

Proposed Legislation and Policy Options

During the first half of the 1980s, U.S. agriculture underwent a difficult period of adjustment. The **Secretary** of Agriculture convened a Challenge Forum in 1984 to explore ways to alleviate these problems. The New Farm and Forest Products Task Force was created as a result of those discussions. The Task Force issued its findings in 1987, and concluded that agriculture must diversify (6).

This study, and continuing problems in the agricultural sector, have led to interest in using agricultural commodities as industrial raw materials. Congress wants to help rural economies and small farmers to recover from difficult times, and new crops and uses are viewed as a potential mechanism to accomplish these goals. To increase competitiveness, Congress wishes to accelerate cooperation between the public and private sector to commercialize new agricultural technologies. The perceived lack of interest by the U.S. Department of Agriculture (USDA) in developing new industrial crops and uses spawned the introduction of legislation in the 100th and 101st Congresses. Several policy recommendations proposed by the Task Force have been incorporated in the legislation. The House of Representatives bill is titled the Alternative Agricultural Products Act of 1990. The Senate bill is titled the Alternative Agricultural Research and Commercialization Act of 1990. Boxes 6-A and 6-B provide a summary of the main provisions of these bills.

The Task Force reached its conclusion largely on the assumption that “the world now has in place an enormous and steadily increasing capacity to produce basic agricultural commodities in quantities which well exceed demand.” It should be noted that this assumption is not universally accepted. In many parts of the world, available arable land is already under cultivation and the potential for increased irrigation is limited. Increases in supply will come from improved productivity. Evidence exists that increases in agricultural productivity are slowing worldwide. In the United States, it is estimated that by the end of this century, barring major technological change, increases in productivity will be lower than increases in demand, which is assumed to increase as a linear extension of past trends (7). It is hoped that advances in biotechnology and information technology will increase productivity, but at the

present time it is not clear when, and to what extent, these increases can be expected. Thus, although there are potential benefits to diversification, further discussion of the urgency and extent of diversification needed is reasonable.

Proposed Legislation

Goals

Effective policy must articulate clear and achievable goals, and provide the necessary mechanisms to attain the goals. The purpose of developing new crops and uses of traditional crops is to bring about technical change in agriculture. In support of this goal, proposed legislation seeks to provide increased funding for research, improve cooperation between public- and private-sector research, and help share the financial risk of commercializing new technologies. It is hoped that these new technologies, while benefiting society as a whole, will specifically improve economic conditions in rural communities and agriculture, particularly for small farms.

An immediate question that arises in developing policy to stimulate new crop and use development is whether policy should be restricted to nonfood, nonfeed uses of agricultural commodities, or whether new food crops should also be considered. Proponents of the nonfood, nonfeed approach argue that industrial uses are more likely to have larger, faster growing, and higher priced markets than food uses. They feel that larger benefits can be achieved if scarce funds are concentrated on new industrial crops and uses of traditional crops. Proponents of including new food crops argue that these new crops diversify agricultural production, increase farm income, and can have positive environmental impacts similar to those of industrial crops. Furthermore, new food crops may be easier to market than industrial crops. In addition to the arguments over what plant types should be included, there is the question of whether animal products should also be considered.

Previous legislation to encourage new uses for agricultural commodities has focused on nonfood, nonfeed uses. The goal of the Native Latex Act was specifically to develop a domestic rubber industry. That goal was later broadened with the passage of

Box 6-A—Alternative Agricultural Products Act of 1990: House Proposal

Purpose

- To increase the commercial use of agricultural commodities produced in the United States.
- . To mobilize private-sector initiatives to improve the competitiveness of U.S. agricultural producers and processors.
- . To foster economic development in rural areas
- . To establish markets for new nonfood, nonfeed uses of traditional and new agricultural commodities.
- To encourage cooperative development and marketing efforts among the public and private sectors.
- . To direct, where possible, commercialization efforts toward the development of new products from commodities that can be raised by family farmers.

