

Fiscal Neglect Breeds Problems for Seed Banks

A lawsuit and a stack of reports suggest that the national system for preserving seeds for plant breeding is in trouble

Fort Collins, Colorado

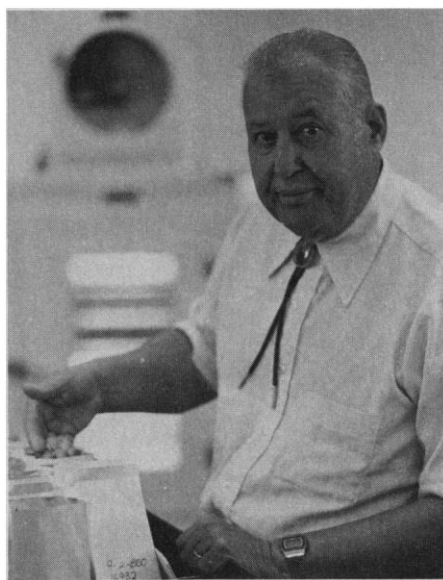
IN a small, plain building at the edge of the Colorado State University campus is a collection of thousands of seeds from wild and domesticated crop varieties from around the globe, representing a treasure trove of genetic diversity. There are seeds from Brazilian corn, Chinese rice and soybean, Turkish wheat, and much more, all kept in dark, refrigerated rooms, packaged in small sacks, row after row, tray after tray for long-term storage. This seed collection and other sister seed banks around the country are biological libraries, each variety holding genetic information that might be key to creating improved plants that are more resistant to disease, drought, and pests and that produce greater yields to feed the United States and the world.

But according to plant geneticists and breeders, various government officials, and several published reports, the U.S. Department of Agriculture (USDA) has not been a very good curator of the collections, which form the National Plant Germplasm System. Some even fear that some seeds have been irretrievably lost through neglect. At a time when biotechnology promises to help geneticists and breeders improve plants with greater speed and precision, the maintenance of the collections is crucial, say agricultural leaders such as William Brown, former chairman of Pioneer Hi-Bred International, Inc., one of the nation's largest producers of corn seed.

In agriculture, the most important resources are commonly said to be soil, water, and air. But Brown and an increasing number of others argue that these collections of germplasm—including seeds, seedlings, and other plant tissue—are equally significant and deserve more attention and money than USDA is giving them. Even at a time when the United States is faced with agricultural surpluses, maintenance of the germplasm collections and research to improve crops are still imperative, according to a November report by the Council for Agriculture Science and Technology, an industry-affiliated group.

Over the past two decades, the report says, the genetic diversity of domestic crops

has narrowed substantially, which potentially makes crops more susceptible to pests or disease. The textbook example of crop vulnerability in the United States is the epidemic of Southern corn leaf blight that destroyed 15 percent of the national corn crop in 1970 because the plants had the same genetic susceptibility. The blight, a fungal disease, cost the U.S. economy hundreds of millions of dollars that year.



Louis Bass, seed bank director

Hoping for \$20 million and more storage space for seeds.

The shortcomings of the National Plant Germplasm System are well documented. In the past 5 years, several major reports, including one by the General Accounting Office and USDA itself, have all pointed out similar deficiencies: the collection of seed is not systematic or extensive enough; more storage space is needed; most of the germplasm already in the banks is inadequately characterized; and seed stock is not being replenished.

The system will come under more scrutiny in the next year. USDA is now conducting another evaluation of the system in response to a lawsuit filed in November by activist Jeremy Rifkin, who charges USDA has mismanaged the seed banks. The Office

of Technology Assessment is halfway through a 2-year study examining the national system and the issue of biological diversity in general. And at the National Academy of Sciences, the Board of Agriculture, which is currently chaired by Brown, will begin a new project this spring to examine how to preserve biological diversity nationally and internationally. The Council for Agricultural Science and Technology said in its recent report, "The future status of plant germplasm does not lack for thoughtful analysis of what should be done. The problem is in carrying out the recommended actions."

Some of the national germplasm system's problems may rest with the way it is organized. GAO reported in 1981 that the National Plant Germplasm System is an unwieldy organization, which "is almost impossible to decipher." USDA's Agricultural Research Service heads the network, which includes the Fort Collins National Seed Storage Laboratory, the only long-term storage facility in the country, and more than a dozen other federal, state, and academic institutions, agencies, and research stations that specialize in certain crop germplasm. The University of California (UC) at Davis, for example, oversees the germplasm bank for stone fruits, grapes, and nuts, and Iowa State maintains a collection of alfalfa, corn, sweet clover, beets, and tomatoes. Germplasm is collected on an ad hoc basis primarily through exchanges with other countries or material donated by researchers. (The working collections, such as the Davis seed bank, distribute germplasm samples free of charge to researchers upon request.) The network also includes several layers of advisory committees. "The net result is a set of components that is not really a system at all. . . . The lack of central authority has led to a number of administrative and operational problems," GAO said.

There are two outstanding problems right now, according to the reports and agricultural leaders. The Fort Collins facility, which is the caretaker of a base collection derived from all the other regional seed banks, is fast running out of storage space. GAO pointed out this need back in 1981, but Louis Bass, the laboratory's director, temporarily resolved the problem by changing storage methods. By switching the seeds from metal containers that were slightly smaller than a tennis ball can to flexible, foil bags, he doubled the lab's capacity.

