The Greening of Cuba*

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The manager of the state farm at the end of the dirt road in Villa Clara province appeared the perfect technocrat. He told me how he had fought against using oxen to prepare the land on his farm. Eventually he had no choice but to give in, since petroleum, tractor parts and tyres have virtually disappeared from the Cuban countryside in the past four years. Now he grudgingly admits that oxen have their benefits. 'Before we could only fit two planting cycles into the rainy season,' he said. 'For more than a month each year, we couldn't prepare the land because the tractors got stuck in the mud. But an ox doesn't have that problem. You plough the day after it rains, or even while it's raining if you want.' As a result, he said, the farm harvests three crops a year instead of two. Although the yield per cycle is lower, the annual yield is higher. The switch to oxen wasn't easy. Though ploughing with an ox team goes back hundreds of years in Cuba, none of the farm workers or agronomists had ever farmed with oxen themselves. 'We had to hire some old campesinos from nearby villages as consultants to teach us how to hitch up an ox team and plough with them,' the state-farm manager said. 'It's amazing how much those old guys know about farming.'

The 1989 collapse of trade relations with the former socialist bloc, together with the ongoing US embargo, have meant that Cuban farmers now have to get by with a tiny fraction of the imported machinery and agrochemicals that they once depended upon. National sugar production, for example, which in the recent past averaged about eight million tons annually, has plummeted by a half in the past two years. This comes from a decrease in acreage planted because of machinery problems, and a drop in average yields from about 64,000 *arrobas* per *caballería* to around 50,000.[1] The state farms that supply the bulk of the cane to the Héctor Molina Sugar Mill, just south of Havana, experienced just such an enormous reduction in yields the last two years. Yet a number of small farmers from whom the mill also buys cane did not.[2]

Several independent farmers who use organic farming techniques have turned in yields ranging from 100,000 to 150,000 arrobas. Another peasant who practices a traditional rotation of sugar-cane with food crops and cattle pasture, though not organic, harvested about 85,000 arrobas last year, and was the largest supplier of food crops to the local marketing board as well. Farmers like these passed unnoticed when eight million tons of sugar were the norm, but they have recently captured the attention

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of agronomy experts who hope to disseminate their farming methods throughout Cuba. Since these peasant producers never used large quantities of the no longer available chemical inputs, they have been better able to weather the present crisis than the state sector has.

Times are changing so fast in the Cuban countryside that the only thing you can be certain of is that what is true today will no longer be true tomorrow. Since the 1960s three things characterized Cuban agricultural policy: sugar, state farms, and a fanatical love affair with the chemical and petroleum-intensive technologies of conventional modern agriculture. Yet since the 1989 collapse of imports, the Cuban government has had to give priority to food crops, and has turned the state farms over to the workers in an attempt to stimulate productivity.[3] Cuba has also embarked upon the first national transformation in history from conventional modern agriculture to large-scale organic and semi-organic farming.[4] Cuba's farmers and substantial scientific infrastructure – both physical plant and human resources – have been mobilized to substitute autochthonous technology for the foreign agricultural inputs. Cuban-made biopesticides and biofertilizers – the products of the country's cutting-edge biotechnology – are being combined with traditional peasant practices as well as ecological pest control, large-scale earthworm rearing, waste composting, and other environmentally rational practices.

This process has not stopped Cuba from falling into the worst food crisis in its history. Some estimates of the drop in average protein and calorie intake over the past three years are as high as thirty per cent, to the point where Cubans are eating better than only Haitians and Bolivians. Because of innovations in the agricultural sector, it seems that food production is going up – though not yet by enough to compensate for the drop in imports.[5]

From the Cuban revolution in 1959 through the collapse of trading relations with the socialist bloc at the end of the 1980s, Cuba's economic development was characterized by rapid modernization and a high degree of social equity and welfare. Cubans arguably had the highest standard of living in Latin America. Yet Cuba never achieved truly independent development, as the island depended upon its socialist trading partners for petroleum, industrial equipment and supplies, agricultural inputs such as fertilizer and pesticides, and even basic foodstuffs for the population. By some estimates, as much as 57 per cent of the total calories consumed by the population were imported prior to 1989.