Institutional Structure—proposes the establishment of a National Institute for Alternative Agricultural Products, an independent entity within the U.S. Department of Agriculture. The Institute will be directed by a 12-member National Alternative Agricultural Products Board, appointed by the Secretary of Agriculture, and comprised of individuals from the private sector. The Board is authorized to appoint an Advisory Council to help review and recommend applications, monitor research progress, monitor operation of the Regional Centers, and provide technical assistance.

The Board is authorized to establish two to five regional centers. Each center must match the funding provided by the Federal Government. Each center is headed by a full-time director, appointed by the Board.

Activities—The Institute can provide financial assistance via grants, loans, interest subsidy payments, and venture capital. It can enter into cooperative agreements. The Director of the Institute is appointed by the Board, and provides for peer review of applications, research and research findings; requires licensing fees, etc. where appropriate; and disseminates information.

Regional Centers encourage interaction among the public and private sector, identify areas where new products and processes can contribute to economic growth; provide technical assistance and business counseling to small businesses to commercialize new uses; identify projects worthy of assistance; make use of existing programs to accelerate commercialization; advise the Institute Director of proposal viability; and coordinate with Small Business Development Centers and the Institute.

Financial Eligibility Criteria

Research and Development Grants—Applications may be made by public and private educational institutions, public and private research institutions, Federal agencies, and individuals. Applications are peer-reviewed.

Commercialization Assistance—Loans, interest subsidies, venture capital, and repayable grants may be made. Applicants must show that the product is scientifically sound, technologically feasible, and marketable. Eligible applicants include universities or educational institutions, non-profit organizations, and businesses.

Selection Criteria

Research and Development Grants—Selected on the basis of the likelihood of creating or improving economically viable commercial products and processes using agricultural commodities. Criteria shall include potential to reduce costs of Federal agricultural assistance programs; unavailability of other adequate funding sources; potential positive impacts on resource conservation, public health and safety, and the environment; and ability to produce the product near the area where the agricultural commodity is grown.

Commercialization Assistance—Priority is given to applications that create jobs in economically distressed rural areas; and that have State, local, or private financial participation.

Funding—At least 85 percent of the authorized funding shall be for Research and Development Grants, and for Commercialization Assistance. Of the Research and Development Grants, at least two-thirds of the funding will be allocated to projects that have substantial funding from their own resources, and that have entered into contractual arrangements with commercial companies that provide at least 20 percent of the total funding for the project. At least 5 percent of the funding is reserved for 1890 institutions. Funds committed by the Institute for any projects shall not exceed 50 percent of the total cost of the project.

Funding is via a revolving fund of unspecified level. Authorization of appropriations are for fiscal year 1991 to fiscal year 1995.

¹In both the House and Senate bills, commercialization is defined as activities associated with the development of prototype products or manufacturing plants, the application of technology and techniques to the development of industrial production and the market development of new industrial uses of new and traditional agricultural and forestry products and processes that will lead to the creation of marketable goods and services.

Box 6-B—Alternative Agricultural Research and Commercialization Act of 1990: Senate Proposal**Purpose**

- To authorize plant research in order to develop and produce marketable products other than food, feed, or traditional forest or fiber products.
- To commercialize such new uses in order to create jobs, enhance rural economic development, and diversify markets for agricultural raw materials.
- . To encourage cooperative public/private development and marketing efforts and thus accelerate commercialization.
- . To direct commercialization efforts toward products from crops that can be raised by family-sized producers.

Institutional Structure—Proposes the creation of the Alternative Agricultural Research and Commercialization Corporation, an independent, nonprofit entity within USDA, and headed by a nine-member board, composed of members from the public and private sectors. It will have four to nine regional centers overseen by an advisory council and located in institutions of higher education, ARS laboratories, State agricultural experiment stations, extension service facilities, and other organizations involved in the development and commercialization of new products.

The Board oversees the Corporation and advises on research projects to be funded. The regional center advisory boards review applications, monitor ongoing projects, and provide technical and business counseling to entities not seeking financial assistance.

USDA's Assistant Secretary for Science and Education has final veto power over the decisions of the board.

Activities—The Corporation may provide grants for research to develop and produce new industrial products. For commercialization projects, the Corporation may provide financial assistance in the form of direct loans; interest subsidy payments to commercial lenders; venture capital investments; repayable grants matched by private, State, or local funds; and umbrella trending.