But now, Bass says, the collection has expanded to more than 200,000 different seed samples, and the laboratory will run out of space in 2 years. "We're pushing for a new facility by 1988," he says. "If we're going to make it, we should have the money in hand

now to begin architectural plans." He is hoping that Congress will appropriate \$20 million to construct another building adjacent to the current lab that would more than triple the storage capacity and meet the system's needs for the next century.

The other problem is that the seed libraries have not analyzed either the gross biological traits, such as certain pest resistance, or the specific genetic information of most of the plants represented. Charles Murphy, acting director of the national germplasm system, said 85 percent of the network's seeds have not been characterized in this way. It is as if a library cataloged the title, author, and genre of an array of books, but knew nothing more about their contents. Robert Goodman, a plant geneticist at Calgene, a California biotechnology company, says, "Unless the seeds are classified, we wouldn't know why to use it. We're still at a stage of needing good descriptive biology" of the seeds.

Supporters of a better germplasm program argue that the government should also be supporting more basic research to adapt desirable traits of wild varieties to domestic crops, a process that may take a decade or more even with genetic engineering techniques. The domestic tomato crop, for example, evolved from extensive breeding that incorporated more than a dozen wild varieties. USDA should also be collecting germplasm related to livestock, such as dairy cattle, not just major U.S. crops, according to the Council for Agricultural Science and Technology. And Robert Perdue, head of USDA's germplasm collecting, says that medicinal plants should be added. Although the National Cancer Institute has supported a program for many years to evaluate the therapeutic value of plants, the germplasm is not stored on a long-term basis for future research, says Perdue, who formerly headed the NCI plant collecting program.

The main solution to most of the system's problems is to increase its shoestring budget, many observers and the reports say. Last year's funding for the USDA system, excluding state extension service money, was \$12.3 million. The internal study sponsored by USDA in 1981 and other studies have said that the annual budget should be at least \$40 million. Last year, funding for evaluation was \$2.5 million and the support for collecting expeditions was only \$42,000. The department also spent \$600,000 to start a computer network that will offer data about the seeds in the collection.

In an unusual agreement, USDA got a helping hand from Pioneer last year because Brown became worried about the demise of a corn collection at an international seed bank in Mexico. Pioneer gave USDA a \$1.5

million, 5-year grant to help grow out and evaluate stock from the seed bank known as CIMMYT in Mexico City. The seed and information will be made available to CIMMYT, USDA, and Pioneer Hi-Bred.

Since the federal program has been strapped for money, California struck out on its own in July and started up a state germplasm system with an annual budget of \$250,000. According to Calvin Qualset, who is the program's director and assistant dean at UC-Davis, the state wants to conserve germplasm that is important to Calil-



Marjorie Sun

A biological library

A technician checks seeds for viability at the Fort Collins seed laboratory.

fornia agriculture or is not covered by the national system already, such as kiwi fruit or strawberries. The state program will also include the preservation of germplasm from animals and microbes.

Those who want USDA to invigorate the germplasm system point out that top USDA officials recognize the need for more money and are doing the best they can given the tight fiscal restraints on the department as a whole. Some are encouraged by the fact that Murphy became acting director of the germplasm network last year. It was Murphy who authored the USDA review in 1981 while a professor at North Carolina State University and is credited with writing a candid and critical assessment of the program.

But the importance of maintaining germplasm is a tough issue to sell to Congress or even to the agriculture community itself, Murphy and others say. Even some biotechnology companies "are largely ignorant about the importance of the germplasm collections," says Thomas Orton, who is a plant geneticist and was until recently with

Agrigenetics in Boulder, Colorado. William Stiles, a staff aide to Representative George Brown (D-CA), remarks that germplasm conservation has not been an issue that translates to votes for legislators. The crop societies, which are the economic force, have not pushed for a better system, Stiles says.

Kenneth Frey, a plant breeder and professor at Iowa State, comments, "This is a hard issue to glamorize. For all that's said, frankly, the collections are not being used that much" because not much is known about what is in the seed banks. "There's not a user community bringing any pressure to bear." Bass says, "In this day and age, we're educated to the spectacular, not to the routine, mundane activities of plant collecting and conservation" in the field or the laboratory.

William Schapaugh, executive vice president at the National Seed Trade Association, says germplasm "is a motherhood issue." But, while major cutbacks are being threatened in other agricultural programs, germplasm is not a top priority on the association's lobbying agenda, he says.

Schapaugh and others are more nervous about an international confrontation that is brewing over access to germplasm collections located around the world. The issue is dividing countries according to geographic and political boundaries. Developing countries, many of which are genetically rich in plant diversity, are asserting that they are being unfairly exploited by developed countries. They charge that developed countries take their germplasm, improve it, and then sell back the seeds at an unfair profit. Many developing countries are now asserting that the Food and Agriculture Organization should take more direct control over the international germplasm centers located around the world, a move that developed countries contend would unnecessarily politicize a successful scientific operation.

Rifkin's suit and the international dispute over access to germplasm may focus political attention on the issue in the next few months. Pioneer has held breakfasts for Capitol Hill staff and legislators to "get the message across," Stiles said. Just before Christmas, Representative James Weaver (D-OR) introduced a new bill that would authorize the national germplasm system \$250 million and would set up more seed banks around the country.

Murphy is encouraged by the attention and even says that Rifkin's suit "certainly doesn't hurt" in publicizing the needs of the system. Germplasm has been "the poor relation" of agriculture for too long, he said. ■ **MARJORIE SUN**

A subsequent article will examine the international dispute over germplasm.