Cuban agriculture was based on large-scale, capital-intensive monoculture, more akin in many ways to California's Imperial Valley than to the typical Latin American *minifundio* or small-scale farm. Agrochemicals and tractors replaced human labour, leading to a rural

exodus, just as had occurred in the US and other countries with industrialized agricultural systems. This production model has been showing signs of strain everywhere – including Cuba – as soil erosion and pesticide resistance lead to rising costs, and stagnant or falling yields. In Cuba, more than 90 per cent of fertilizers and pesticides, as well as most of the ingredients to formulate them locally, were imported from abroad.

When trade relations with the socialist bloc collapsed, pesticide and fertilizer imports dropped by about 80 per cent, and the availability of petroleum for agriculture dropped by a half. Food imports also fell by more than a half. Suddenly, an agricultural system almost as modern and industrialized as that of California was faced with a dual challenge: the need to essentially double food production with less than half the inputs, and at the same time maintain export-crop production so as not to erode further the country's meager foreign-exchange holdings.

In some ways Cuba was uniquely prepared to face this challenge. With only two per cent of Latin America's population but eleven per cent of its scientists and a well-developed research infrastructure, the government was able to call for 'knowledge-intensive' technological innovation to substitute for the now unavailable inputs. Luckily an alternative agriculture movement had taken hold among Cuban researchers as early as 1982, and many promising research results – which had previously remained relatively unused – were available for immediate and widespread implementation.[6]

Organic farming

Most of Cuba's agricultural soils have suffered a high degree of fertility loss and depletion of organic matter due to the past intensive use of pesticides and fertilizers. To rebuild healthy soils, Cubans are now using green manure crops as part of crop rotations, composting municipal garbage and other waste products, and undertaking the industrial-scale production of high-quality humus, using earthworms as composting agents.[7] In 1992, 172 vermicompost centres produced 93,000 tons of worm humus.[8]

Waste recycling is high on the new agenda. All kinds of waste products are being converted into animal food, energy and fertilizer. These organic by-products are collected from sugar-cane processing, cattle and sheep ranches, poultry and pig farms, food and coffee processing plants, crop residues, and municipal garbage. Liquid wastes help irrigate the agricultural fields. Sugar-cane stalks are being recycled into particle board and paper, as well as into fuel for the mills' boiling pots. Integrated pig production is a good example of how complex this recycling can be-

come. The process begins with the collection of food scraps from workplace cafeterias, restaurants and schools. These scraps are fed to the pigs as a feed supplement. Farmers may also mix in waste from slaughterhouses, which is a good protein source. Next, the liquid and solid waste from the pigs is recycled to be used in vermiculture, in biogas generation, and even as a feed supplement for the same pigs. The stated goal is to reach zero non-recycled waste.

Cuba has a unique system of pest management in sweet potatoes – a staple of the local diet. Predatory ants are mass-reared in banana stems and introduced into the fields at the point when tuber formation begins. The ants then build their nests around the sweet potatoes in the soil, protecting them from the ravages of the sweet-potato weevil. A similar method is used in plantain plantations. Cuba now has fourteen centres for ant production scattered around the country.[9] Other centres mass-rear other insects that prey upon or parasitize various species of crop pests.

Empirical evidence from the US and elsewhere demonstrates that organic-farming methods can take between three and seven years from the initiation of the conversion process to achieve the levels of productivity that prevailed beforehand.[10] That is because it takes time to restore lost soil fertility and to re-establish natural controls of insect and disease populations. Yet Cuba does not have three to seven years; its population must be fed in the short term. Because of the urgency of the crisis, Cuban scientists and planners are bringing sophisticated biotechnology to bear on the development of new organic farming practices.

Biotechnology

In the US we are unused to hearing the words 'biotechnology' and 'organic farming' in the same sentence. We tend to think of all bio-technology in terms of releasing genetically engineered organisms into the environment, a process which poses ecological and public-health risks that are not consistent with the goals of organic farming. What the Cubans are doing is different. They are collecting locally occurring strains of micro-organisms that perform useful functions in natural ecosystems. These range from disease microbes that are specific to certain crop pests, and thus non-toxic to other forms of life, to micro-organisms that convert atmospheric nitrogen into a form that crop plants can use. These micro-organisms are then massively reproduced in order to be used as biopesticides and biofertilizers in agro-ecosystems.[11] Some of these products are available commercially in the US as well, but Cuba is way ahead in terms of the diversity of such biological preparations that are in widespread use.

