Toona (*Toona sinensis*)

CHAPTER FIFTEEN

The Future of Leaf Vegetables

The World Health Organization recommends that everyone consume at least 400 g of fruits and vegetables every day. To minimize health risks they recommend 600 g daily. The global median consumption is estimated at just 223 g, with nearly 80% of the world's population falling below the minimum recommendation. Almost no one, regardless of their income, eats 600 g or more.

Leaf vegetables typically make up less than 5% of the total fruits and vegetables eaten. About 10% of the world's food budget goes to vegetables and about 10% of that to leaf vegetables. The percentage of global agricultural research and development money that goes toward leaf vegetables is probably well under 1%. This is not a wise investment strategy. A 2005 review of 375 projects across the world done by the UK's Department for International Development found that rates of return to public investment were higher for vegetable production than for any other agricultural activity.[1]

Unfortunately in many developing countries the intense effort to reach self-sufficiency in staple crops has been at the expense of the greater nutritional value derived from more diverse crop production. The food crisis is not just a matter of calories but an issue of nutritional quality, and leaf vegetables have an essential role to play in balanced diets.

1 www.dfid.gov.uk/research/returns-to-research.pdf

Green leafy vegetables have never been a big star in the world of modern food. Although turnip greens rarely ran in the same circles as Tang and freeze-dried ice cream, the food industry hasn't completely given up on modernizing leafy vegetables. On the production end there is, of course, the food future fantasy favorite, genetic engineering. The most popular greens, lettuce and spinach, are already having their DNA rearranged to meet perceived consumer preferences, and others will likely follow. The limited market for less popular greens reduces their appeal to corporate bio-technicians.

Demand for visually stunning organic salad greens is growing, and attracting the attention of big organic growers. Increased hydroponic greenhouse production near major urban markets is poised to address this demand. There are futuristic schemes for growing perfect lettuce on revolving clear plastic walls inside completely controlled factory environments. Oddly, these are promoted as an environmental advance because they are essentially outside of the messy natural environment, relying on an improved artificial environment of purified water and filtered air within their plastic shells.

There are other emerging trends for leaf vegetables that include more significant roles: ending micronutrient malnutrition, helping to balance unhealthy industrial diets, and making a transition towards sustainable agriculture. A quick glimpse at a few of these futures:

Leaf Vegetables in Asia

China, home to nearly one-fourth of the world's people, has undergone a tremendously rapid transformation from chronic poverty and malnutrition, to being one of the world's economic superpowers. Unlike most other societies that have industrialized, the Chinese people are actually eating more vegetables rather than less as they become wealthier.

Chinese vegetable production is extremely intensive, responding to the huge demand for vegetables and the small percentage of land that is suitable for agriculture. The Chinese are leading the way in the development of solar-heated greenhouses that are used primarily for year round production of leaf vegetables. Chinese leaf crop production is diverse as well as productive. Toona (*Toona sinensis*) and Wolfberry (*Lycium barbarum* and *L. chinense*) are two native Chinese temperate perennial leaf crops that are beginning to become known outside of their native region. Among dozens tested at the World Vegetable Center in Taiwan, toona was rated as the vegetable with the highest antioxidant activity, while wolfberry leaves scored the highest in iron.

Leaf Vegetables in Latin America

Currently more than 10,000 children in Mexico City and four rural Mexican states are eating alfalfa-leaf-concentrate-enriched products regularly. Thanks to the collaboration of the BRIMEX clinic, the HERDEZ Foundation and Mexican doctors and scientists, a range of foods has been developed and tailored to the taste of children. They contain enough alfalfa leaf concentrate to help balance their diets, and prevent anemia and vitamin A deficiencies. Called Fortiplus, this line of leaf concentrate-enriched products includes a caramel bar, a green apple flavored sweet powder, purée for babies, and atole, a traditional hot beverage.

While the project is still reliant on imported leaf concentrate, for seven years the Fortiplus experience has been a groundbreaking effort to deliver leaf concentrate to malnourished and at risk children. It has been done on a large scale, with government approval, and has used attractively packaged products that children enthusiastically accept.

The 2009 decision by the European Food Safety Authority (EFSA) approving alfalfa leaf concentrate for general human consumption should make product registration much easier for other groups or companies that want to try variations on the Fortiplus endeavor. As of this writing, several groups, including a company in India, are inquiring about the possibility.

Leaf Vegetables in the US

Even in the heart of the industrial food empire, there is some movement toward a new role for leaf vegetables. Michele Obama, the wife of the current president, reinstituted the White House vegetable garden and immediately enlisted the help of local children to plant spinach, kale, collards, onions, chard, chives, and several types of lettuce. Community gardens, organic food sales and farmers' markets are all expanding every year.