Through the regional centers, the Corporation is to encourage interaction among public and private entities in new product development; identify areas where commercialization could foster rural economic growth; provide technical assistance and counsel to small businesses interested in commercialization; identify new farm and forest products and processes worthy of financial assistance; use existing scientific, engineering, technical, and management education programs to accelerate commercialization efforts; review proposals for financial assistance; and coordinate activities with Small Business Development Centers.

Financial Eligibility Criteria

Commercialization Assistance—Applications may be made by a university or other higher education institution, nonprofit organization, cooperative, or small business concern that is capable of legally complying with the terms and conditions of assistance. Applications are filed with the director of the regional center and must document that the proposal is scientifically sound and technologically feasible, and marketable.

Research and Development Grants—No eligibility criteria are specified

Selection Criteria

Research and Development Grants—Projects selected must show promise to develop new technologies that use or modify existing plants or plant products to provide an economically viable quantity of new industrial products; show potential market demand, reasonable commercialization time frame, and the ability to grow the raw material at a profit; create jobs in economically distressed areas; have State or local government and private financial participation; be likely to reduce Federal commodity program costs; be unlikely to obtain adequate non-Federal funding; be likely to have a positive impact on resource conservation and the environment; and be likely to help family-sized farms and adjacent communities.

Commercialization Assistance—Projects selected must create jobs in economically distressed areas; have State or local government and private financial participation; have good management qualifications; show strong market demand for the potential product; and show potential for repayment to the revolving fund.

Funding—Funding is to be by a revolving fund. Appropriated funds for fiscal years 1990 to 1993 are to be \$10 million, \$20 million, \$30 million, and \$50 million respectively, and \$75 million per year for fiscal years 1994 to 1999.

the Critical Agricultural Materials Act to develop a domestic capacity to produce critical and essential industrial materials. New legislation also focuses on the development of new industrial crops and uses of traditional crops rather than on food crops.

It is not clear that developing agricultural commodities as an industrial raw material source will have a significant impact on rural economic development. Clearly, developing new crops and uses of traditional crops can be a component of a comprehensive rural policy, but as a policy in itself, it is unlikely to revitalize rural economies. Furthermore, in the absence of additional programs (e.g., teaching new management skills to farmers, and helping them share the additional risks of new technologies), potential benefits from the development of new crops and uses may accrue primarily to large-scale farms rather than to small farms.

Proposed legislation limits private-sector participation to small firms (for research and cooperative agreements) and to firms that will locate manufacturing facilities in rural areas (for commercialization funding). There are many good reasons for limiting assistance to small firms. These firms are often innovative, but due to lack of resources, are unable to pursue long-term, risky projects. Additionally, it is feared that providing funding to large firms simply displaces private funds that would have been invested anyway.

Limiting commercialization funding to firms that will locate in rural communities is an attempt to achieve the goal of revitalizing rural economies. These goals are laudable, but may be inconsistent with the other goals of the proposed legislation. As already discussed, the goal of rural revitalization may not be achievable by this policy. In addition, many firms that are likely to be involved in the commercialization of these new products and processes, are large rather than small firms. The eligibility restrictions in the legislation are such that in the attempt to achieve one goal (that of rural development), serious constraints to achieving other goals (development of new agricultural markets) may be introduced. Potentially, there are products where the two goals will be compatible, but it is likely to be a subset of the total products that could be developed. This raises the question of whether all goals are and should be equal, or whether some should have higher priority than others.

Institutions

in addition to having clear goals, effective policy must be flexible and offer a range of mechanisms to achieve stated goals. Policies to achieve technical change will need to address opportunities and constraints in the research and development, commercialization, and adoption stages. As a means of administering the new policy, legislation proposes the establishment of an independent corporation housed within USDA. However, it is not clear that industrial uses of agricultural commodities are such unique agricultural technologies that their development can only be accomplished with the establishment of a new corporation. Rather, the impetus for an independent institution arises because of perceptions that USDA is not interested in, nor has been responsive to constituent requests for new industrial crop and use research. Critics point to the lack of funding for new industrial use and crop research as evidence that this is not a USDA priority. The issue raised is one of how the USDA establishes its priorities and allocates its resources to meet those priorities.

