cuts—about 8.2 percent—to compensate for SDI's exemption.

The department's new university research initiative also was hit hard by Gramm-Rudman. The first $25 million, the figure originally proposed by the Administration, has been cut deeply to insulate SDI. The reduction was shared equally by the Defense Advanced Research Projects Agency, Army, Air Force, and Navy, which jointly underwrite this research. The remaining $75 million added by Congress for university instrumentation, equipment, fellowships, and interdisciplinary research (bringing the program to $100 million) has been reduced 4.9 percent. And this year's cut may be a sign of worse things to come. The department itself, sources say, is recommending wiping out the $75-million congressional add-on in its forthcoming budget proposal for 1987.

Next October, SDI and the military equipment and personnel accounts—also exempted this year—could be subject to Gramm-Rudman's automatic reductions. Should Congress and the Administration fail to agree by 5 October to reduce the annual budget deficit to $144 billion, the automatic mechanism will take over. All parts of the FY 1987 budget (except protected programs) would be cut equally to bring the deficit to the target specified in the legislation passed in December 1985.

Reaching the $144-billion mark for 1987 will be difficult. Deficit projections for 1986 calculated by the Congressional Budget Office have grown from $180 billion to $220 billion over the past 5 months, chiefly because of revenue shortfalls and higher costs for farm price-support programs. The $11.7-billion cut that Congress mandated under Gramm-Rudman in FY 1986 will only lower the deficit to $208 billion. Consequently, $64 billion must be shaved from federal expenditures for the next fiscal year, which begins 1 October.

Deep cuts in discretionary spending will be necessary to achieve this, unless the Administration gives in to mounting cries for new taxes. Although the White House is expected to continue to support increases for basic science research in FY 1987, applied research and technology demonstration programs will suffer in many instances—two areas being fossil and nuclear energy.

In the meantime, Gramm-Rudman is under assault in the courts. The law's constitutionality is being contested by the National Treasury Employees Union, Representative Mike Synar (D–OK), and the Public Citizens Litigation Group, a nonprofit group set up by Ralph Nader 14 years ago. At issue is whether the rights and budgetary responsibilities of the Congress have been abrogated by the automatic sequestering provision.

The Reagan Administration is challenging the role of the General Accounting Office in the automatic budget-cutting mechanism. The Justice Department sees GAO's reporting role as an infringement on the President's budgetary responsibilities. Determining whether the Gramm-Rudman budget reduction targets will be met in any given year, says Justice, should be left to the executive branch—not the GAO, a branch of Congress.

If the court accepts these arguments, there is a fallback provision in law. It calls for the House and Senate to approve joint resolutions on reductions to meet the budget deficit targets, which drop by increments of $36 billion annually through FY 1991. But without the automatic provision, the door remains open for disputes between the two houses of Congress, and/or for the President to settle for something less than the stated targets. Minus the sequester provision, legislators say that the new law is toothless.

With the national debt now at $1.94 trillion and rising fast, the pressure to reduce the deficit will not recede—even if the law is overturned. The National Taxpayers Union already is asking the United States District Court for the District of Columbia to set a firm schedule for halting annual spending deficits. In what it claims is the largest class-action lawsuit ever filed, the taxpayer lobby argues that the rights of the nation's 60 million children and of future generations are being abused by greedy adults who are living beyond their means. It asks the court to enjoin the federal government from issuing new bonds except in times of national emergency and unless there is a clear plan for repaying the debt.

And in the Senate, there will be another attempt to pass balanced budget legislation, budget committee aides say. But does this mean Congress is really ready to address the deficit issue? Only time will tell. In 1978 the Congress committed itself to balance the budget by 1981, but in early 1981 the law was rescinded. ■ MARK CRAWFORD

The Global Flight Over Plant Genes

Developing and developed countries face off at a recent FAO meeting over access to germplasm

WHILE most developing countries are rich in native genetic diversity in plants, developed nations are paupers—the United States included. If American farmers were limited to growing native crops, they would be harvesting not wheat, corn, and soybeans but merely cranberries, blueberries, Jerusalem artichokes, and pecans. Yet, with the breeding of imported plant varieties, such as Chinese soybeans and Latin American maize, the United States and other industrialized nations have become major food producers.