Located on agricultural cooperatives, 222 artisanal biotechnology centres produce these biotech products for local use. These products are typically made by people in their twenties, who were born on the cooperative and who have some university-level training. In a sense, Cuba is demystifying biotechnology for developing countries by showing that biotechnology does not have to rely on multi-million-dollar infrastructure and super-specialized scientists. Rather, the sons and daughters of campesinos can make and use biotechnology products in remote rural areas. Industrial production of these biopesticides will soon be under way for use in larger-scale farming operations that produce for export. The labour-saving methods of biotechnology are particularly appropriate for Cuba because like the US, Cuba faces labour shortages in agriculture. Eighty per cent of the Cuban population lives in urban areas and only twenty per cent lives in the countryside, while in other countries with widespread alternative agriculture such as China, this ratio is reversed. At the same time, the Cuban government is going to great lengths – such as constructing high-quality housing and entertainment centres – to make relocating in the countryside an attractive option for city dwellers.[12]

Linking people with the land

Cuba is also radically reorganizing its production in order to create the small-scale management units that are essential for effective organic farming. This reorganization has centred on the privatization and cooperativization of the state sector.[13] Under conventional systems, a single technician can manage several thousand acres on a 'recipe' basis by simply writing out instructions for a particular fertilizer formula or pesticide to be applied with machinery on the entire area. Not so for organic farming. Whoever manages the farm must be intimately familiar with the ecological heterogeneity of each individual patch of soil. The farmer must know, for example, where organic matter needs to be added, and where pest refuges and entry points are.

In Cuba this scaling back of production units has coincided with the issue of production incentives. Several years ago planners became aware that the organization of work on state farms was profoundly alienating in terms of the relationship between the agricultural worker and the land. Large farms of thousands of acres had their work forces organized into teams which would prepare the soil in one area, move on to plant another, weed still another, and later harvest an altogether different area. Almost never would the same person both plant and harvest the same field. Thus no one ever had to confront the consequences of doing something badly or, conversely, enjoyed the fruits of his or her own labour. In an effort to

recreate a more intimate relationship between farmers and the land, and to tie financial incentives to productivity, Cubans began several years ago to experiment with a programme called '*Vinculando el hombre con la tierra*,' or linking people with the land. This system made small work teams directly responsible for all aspects of production in a given parcel of land, allowing remuneration to be directly linked to productivity. The new system was tried on a number of state farms, and rapidly led to enormous increases in production.

The process of linking people with the land culminated in September 1993, when the Cuban government issued a decree terminating the existence of state farms, and turning them into Basic Units of Cooperative Production (UBPCs), a form of worker-owned enterprise or cooperative. The 80 per cent of all farmland that was once held by the state, including sugar-cane plantations, has now essentially been privatized into the hands of the workers. The UBPCs allow collectives of workers to lease state farmlands at low rent, in permanent usufruct. Property rights remain in the hands of the state, and the UBPCs must still meet production quotas for their key crops, but the collectives are owners of what they produce. Perhaps most importantly, what they produce in excess of their quotas can now be freely sold on the newly reopened farmers' markets.[14] Members elect management teams that determine the division of jobs, what crops will be planted on which parcels, and how much credit will be taken out to pay for the purchase of inputs.

The pace of consolidation of the UBPCs has varied greatly in their first year of life. Today one can find a range from those where the only change is that the old manager is now an employee of the workers, to those that truly function as collectives, to some in which the workers are parcelling the farms into small plots worked by groups of friends or *socios*. It is still too early to tell toward what final variety of structures the UBPCs will evolve.

Even before the present crisis began, Cuba had been trying to move closer towards self-sufficiency in food crops.[15] Under the National Food Program, which began in the mid-1980s, sugar estates have been required to plant food crops and raise livestock in uncultivated areas. The goal was for each farm to supply the food needs of its workers and their families. The cultivation of beans, plantains, and root crops has increased as a result, although exact figures are hard to come by.

