The Last Harvest

As I mentioned at the last meeting I have been reading *The Last Harvest: The Genetic Gamble that Threatens to Destroy American Agriculture.* As a follow-up to the article last month I would just like to share some of the highlights of this book with you.

I found it interesting to discover that Benjamin Franklin was responsible for bringing Chinese gravance to this country. He liked the 'cheese' that was made from it. It is now worth $10 billion a year to American farmers (we grow half of the world's crops in the U.S.). Any guesses as to what it is? It is soybeans, and the 'cheese' is tofu. Mr. Franklin also brought us rhubarb, upland rice and broom corn, plus *The Poor Richard's Almanac*.

Thomas Jefferson wrote, "the greatest service which can be rendered to any country is to add a useful plant to its culture." During his sojourn in France as minister in the 1780's and 1790' he arranged annual shipments of seeds to America from The Jardin des Plantes in Paris. He obtained rice from China, Egypt, Palestine and Africa. He illegally filled his pockets in the Italian Piedmont with rice in 1787. He also sent a shipment to South Carolina. An exportation that was punishable by death. Mr. Jefferson considered seed collecting and experimentation his most important contribution to the United States.

In 1819 the Secretary of the Treasury, William L. Crawford, directed all diplomats and naval officers to collect seeds when abroad. In 1862 Abraham Lincoln established the Department of Agriculture to expand seed exchange.

According to Paul Raeburn, "300 years before George Washington, Thomas Jefferson and Benjamin Franklin began stowing seeds in their pockets, Columbus began the greatest seed swap in history. When he landed on American shores he saw corn, beans, squash and sweet potatoes, which were things he had never seen before. Columbus brought with him seeds of wheat, chickpeas, melons, onions, radishes, salad greens, fruits, and sugar cane, which he introduced to the New World, and he took seeds of the American crops home."

A meal of foods native to the United States would be a slim one. Blueberries would be on the menu, but without wheat there would be no blueberry pie or pancakes. A glass of cranberry juice would be included, but it would without sugar to sweeten it. The main course would consist of sunflower seeds, pecans, and a few other nuts. The vegetable could be the tuber Jerusalem artichoke. Raspberries and grapes round out the list. Forget about Thanksgiving Day staples; squash, sweet potatoes and pumpkins came from Latin America.

Three crops provide 60% of the calories and 56% of the protein that people get from plants: wheat, corn and rice. All three of these crops belong to the grass family. The grasses also include barley, sorghum, millet, oats, and rye. The grass family provides about 80% of the calories that humans consume. None of these grasses originated in the United States. Kentucky Bluegrass is Asian and arrived here via Europe. The same is true of many other crops. Of the world's 20 most important food crops not one is native to the Unites States.

The breed of corn we use in the American Midwest took 150 years to process. Until this century, farmers made their own seed selections for the next year's planting. They chose the hardiest, most productive and most desired ears of corn. In the late 1870's the first hybrid cross was created from deliberately crossing one variety of corn with another. Today of the thousands of corn varieties available, the National Academy for the Sciences has found only six varieties of corn accounts for 71% of American corn crop. Nine varieties of wheat account for 50% of the wheat crop. Four potato varieties account for 72% of American potatoes. Two types of peas produce 96% of pea crops. And only one sweet potato, the Centennial, accounts for 69% of the American harvest. What is the problem with these statistics? Well, their genetic uniformity could be the basis of vulnerability to devastating epidemics.

It takes 10 to 20 years to develop resistant strains against fungi, aphids, insects, and diseases. When all the plants in a single field are near clones of one another all it takes is one outbreak of insects or disease to destroy all the plants of the entire monoculture. The Irish potato blight is an example we all know.

Presently agroscientists are trying to stay ahead of the Russian wheat aphid, which arrived in Colorado in 1987. Wheat is Colorado's leading cash crop. Spraying herbicides is only a temporary solution due to the expenses and ability for the aphids to develop their own genetic resistance to the herbicides. Half of the Colorado acreage of wheat is of only one variety, TAM107.

Further analysis of the limitations of biodiversity in our food crops revealed that of 138 commercial hybrids of corn in the U.S. 56% of them are genetically distinct from one another. Of the other 54% only seven genetic groups were identified. The U.S. is heavily dependant upon only four inbred lines of corn.

Sunflowers are a $200 million a year crop in the U.S.. 90% of the hybrids used share the same cytoplasm (the substance of the cell exclusive of the nucleus).

Due to the influence of the market that sells McDonalds Russet Burbank potatoes for their fries, Burbank potatoes are becoming the dominant potato planted in Washington State. In 1990 a new variety of potato blight was discovered in Vancouver, BC and Athens, PA. We may have to change our preference for Russet Burbank potatoes.

250,000 plants species are identified (thus far) worldwide. Donald Falk, Director of the Center for Plant Conservation at Missouri Botanical Gardens in St. Louis, MO, estimates 3000 to 5000 of these becoming extinct. Only 250 are listed as endangered or threatened by the U.S. Fish & Wildlife Service. Of these 250 at least 37 are potential sources of germplasm (the substance in egg or sperm cells by which hereditary characteristics are believed to be transmitted) for agriculture.

Each species is like a brick in the foundation. They are the building blocks of more complex systems, and it is their particularly adapted sizes and shapes that make the structure so sound. Every time a species becomes extinct it is like pulling a brick out of the foundation. You can probably survive a few such losses, but by the time 12 to 20% of the bricks are gone the whole system is going to become dangerously unstable.

In 1992 the United Nations Food & Agriculture Organization (FAO) estimated the 40,000 plant species would become extinct by the middle of the twenty-first century. This constitutes a grave threat to our world food security.

According to the Office of Technology Assessment (OTA) in 1987 75 % of human nutrition is provided by some seven plants: wheat, rice, corn, potato, barley, sweet potato and cassava. In 1990 Robert and Christine Prescott-Allen, looking world wide, suggest that human diets rely on 103 species. Genetically speaking this is a minuscule number of what is available for our use.

E.O. Wilson in his book *The Diversity of Life* states preservation of the natural system is the only answer to preservation of the world's biodiversity. Seed banks are vulnerable to political upheaval, fires, and earth quakes. In situ (on the original site) is the most promising solution to protecting landraces. As generations came and went and seeds were selected by the farmer and handed down to his sons, each farmer eventually held seeds unique to his own farm. Traditional crop varieties developed in this way are known as landraces. Over the centuries they have accumulated by the tens of thousands.

The agricultural gene pool is shrinking. Large seed companies have the best opportunity to exploit plant genetic engineering. By 1985 four companies supplied 64% of the corn seed in the U.S. (36% came from Pioneers). Biotechnology has the potential to increase agricultural productivity by boosting yields, lowering costs, and devising new products, but at what cost? Has our focus become too narrow?

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