The OTA report *Agricultural Research and Technology Transfer Policies for the 1990s* finds that the issues of priority-setting, planning, and resource allocation for agricultural research is a general problem within USDA, and not one limited to new crop and new use research (9). The existence of an agricultural research and extension system that is responsive to user needs, sets research priorities and measurable goals, allocates resources in a manner necessary to achieve those goals, and develops a more effective technology-transfer component could eliminate the need to develop entities with narrow authorities. Arguments can be made that the creation of new programs to address individual research issues is merely a band-aid approach that creates a new level of bureaucracy without significantly affecting the fundamental problems within the agricultural research and extension system. A General Accounting Office review of management procedures in USDA indicates that one major reason why USDA has difficulty in managing initiatives that cut across agencies and programs is because historically, as new needs arose, new agencies were created within USDA to handle these needs. These agencies, over time, develop policies consistent with their perceived goals (but not necessarily with USDA goals), and attract constituencies that support

each agency's continuance (8). It could be argued that creation of an agricultural corporation to commercialize new crops and uses continues this trend.

Reauthorization of the Office of Critical Materials (OCM) is an alternative to making fundamental changes in the USDA research and extension system or to establishing a new corporation for developing industrial uses for agricultural commodities. The goals of the Critical Materials Act, which established this office, are more modest than those of current legislation. However, OCM is actively involved in the commercialization of new industrial crops; it has cooperative agreements with the private sector and is engaged in projects with industry to demonstrate the commercial feasibility of some of the new crops. Expansion of the mandate of this office to include new uses of traditional crops, and better coordination with the Small Business Innovation Research Programs, could achieve several of the same goals of the current legislation.

Policy Instruments

The new legislation offers several mechanisms to encourage the development of new industrial crops and uses for traditional crops including funding for research and development, in addition to that provided in other categories of the USDA research title. The new legislation strongly emphasizes and funds technology transfer of research from the public sector to the private sector by funding cooperative research agreements.

Proposed legislation does contain some provision for technical assistance, but it is limited. Staff at regional centers, as well as advisory boards are to provide technical and business counseling to firms that are engaged in commercializing new industrial crops and products. They are to coordinate with the Small Business Development Centers (SBDC) and other regional and local agencies or groups involved in development. Some studies have suggested that lack of technical assistance is at least as important a constraint to rural firms as are financial constraints (1,5). Small rural firms most frequently use local bankers, accountants, and lawyers for technical and business counseling, rather than the SBDC, even though there are 53 such centers in all but four States with a budget of nearly \$90 million (4,10). Working closely with, and providing educational classes for local bankers, accountants and lawyers may be an effective way for the regional centers to provide

some technical assistance. Additionally, the role of the Agricultural Extension Service might be expanded. Historically, the Extension Service has transferred information about new production technologies to farmers. Recently, the Extension Service has begun to develop a strategic marketing orientation to help farmers and agribusiness focus on market potential.

Technical and business counseling provided by the programs described above will be useful, but in many cases may be inadequate. To use new processes, many small firms may need a detailed evaluation of their management and production strategies. Effective State technical assistance programs frequently make site visits and provide customized reports to clients. These evaluations average 5 to 6 days of service at a cost ranging from \$1,000 to \$20,000 per client (10). This type of technical assistance will not be provided for in the proposed legislation. Given the potential importance of rural technical assistance to help produce new products from agricultural commodities, Congress may need to consider putting more effort into this aspect of commercialization than is currently available in the proposed legislation. One possibility might be to provide block grants to effective State programs.

Proposed legislation provides funding for commercialization. The legislation defines commercialization as activities associated with the development of new products and processes, the application of technology and techniques to the development of new products and processes, and the market development of new products or processes. Funding targeted for the development of new products and processes would be awarded to innovative firms in a manner similar to the SBIR programs. Funding and adequate technical assistance needed to help the majority of firms lacking research capacity to adopt the newly developed processes, is lacking. Proposed legislation is thus similar to most U.S. technology policy in that it only addresses the issues of new technology research, development, and commercialization, and not the problems of industrial technology adoption.