That dichotomy has rankled Third World countries and has led to a controversy over the control of resources of plant germplasm, such as seeds and plant tissue. Two years ago, the debate came to a boil at a meeting of the Food and Agriculture Organization (FAO) when many developing countries, feeling exploited by advanced nations, endorsed a resolution that all germplasm, including the proprietary lines of seed companies, should be freely available to all countries. The United States was virtually alone in vigorously opposing the idea that the breeding stock of commercial companies, the result of decades of crossbreeding and a lot of research money, should be available gratis.

Now the politics and the issues of the debate are shifting, according to representatives of developing countries, activist groups, U.S. government officials, and the American agricultural community. At a November meeting of the FAO, a few key developing countries that initially supported the International Undertaking on Plant Genetic Resources, such as Brazil, expressed second thoughts about the resolution. At the same time, however, many developing countries have urged FAO to take more direct control over a loose network of plant gene banks located around the world, a

move that many advanced nations and scientists say would unnecessarily politicize a successful scientific program.

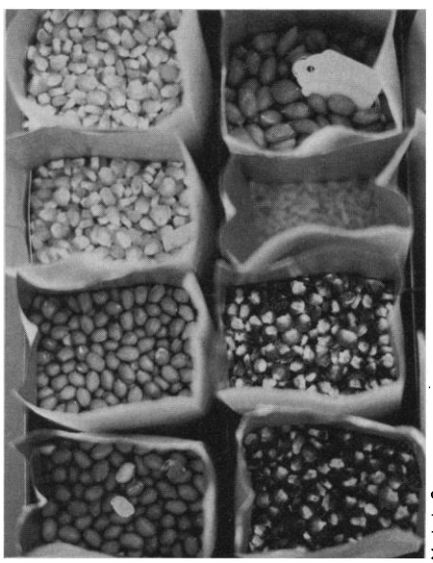
The main impetus behind the resolution is that plant germplasm should be considered a common heritage, says Cary Fowler, one of the prime movers of the resolution and director of a nonprofit farm assistance group in North Carolina, the Rural Development Fund. "If farmers in the developing world have cultivated a crop variety for 10,000 years and don't claim plant rights, why should companies insist on proprietary lines for 10 years of work?" he asks. "The United States needs to show more understanding about the rationale of developing countries." But in a practical sense, he says, "making breeding lines freely available is not enforceable or even wanted." By affirming free access to breeding lines, developing countries are making a philosophical point and staking out a bargaining position to achieve other goals, such as international aid for conservation, Fowler says. Developing countries also want more technical assistance in plant breeding, according to U.S. officials.

The U.S. government and the American Seed Trade Association, however, view the call for open access as a direct attack on plant breeders' rights. While they support the free exchange of germplasm among the international gene banks and government seed collections, the resolution "is inconsistent with the United States laws concerning patent rights, intellectual property and plant variety protection," says Antonio Gayoso, the U.S. representative to the FAO at the November meeting and director of the Office of International Development at the State Department.

Underlying the resolution are a variety of suspicions apparently held by Third World countries, according to government officials and agricultural representatives in the United States. Seed companies are said frequently to collect wild plants from developing countries, modify them, and then sell the seeds back at an unjust profit. There is an exaggerated impression that biotechnology can be used as a tool to snip genes from exotic germplasm taken from developing countries and create new crops in a snap. And international gene banks are alleged to restrict the availability of their collections though they are supposed to distribute germplasm freely. "There is a lot of misunderstanding and misinformation out there," says Trevor Williams, director of the International Board on Plant Genetic Resources, the group that coordinates 43 gene banks, 21 of which are located in developing countries.

Plant breeding, for example, is a lengthy and uncertain endeavor. Steven Witt, director of the California Agricultural Lands Project, says in his new book, *Biotechnology and Genetic Diversity*,* "No one takes wild, weedy or primitive germplasm, tinkers with it a bit, and turns it into the stuff of finished seeds that fetch first-rate profits [from Third World farmers]. Only the Wizard of Oz could do that." Plants are bred to suit specific geographic areas, and U.S. companies mainly produce seed for the domestic market. William Schapaugh, executive director of the American Seed Trade Association, says that in 1984 export sales of seed accounted for $300 million, or only 6 percent, of a domestic market of $5 billion.