Dynamic debate

This process of downsizing and conversion to organic farming is, of course, not taking place without controversy and setbacks. A dynamic debate is

underway inside Cuba which cuts across the agricultural sector, from government ministries, universities and research centres, to farmers and associations of producers. One side argues that what is taking place should be seen not precisely as a process of conversion, but rather as a temporary substitution during a period of crisis. This viewpoint holds that once trade conditions change, agrochemical inputs should once again be vigorously used. The opposite point of view, put forth by the Cuban Association for Organic Farming among others, holds that the previous model was too import-dependent and environmentally damaging to be sustainable. People in this camp argue that the present change was long overdue, and that further transformations are needed to develop truly rational production systems.[16]

The Organic Farming Association is a non-governmental organization (NGO), a rare phenomenon in Cuba.[17] The association is playing a pivotal role in what might be called the institutionalization of the alternative model. Members are ecological agriculture activists ranging from university professors and students, to mid-level government functionaries, farmers and farm managers. They are struggling on a shoe-string budget to carry out an educational campaign on the virtues and indeed the necessity of maintaining and reinforcing the alternative model.

Opponents of such institutionalization point to the recent collapse of Cuban attempts at massive implementation of so-called Voisin Pasture Management as evidence of the inadequacies of organic farming technologies. The Voisin system was supposed to maintain dairy productivity without the widespread use of chemical fertilizers on pastures. The basic principle is as old as animal husbandry itself – the rotation of paddocks in such a way that manure is supplied to growing grasses at the precise moment when it is most needed. The Voisin system failed in Cuba, however, because it required portable electric fencing that was both in short supply and susceptible to the ubiquitous power cuts, and because the density of cattle per acre was too high. Advocates of an alternative model for agriculture point out that it was not the principle of rotational grazing that failed, but rather the way in which it was applied.

Such debate aside, what may be most remarkable about the recent changes in Cuban agriculture is the rediscovery of the traditional values and knowledge of farmers. The Ministry of Agriculture has launched a national programme to recover traditional farming knowledge, recognizing that peasants have always practiced low-input, agro-ecologically sound agriculture. Mobile seminars and workshops are taking place around the country, where farmers can meet to trade their farming secrets and to share them with researchers and government officials.

If a silver lining to the current crisis exists, it is surely the new integration of socialist values with environmental consciousness and greater individual responsibility. Roberto García Trujillo, an assistant dean at the Agricultural University of Havana (ISCAH), is the founder of the Organic Farming Association. On the weekends, he practices what he preaches, working his tiny organic farm on a patch of land inherited by his wife. While he and his son turned the compost pile one Sunday morning, he mused:

> Many people think that farming is a simple and mundane act, but they are wrong. It is the soul of any great culture, because it requires not only a great deal of accumulated knowledge, but also putting this knowledge to use every single day. Knowledge of the weather, the soil, plants, animals, the cycles of nature; all of this is used everyday by a farmer to make the decisions that have to be made in order to produce the food that we eat. To us it may seem like food comes from a factory, but in reality it comes from a culture that, generation after generation, has been created to produce that food.[18]

Conclusion

It is clearly too soon to tell if the transformation of Cuban agriculture will be permanent, or even if it will help Cuba survive its present crisis. Nevertheless, Cuba may turn out to be a model for the rest of us. Whether we live in Latin America, the US, Asia, Africa or Europe, we are all facing the declining productivity of modern conventional agriculture. As soils are progressively eroded, compacted by heavy machinery, salinized by excessive irrigation, and sterilized with chemicals, and as pests become ever more resistant to pesticides, crop yields are in decline. Meanwhile, aquifers and estuaries are being contaminated with agrochemical run-off. Organic farming and other alternative technologies are intensively studied in laboratories and experimental plots worldwide, but examples of implementation by farmers remain scattered and isolated. Cuba offers us the first large-scale test of these alternatives. Before we are all forced to make this transformation, this island nation offers us perhaps our only chance to see what works and what doesn't, what the problems are and which solutions will emerge.[19] Cuba is also carving out a path back from the de-skilled work process of large-scale industrial farming, toward a more human endeavor, engaged equally with traditional knowledge and modern ecological science.