Nutrition and sustainability are gradually beginning to show up at the same meetings. Cities, like Davis, California, are racing to become carbon neutral (putting no net carbon into the air) partly by encouraging home vegetable gardens. Local food clubs are forming and several groups have sprung up to begin the wholesale conversion of iconic suburban lawns into vegetable gardens.[2]

For a people whose children are becoming too fat to jump over a phone book, who eat 20% of their meals in cars, and who have the highest health care expenses in history, this impulse to reconnect with nature through food is encouraging.

Leaf Vegetables in Africa

Perhaps the brightest glimpse of a new leaf vegetable future comes from Africa, where for so long most news has not been happy. The interest generated from an international conference held in 2006 in Ghana on the uses of the moringa tree, has been so great that several national moringa associations have already formed in African

2 Food Not Lawns: How to Turn Your Yard into a Garden and Your Neighborhood into a Community, Heather Coburn Flores, Chelsea Green; 1ST edition (October 1, 2006), ISBN-10: 193339207X, ISBN-13: 978-1933392073

countries. Moringa is well adapted to most of sub-Saharan Africa, where the world's worst rates of malnutrition are found. The speed with which moringa leaf powder is entering rural markets in Africa is heartening, because it offers a low-cost, locally produced, sustainable solution to much of that malnutrition.

At a World Vegetable Center project in Arusha, Tanzania, home gardens yielded an average of 73 kg (161 lb) of 14 different improved varieties of vegetables from just 9 sq m (100 sq ft) under intensive cultivation, using hand tools. These tiny home gardens produced enough for a person to have 200 g of vegetables per day for the entire year. This is enough to nearly double vegetable consumption and help the gardeners reach the WHO recommended minimum intake of fruits and vegetables.

These types of training programs can be run without massive aid programs and without patented, genetically modified seed. They are not for export agriculture and will not pay off the national debts. What they could do is eliminate most anemia, vitamin A, and folate deficiency in Africa. They could add years of life expectancy, increase children's ability to learn, and increase productive labor. By showing people how to produce so much nutritious food close to home, these home vegetable garden training projects could reduce the heavy burden of unnecessary suffering that the African people have carried.

AN INVITATION

I have tried to put forward the case that leaf vegetables could become an important part of the solutions to three major problems in the world's food system. These are micronutrient malnutrition, serious nutritional imbalances from industrialized diets, and a fundamental lack of ecological sustainability in the way the current system produces and distributes food. A large research and development undertaking is needed before leaf vegetables can reach this potential.

Most of the large universities and research institutions working with agriculture and food technology have focused on commercially important crops and foods with viable funding possibilities. Sustainable production of leaf vegetables has been largely ignored. This may be a blessing in disguise because it means that much of the work that needs to be done with sustainable leaf vegetables will have to arise from a distributed network of small-scale, hands-on researchers. Their work is more likely to evolve naturally from having many small trials and errors. It is also likely to have fewer large and unpleasant unintended consequences for low-income people and for our natural ecosystems.

Below are some ideas for research and development projects that I believe could help advance the role of leaf vegetables in nutrition and sustainable agriculture. I invite you to join in this effort in whatever capacity you can, and to communicate what you learn through one of the networks listed in the appendix.

- Research and testing of small-scale leaf concentrate pulpers and presses, especially ultra filtration. This is the use of a semi-permeable membrane to separate leaf concentrate from leaf juice without using heat
- Research and promote the use of dried leaf concentrate in ready-to-use therapeutic foods for disaster relief, refugee camps, etc.
- Research into all aspects of edible cover crops and partial leaf harvest schedule

and intensity, for optimal combinations of leaf vegetables and soil improvement

- Research into using water hyacinth, perhaps the world's worst weed, as a source of leaf concentrate
- Research into fermentation of cassava leaves to remove toxic HCN and make an edible product similar to sauerkraut or kim chi
- Research into planting density and partial leaf harvesting schedule for optimal combined yields of multi-use crops, such as sweet potatoes, cassava, cowpeas, pumpkin, and okra
- Research on value of chaya and bitter gourd leaves in controlling diabetes
- Research into maximizing biological nitrogen fixation on a garden scale
- Research into biochar and carbon sinks on a garden scale
- Research into edible leaf fiber crops to discover if there are crops that could be grown for both commercially useful fiber in the stem and edible leaf (e.g. ramie or jute)
- Research into renewable bio-plastic glazing for greenhouses, cold frames and solar dryers
- Research into leaf crops as dynamic accumulators for essential plant and human nutrients
- Research into vermicomposting and advanced compost teas for both garden fertility and disease control
- Study whether short training in nutrition and vegetable gardening would lower healthcare costs enough to encourage insurance companies to offer better rates, as they do for non-smokers
- Training in hygiene and quality control for workers in an informal food economy
- Developing cold-hardy varieties of some tropical perennial leaf crops

Epilogue

When I was ten years old I saw a pamphlet called "Cars of the Future." They were pretty cool: three-wheelers with one big swiveling, bug-eyed headlight, personal jet packs and hovercraft. Fifty-two years further into that future I drive a car that doesn't get flooded or get flat tires as often as older cars did. It has a nagging beep when I don't buckle my seat belt fast enough and a $200 dollar (don't misplace it!) key with a computer chip in it. I still check the oil by probing it with a metal dipstick to see how deep it is. Some future! Even the fins are gone.