Biotechnology will help plant breeders with their job, but crossbreeding will still take as much as a decade of work, according to Peter Day, director of the Plant Breeding Institute in England. "When my colleagues cross wheat with every trick they know, it may still take 8 to 10 years to make something. And it's possible that at the end of that time, you won't have anything either," Day says. "There isn't much that biotechnology can do to help shorten that time [for crossbreeding]."



Marjorie Sun

Seeds of discord

Developing countries want free access to all seeds, including proprietary lines.

According to Williams, it is a misconception that there are restrictions on germplasm stored in the international gene banks. Plant germplasm from the centers "is freely available." Fowler on the whole gives the United States high marks for making germplasm widely available from its national germplasm collections. He asserts, however, that the federal government had banned the export of germplasm to Nicaragua as part of the embargo against the country. Fowler says that the United States should not restrict germplasm for political reasons.

Gayoso says in an interview, however, that the embargo against Nicaragua did not include germplasm. "That's absolute rubbish," he remarks. The embargo restricted the export of commercial goods, not scientific material, he says. Charles Murphy, acting director of the National Plant Germplasm System, says that such a request from Nicaragua "would have been honored."

If there have been offenders of the principle of free exchange, several developing countries qualify. Ethiopia, which has great plant diversity and has not signed the resolution, bars the shipment of coffee germplasm from its borders, according to Witt. India restricts the export of genetic material related to black pepper and turmeric. Taiwan limits the distribution of sugarcane germplasm.

Two years ago, developing countries pretty much voted as a block in support of the resolution. But at the recent FAO meeting, some Third World nations, whose agricultural economies are being revolutionized by the introduction of new crop varieties from their own research and foreign aid, expressed some of the same reservations as the United States about free access to proprietary lines. A representative of Brazil, which reportedly limits the export of rubber germplasm, said at the conference that Brazil "considers itself unable to include [breeders' lines] in international exchange agreements."

Gayoso says that Brazil's change of heart was "a major breakthrough." In addition, Canada, Argentina, India, and several Scandinavian countries expressed reservations about the resolution and the "access" provision.

Nevertheless, many other developing countries have continued to urge FAO to take more direct control of the International Board on Plant Genetic Resources, a move that some fear will inhibit scientific research. As a result, the board now finds itself in the middle of a tug-of-war between two groups seeking control—the international gene bank network, which is called the Consultative Group on International Agricultural Research and funds the board, and FAO, which administers the money.

The board functions mainly to coordinate plant research at the international stations, according to Nyle Brady, assistant administrator for science and technology at the U.S. Agency for International Development, which funds 25 percent of the international

*California Agricultural Lands Project, 1985.

network's annual budget of $185 million. The members of the board and its advisory group have been leading researchers.

But 2 years ago, FAO members established a new commission on plant genetic resources, which presumably would assume authority over the international board. The commission delegates are primarily nonscientists. Schapaugh says that developing countries are attempting "to use FAO to wrest control of germplasm resources" from the international board and "to use FAO as a visible forum to advance their prejudices against intellectual property rights and private enterprise."

A task force of the Consultative Group will soon be making a recommendation on whether the board should break away from FAO. The full Consultative Group is expected to make a final decision in May. There have been rumors that the United States would withdraw from FAO if it tried to assume more authority over the board, but Gayoso says, "The U.S. wouldn't withdraw from FAO. That has never entered the discussion." The issue is not sufficiently significant to prompt such a drastic response, he says.