In addition to commercialization funding and technical assistance, there may also be a need for assistance in financing capital investment and operating expenses, particularly in rural areas. Some studies indicate that debt financing markets in rural

communities operate efficiently, and that operating capital is available for rural firms (1,5). However, equity markets in rural areas are generally not so well developed as in urban areas. Congress may wish to explore options that generally improve the effectiveness of equity markets in rural areas. Improving the SBIC programs supported by the Small Business Administration and developing secondary financial markets to help rural lending institutions share risk are two possible avenues to explore.

One function of the Alternative Agricultural Research and Commercialization Board, proposed in the legislation, is to disseminate information about commercialization projects. However little funding is provided for this function. Informing industry of potential research and commercialization opportunities is an important component of generating industrial interest in developing new products using agricultural commodities. There is growing participation of industry in Federal laboratory and industry fairs; this could be a potential avenue for informing industry about publicly funded research on new industrial crops and uses of traditional crops. Additionally, the Critical Agricultural Materials Act specifically provided for the establishment of a database regarding new industrial crops and use development at the National Agricultural Library. New legislation does not explicitly provide for this function. Research conducted at non-land grant universities, and that conducted at State Experiment Stations but without Cooperative State Research Service (CSRS) funding may not necessarily be included in USDA databases. Congress may wish to consider provisions for database maintenance.

A strategic approach is needed for the development of industrial products from agricultural commodities. A first priority is an understanding of the market potential for new industrial crops and uses. Appraisal is needed of the structure of the industries that will use the new agricultural commodities and of competing technologies currently used and being developed. It is impossible to identify all contingencies that might occur, and funding generic research can lead to new insights. However, a shotgun approach to new crop and use development is not likely to be effective, particularly if a short development time frame is desired; some research must be focused. A priority of new crop and use commercialization should be the development of a marketing

and research and development strategy; social-science research will play a fundamental role. Conceivably this approach could be undertaken in the proposed legislation, but social science research is not explicitly discussed. It is the current lack of research in these areas that makes it difficult to evaluate the commercialization potential of industrial uses of agricultural commodities.

Policy Options

Policy options presented are in three categories:

1. commodity programs options;
2. research, development, and commercialization proposals; and
3. additional options that require further study.

Commodity Program Options

Agricultural commodity programs, as they currently exist, provide substantial barriers to the adoption of new crops by farmers. Additionally, these programs skew farmer production decisions so that a few crops are produced in surplus (e.g., corn) while other crops are not produced in quantities sufficient to meet domestic demand (e.g., oats). Agricultural commodity programs have three main components: non-recourse loans, target prices (deficiency payments), and supply-control programs. Simultaneous adjustments in at least two, and possibly all three of these components will be needed to remove barriers to diversification.

Agricultural commodity programs have a major impact on farmer planting decisions. The risk of losing future base acreage if crops other than those enrolled in commodity programs are planted, is a significant impediment to the planting of any crops other than specified commodity program crops. Farmers continue to plant acreage to certain crops even when these crops are in surplus and market signals indicate other crops might be more profitable to grow. Planting disincentives exist not only for new crops, but for many traditional crops as well. Because of surplus production, Acreage Reduction Programs (supply control) are implemented.

OTA proposes four options for commodity programs:

- changes in the commodity base acreage formula to increase planting flexibility, referred to hereafter as "Normal Crop Acreage";

- changes in the commodity base acreage formula to increase planting flexibility, referred to hereafter as “Triple Base Option”;
- changes in the target prices, referred to hereafter as “Target Prices”; and
- continuation of commodity programs similar to those contained in the 1985 Food Security Act, referred to hereafter as “Status Quo.