On the other hand I remember watching a Superman TV episode in which Lois Lane asked the computer of the future to solve the biggest mystery in her life, "What is Superman's secret identity?" After some suspenseful buzzing, blinking, and beeping, the huge machine was unable or unwilling to cough up the answer. Back to the future, I type Lois's query into my laptop and Google provides me with 194,000 results in 0.39 seconds. My son walks around with a gizmo the size of a thick postcard communicating with friends thousands of miles away, listening to music, and getting directions to pizza parlors from a satellite orbiting Earth.

You can never tell what the future might bring, but a while ago I had some thoughts about leafy greens and the future of our global food system while helping on a roadside cleanup along a state highway near my home in Big Hill, Kentucky. We collected 22 bags of garbage in less than half a mile. Kentucky Solid Waste Coordinators had done a survey showing that 49% of roadside trash was beverage containers and 20% was fast food litter. While picking up the endless plastic soda bottles I reflected back on the system that had brought them there.

A half liter (16 oz.) soda is about 90% water, with about 13 teaspoons of sugar in the form of corn syrup, and small amounts of flavorings and caffeine. The corn is grown hundreds of miles away—with synthetic fertilizers, herbicides, and insecticides—from genetically modified seed. This agricultural system greatly reduces the organic matter and thus the water-holding capacity of the land. Largely as a result of these short sighted agricultural practices millions of tons of topsoil are lost to erosion each year growing that corn in the US. Some of this soil washes down the Mississippi River to the Gulf of Mexico, where it adds to an abiotic (dead) zone caused by agricultural runoff. This erosion-engendered dead zone, roughly the size of New Jersey or El Salvador, is destroying the prospects for Gulf fish and shrimp (prospects that didn't improve when a ruptured well dumped 200 million or so gallons of crude oil into the Gulf in the summer of 2010). A farmer needs to grow a lot of corn because it stills sells for little more than it did just after World War II. In fact, if it weren't for government subsidies, he couldn't afford to grow corn at all. He is likely old and nearly bankrupt and

living in a rural town that is losing both citizens and businesses.

The starch is stripped from the corn and the protein, vitamins, minerals, and fiber go to animal feed. The corn starch is broken down with acids or enzymes, bleached, and clarified to become corn syrup. This is the ideal global food commodity: cheap, perfectly uniform, colorless, flavorless, with a long shelf life and no nutrients other than calories. The syrup is mixed with carbonated water and artificial flavoring and bottled in non-returnable, non-biodegradable plastic made from non-renewable petroleum. These bottles full of refrigerated sugar water are sold in Appalachian Kentucky, where over 60% of adults are overweight and over 10% have been diagnosed with diabetes. The empty soda bottles are thrown from speeding cars and, before they land, the money paid for the soda is heading out of Kentucky to Coca-Cola and PepsiCo shareholders, who have invested hundreds of millions of dollars in clever advertising to encourage us to buy their products. You can now pick up the same bottles sold by the same corporations along the roadside in southern Mexico.

After returning from the roadside cleanup that evening, I picked a mixture of greens from our garden for supper. It struck me that greens were the anti-corn syrup. They are intensely colorful, with strong unique flavors, and almost no shelf life. They are extremely low in calories but rich in the very vitamins, minerals, fiber, and antioxidants most lacking in the Appalachian diets and in much of the world. We grow our own greens, so no money leaves our economy and no fuel is burned shipping them to us or driving to buy them. There is no advertising, no packaging to dispose of, and any waste products go toward improving the fertility of next year's garden, through composting.

I can choose among a variety of over 50 different greens. The familiar spinach, kale, collards, mustard greens, leaf lettuce, Swiss chard, and beet greens are there. So are moringa, chaya, vine spinach, quail grass, butterfly pea, and a dozen or so other tropical greens. I can even pick wild greens like dandelions or lambsquarters. All of them are nutritious and none required buying any commercial fertilizer, herbicide, or insecticide.

No one wants to eat just greens (I'm about as close as you get), but the difference between the greens and the soda might be instructive. Any food system that will be here to provide nourishment for our great-grandchildren may have to be much more like the greens than the soda. It will have to be modeled on the biologically sophisticated climax ecosystem, rather than the mechanically simplistic factory. Green is the color of the future.