To Fowler's frustration, one of the main purposes of the resolution has been lost in the face of these other debates. The real thrust of the resolution was to promote the conservation of plant germplasm, he says. FAO members have expressed increasing interest in in situ conservation, but such programs are very expensive. At the November FAO meeting, Mexico proposed that the commission conduct a study on the establishment of an international fund for plant genetic resources and many other delegates supported the idea, which was not described in any greater detail. The *New York Times* and the *Washington Post* reported that a fund of $100 million was proposed and approved by a majority of the delegates, but according to transcripts of the meeting and to participants, no such proposal was made. Only the feasibility of setting up a fund was proposed, say Gayoso and Fowler, who also attended the Rome meeting. The United States opposed the feasibility of the study, contending that there are existing ways to fund conservation efforts.

Gayoso says he is encouraged by the events of the November meeting. "There was much less friction this time. Once countries start looking at it [the resolution], they'll realize how flawed it is." Fowler, however, hopes that the United States will eventually support the resolution in some form. "To discard the undertaking because of the reference to access to proprietary lines is to throw the baby out with the bath water." ■ **MARJORIE SUN**

A Plea from Academia

A long-awaited report by the White House Science Council on the health of the academic research enterprise is in the final stretch. A draft, prepared by a panel headed by David Packard of Hewlett-Packard and D. Allan Bromley of Yale University, was presented to the council on 17 January. However, its plea for a major, sustained infusion of cash to shore up the universities' research infrastructure is not likely to gain a lot of fans in a government that is obsessed with cutting the federal deficit. Indeed, with unfortunate timing, the report was presented just 2 days after the Office of Management and Budget and the Congressional Budget Office unveiled a blueprint for shaving $11.7 billion off federal spending in fiscal year 1986—a cut mandated by the Gramm-Rudman-Hollings deficit reduction legislation (see page 443).

The report, which was begun in the balmier days of early 1984 when the Reagan Administration was proposing big increases in support for academic science, rests on the premise that the universities have been constrained by insufficient and uncertain funding, and their operations have been increasingly tied up in bureaucratic red tape. "One conclusion is clear," says the draft, "our universities today simply cannot respond to society's expectations for them or discharge their national responsibilities in research and education without substantially increased support."

Pointing out that only $8 billion out of almost $100 billion devoted to R&D in the United States in 1984 was spent in the universities, the report urges the federal government to "make substantially greater investments in our centers of learning in the 1980's and 1990's than in the 1970's." Where should the money come from? "The source of such funding in these times of fiscal stringency is not obvious," it acknowledges. However, the report notes that the most likely source is somebody else's funds: "Reallocation of R&D appropriations appears to be the most probable source, but we believe that incremental new funding will be required."

One area in particular that should get some increased financial support, says the report, is research facilities. It recommends that a new fund be established in the National Science Foundation to which the universities can submit proposals. Awards, made on the basis of peer review, would have to be matched with nonfederal funds. No dollar figure is put on the proposal, but the report recommends that the funds be added to the R&D budget rather than transferred from existing activities.

In an attempt to reduce some of the bureaucracy involved in university research, the report recommends a shift to longer-term grants and contracts, with a duration of "at least three and preferably five years," and suggests that investigators be allowed to use up to 10 percent of their funds on a discretionary basis to support activities not necessarily covered by the grant.

Perhaps the most controversial feature of the report is a section aimed, ironically, at reducing the controversy surrounding reimbursement of indirect costs of university research. Indirect costs vary enormously from university to university, ranging from 99 percent of direct costs at Harvard Medical School to 30.6 percent at the University of California at San Francisco, the report notes. It suggests that a portion of indirect costs—those related to administrative expenditures—be fixed at a uniform percentage of direct costs. This would eliminate the need for faculty members to file detailed reports of how they spend their time, but it would not sit too well with those universities whose rates would be reduced. The panel also recommends that proposals submitted for peer review at the National Institutes of Health include indirect as well as direct costs, a practice already employed by the National Science Foundation. This would provide reviewers with information on the total cost of the proposal.

When he outlined the report to the White House Science Council, Bromley summed up its theme as urging a shift in attitude on the part of the federal government. He said the panel would like to see university research regarded as an investment, rather than something to be procured, like a weapons system. After the meeting, Bromley acknowledged that the fiscal climate may not be propitious, but he argued that the universities are too important to be left waiting for better times.

The draft will now be massaged by the council itself, and it is expected to go to the President in the next few weeks. ■ **COLIN NORMAN**