Normal Crop Acreage

Normal crop acreage (NCA) was the system used in 1978 and 1979 for wheat, feed grains, upland cotton, and rice, and was based on the number of farm acres that had been planted to specified crops in 1977. Which crops should be included in normal acreage is subject to debate. Base acreage is established for the whole farm, rather than for individual crops. Within the NCA concept, farmers can allocate acreage to any crop they chose, so long as the total program crops plus set-aside acres do not exceed the NCA. This program allows increased planting flexibility for the farmer, but decreases the ability of the USDA to control supply. Supply control is particularly difficult if target prices for selected commodities are high relative to market prices of other commodities. Farmers will opt to plant the crop with the high target price. Thus, even though they can plant any crop they chose without losing base acreage, they may still choose to produce certain crops in surplus because of the strong price signal sent by the target prices. Passage of this option, without changes in target prices, will not eliminate many of the disincentives to the adoption of new crops (3). Normal crop acreage is the proposal recommended by the administration.

Triple Base Option

The triple base option is also intended to provide planting flexibility. This option divides base acreage into three categories: land taken out of production; land planted for which deficiency payments are made; and land planted for which no deficiency payments are made but where market crops could be grown. The plan provides planting flexibility on the permitted acreage without risk of losing base acreage. Because the planting decisions made for the third base (that which receives no deficiency payments) are based more on market price signals than on target prices, this option presumably would remove some disincentives to planting new crops, assuming that these new crops are permitted under the terms of the commodity program. However, farm

groups generally oppose this option because they feel it is motivated not by a desire to provide flexibility, but rather to reduce payments to farmers because of budget constraints. It is also argued that this plan is inequitable because not all farmers can grow more than one crop profitably due to weather and soil constraints (2).

Target Prices

This option would either change the target price itself, or change the acreage and yields of program crops eligible to receive deficiency payments, which would effectively change the target price. Changes in the base acreage formula only, without changes in target prices, may be insufficient to remove barriers to the adoption of new crops, or to reduce commodity surpluses significantly. These outcomes seem to be likelier with the Normal Crop Acreage than with Triple Base Option, because the Triple Base Option effectively reduces target prices by decreasing the acreage eligible for coverage. Reduction in target prices are expected to result in a dollar-for-dollar reduction in farm income. The Triple Base Option would reduce farm income less significantly. Decreasing target prices combined with the Normal Crop Acreage could result in greater crop diversity. Some concern exists that increased planting of non-program crops by farmers participating in commodity programs would negatively affect prices of those crops and hence, the income of farmers who grow non-program crops without participating in the commodity programs.

Status Quo

Maintaining commodity programs similar to those in the 1985 Food Security Act is unlikely to remove disincentives to the production of new crops by farmers.

Research, Development, and Commercialization Proposals

OTA proposes three alternatives for the research and development of new crops and new uses of traditional crops:

- continuation of the current policy including appropriations for the Office of Critical Materials, referred to hereafter as the “Status Quo”;
- establishment of institutions outlined in the House and Senate bills referred to hereafter as the “Agricultural Corporation Alternative”; and

- reorganization of the agricultural research and extension system to be more responsive to end-user needs, referred to hereafter as the “National Research and Extension Policy Alternative.”

Status Quo

The status quo option calls for maintaining the Office of Critical Materials as the main office to coordinate the research, development, and commercialization of industrial materials from agricultural commodities. New-use research and development will continue to be mainly the responsibility of the ARS. The SBIR programs will play a small role, and States will develop their own programs. Features and likely consequences of the status quo include the following:

1. The Office of Critical Materials and the SBIR programs are small and relatively isolated programs within USDA. The role of the Federal Government in the development of new crops and new uses of traditional crops is likely to remain modest in size. The Office of Critical Materials is mainly involved in the development of new industrial crops, rather than new uses of traditional crops. New uses of traditional crops will remain the responsibility of primarily ARS and CSRS research. New food crops are not part of the program.
2. Continuation of the Office of Critical Materials will not address the underlying problems of priority setting, planning, and resource allocation within USDA.
3. Coordination of USDA programs will be by informal mechanisms rather than an integral part of the program itself; the Office of Critical Materials (OCM) has no authority over, or input into, the policies of other programs within USDA. The OCM does work closely with individual researchers at the Northern Regional Research Center (ARS) and in land-grant universities to develop the new crops they have identified as potential candidates for commercialization. Coordination between OCM and the USDA Small Business Innovation Program, however, is informal.
4. The goals of the Critical Agricultural Material Act are more modest than proposed legislation. The focus is on the development of a domestic capacity to supply industrial materials that the United States uses on a daily basis

and that are currently obtained via imports or from petroleum. The emphasis is on supplying a relatively well-defined market rather than on achieving broad social goals, although one could argue that the security gained by having a domestic source of strategic and essential materials is a worthwhile social goal.

