/cc seed, equipment, grain storage and processing, and other, non-agricultural activities (the subsidy can be used by the farmer for any activity within the program).

The major departure from our methodology is EPAGRI's decision several years ago not to use farmer extensionists. I myself would feel that this is the program's greatest shortcoming. This program could achieve similar results at a much lower cost if it did a decent job of incorporating farmer extensionists into its program. Certainly the human resources are already available. The farmers are highly convinced of what they are doing, enthusiastic about the technologies, interested in finding other technologies that would also be of benefit, and extremely capable of communicating these technologies to others. Some people would say that part of the success of this program is, in fact, traceable to the high educational level of the state's farmers. That is undoubtedly true, but I do not feel this detracts in any major way from the program's over-all success.

CONCLUSIONS

Very useful during this visit was the dialogue we carried on, sometimes well into the night, about the meaning and consequences of what this program has done. I will briefly describe here ten of the more important conclusions:

1. Maintaining soil cover is much more important in preventing erosion than terraces or soil conservation barriers, live or dead. Although the books have told us this for years, EPAGRI's is the first soil conservation program I have seen which took this fact seriously to heart, and was able to convince the farmers of its value through their own observation and experience with successful technologies. Thus, one more nail has been pounded into the coffin of our old bag of tricks, which featured contour ditches, grass or tree barriers, and contour rock walls. We are not ready to abandon these practices entirely, but certainly we are in the middle of a process of re-examination which will very likely result in a major de-emphasis in our use of at least rock walls and contour ditches.

2. The over-all quantity of biomass applied is more important, relative to the quantity of nitrogen fixed, than we had previously assumed. This fact was substantiated by the farmers' widespread and ongoing use of both oats and turnips as gm/cc's. But this observation is has its logic. When we realize that soil cover and achieving a no-till system are each objectives that are as important to the farmer as is applying nutrients to the soil, we

THE TECHNOLOGY AND ITS RESULTS

Although EPAGRI is involved in sanitation, infrastructure and post-harvest operations, in addition to agriculture, I will concentrate here on its work in soil conservation and recuperation, because this is the area in which EPAGRI's work is, as far as I know, not only highly original, but at the very cutting edge of work on these issues worldwide. (Similar work on green manures/cover crops is also very advanced in the states of Río Grande do Sul and Paraná, but in those states, most of the work has been done on large-scale, tractor-based farms rather than the small- to medium-sized, animal traction-based farms that dominate the work in Santa Catarina.)

The technologies being used by EPAGRI include the more or less traditional contour grass barriers (for which they have a series of species, including a very popular dwarf Kinggrass) and orienting of crop rows according to the contour, but by far the most important part of their work, and by far the most popular with the farmers, are the green manures/cover crops. (These plants are used to fertilize and condition the soil. Nevertheless, they are usually applied to the soil surface rather than buried. Thus, they are not handled as "green manures" in the traditional sense. At the same time, they are valued for their soil cover, both as "green mulches" while they are growing and as dead mulches after being cut, but they do much more for the soil than just cover it. I will, therefore, refer to them from here on as gm/cc's.)

The leading agronomists on EPAGRI's team have been working with gm/cc's for over fifteen years. During this time, they have gradually increased their repertoire of gm/cc species, to the point that they are now working intensively with some 60 species of gm/cc, and have seen widespread adoption of about 25 of these. These species include all the ones we are working with here in Central America, including the velvetbean (Mucuna pruriens), jackbean (Canavalia ensiformis), lablab bean (Dolichos lablab), cowpeas (Vigna spp.), and sweet clover (Melilotus albus), with the one exception of the scarlet runner bean (Phaseolus coccineus). Those gm/cc's we use in warmer areas (below 1,500 mts.) are the ones they use during the warm period of the year, or summer, and those like the sweet clover and scarlet runner bean, which we are trying out at higher elevations, are the ones they use during their winter. But in addition to the species we know, they are widely using others, with the most popular including various vetches (Vicia spp.), rough peas (Lathyrus spp.), crotalarias, clovers (Trifolium spp.), and lupines (Lupinus spp.). They are also using a number of non-leguminous species, most notably oats (Avena spp.) and turnips (Raphanus sativus). For anyone interested in more information about each of these species and how they are managed (and who can more or less read Portuguese--fairly easy for anyone who knows Spanish), I would highly recommend Claudino Monegat's Plantas de Cobertura do Solo, Caracteristicas e Manejo em Pequenas Propriedades. (1) A second very good book on the subject, but which is limited primarily to results from experimental stations