5. Financial selection criteria is not limited to small firms only. The broader range of potential participants, compared to proposed legislation, may increase the commercialization prospects for some products.
6. Small business technical assistance and commercialization loans are not part of the program. However, there is a strong technology-transfer component in the form of demonstration programs with industry, and provision of agronomic data about new crops to farmers and extension personnel.
7. Unlike the legislative proposals, the Critical Material Act contains an explicit provision for germplasm collection. Lack of germplasm is a serious constraint for the development of some new crops.
8. There is currently no long-term commitment of funds to the Critical Materials Office. Development of new uses and new crops will require a sustained and adequate commitment of resources.
9. There will be no explicit funding for generic technology-transfer programs for ARS; technology-transfer funding is strictly for industrial uses of new and traditional crops.

Agricultural Corporation Alternative

This alternative involves the passage of a compromise version of the House and Senate bills. Its features and likely consequences include the following:

1. There will be a significant expansion of the Federal role in research, development, and commercialization of new industrial crops and uses of traditional crops.
2. There will be an additional administrative layer added to USDA, but Department problems of priority setting, research planning, and resource allocation will not be addressed. Furthermore, a new administrative component could potentially add to the difficulties already facing USDA in its efforts to coordi-

- nate cross-cutting problems across multiple agencies.
3. No explicit provision exists for the development of a strategic plan to develop new crops and uses of traditional crops. The House bill does provide for hearings to establish goals and priorities; it may be possible to incorporate strategic planning within this framework, but it is not guaranteed. Furthermore, no mention is made of social-science research in any of the proposals. This research, though an integral part of developing new products, is currently lacking.
 4. Development of regional centers leads to a more decentralized approach to new crop and new use development. Decentralized approaches increase the likelihood of duplication and neglect of important elements. However, regional centers are closer to problem areas and are likely to have more local contacts than centralized offices.
 5. Goals of the legislation may be difficult to achieve without additional policy. Agricultural policy and rural policy are not synonymous, and aiming production at small farms will be difficult to achieve.
 6. Financial selection criteria may be too restrictive and diminish opportunities for commercialization. It may be difficult for a new crop or new use proposal to satisfy all, or even a majority of the criteria stated in these bills. Flexibility in the interpretation of the criteria will be needed.
 7. Venture capital will be provided under the proposed legislation. Equity capital may be limited in rural areas and this provision could be beneficial. However, other approaches such as expanding equity funding to all rural firms, and improvements in rural equity-capital markets might lead to increased rural development impacts.
 8. There is no explicit provision of funds for germplasm collection. It is not clear that proposed legislation considered this as research needed for development of new crops and uses of traditional crops.
 9. Some duplication of SBIR program activities may exist.
 10. There will be no explicit funding for generic technology transfer programs at ARS; funding is strictly for new industrial crops and uses of traditional crops.
 11. There will be no funding for new food crops; this potential avenue for diversification is excluded.
 12. No explicit consideration exists for database needs. Some projects may automatically be covered by USDA research databases, but others will not. This could potentially increase the difficulty of information dissemination.
 13. Technical assistance provided will be small and in many cases, insufficient. Additional consideration needs to be given to this component of new crop and use development and commercialization.
 14. No provision is made for adoption of new processes and technology across industry.

National Research and Extension Policy Alternative

This proposal is based on the assumption that no reason exists to treat new crop and new use research and development differently from other agricultural technologies. The impetus to establish a new corporation to promote the research, development, and commercialization of new crops and uses arises from perceptions that USDA has been unresponsive to this type of research. The perceived lack of responsiveness of the USDA to changing needs and priorities is not limited to new crops and uses of traditional crops. Because of the agency's apparent intransigence, a reevaluation of the agricultural research and extension system is warranted. In the OTA study *Agricultural Research and Technology Transfer Policies for the 1990s*, this alternative is explained in detail.

Essential elements of the proposal include a User Advisory Council composed of elected representatives from farmer organizations, agribusiness organizations, public interest organizations, foundations, and government action agencies. The council identifies problems, recommends goals and funding levels, coordinates industry support, and evaluates progress. The council works closely with the Agricultural Science and Education Policy Board (ASEPB), which will be the research and technology-transfer planning center for USDA. The board is headed by the Assistant Secretary for Science and Education, and will include the Assistant Secretary for Economics, the Administrator of each USDA research and technology transfer agency, chairmen of the committees on policy, and representatives

from NIH, NSF, non-land grant universities, and 1890 universities. The board, with the active involvement of the User Advisory Council, sets goals, establishes priorities, assigns agency research responsibilities, and evaluates results, among other duties.

Technical panels are created for each major research and technology-transfer priority. These panels work with the board and provide scientific expertise in the planning process. This proposal provides a basis for effective agricultural research and extension planning in a mission-oriented context. User input is an integral component of the proposal. Allocation of funding is to priority programs rather than agencies. Features and likely impacts of this proposal include the following:

1. USDA's fundamental problems with priority setting, planning, resource allocation, and technology transfer will be addressed.
2. New crop and new use research and development may not necessarily be designated a priority area by the User Advisory Council. Proponents argue that because new crops and uses do not have a constituency, they will not receive attention; however, this research has been given attention by the Secretary of Agriculture, and has been designated as priority area by the current User's Advisory Board.
3. Funding will depend on whether new industrial crop and use development is considered essential to the health of agriculture. If so, new crop and new use research will be a priority and a sustained level of funding will occur. However, there is flexibility to reduce or eliminate this funding if priorities change.
4. Because the technical panels help to identify all areas of research that will be necessary to achieve stated goals, a flexible and multidisciplinary systems approach to agricultural research, development, and extension that cuts across USDA agencies, will be established. This approach would allow, for instance, for the collection of germplasm and for social-science research. This approach also allows for the development of some types of information necessary for technical assistance. It would also encourage the development of a marketing strategy and provide for the assessment of likely impacts of the new technology.
5. This proposal is a research and technology-transfer proposal and would not provide fund-

ing for commercialization or prototype plant development.

6. Explicit funding for technology transfer programs at ARS is possible but not guaranteed under this proposal, Technology transfer from Federal labs other than USDA might not be included, but representatives from other agencies sit on the Board.
7. Increased funding for new food crops is possible but not guaranteed.
8. The role of the Agricultural Extension Service will be an important part of the program.

Options Requiring Further Study

Following is a list of options which Congress may want to explore further to enhance the potential of new industrial crop and use of traditional crop commercialization.

Financial Options

Rural debt markets seem to be working efficiently, but equity markets are not as well developed in rural areas. Congress might want to engage a study to explore possibilities to improve rural equity markets. This might include development and improvement of secondary financial markets as one possibility. For rural development to occur, a wide diversity of employment opportunities must be made available. Venture capital for more than just plants to produce products using agricultural commodities is needed.

Technical Assistance

Technical assistance, particularly in rural communities is a serious constraint for firms. Technical assistance, as well as improved access to funds for capital investment and operating expenses is needed to enhance the potential of adoption of new technologies and processes by firms. Improved access to training will also be needed. Programs to improve the delivery of technical assistance should be examined. One possibility might be to provide block grants to State programs that are effective at delivering technical assistance to rural firms.

Germplasm Collection

To develop new crops and improve traditional crops, availability of appropriate germplasm will be needed. Germplasm collection, improvement of facilities, and research on new storage and maintenance technologies is needed.

Small Farm Programs

Small farm operators may need to learn new management skills to use new technologies and face difficulties managing the risk associated with new technologies. Programs that aid farmers in these endeavors may help facilitate new technology benefiting small farms.

Macroeconomic Policy

The U.S. Government now has large and growing debts. Numerous studies have demonstrated the adverse impacts this has had on agriculture and rural economies. Finding solutions to the Federal deficit will be important to improving the agricultural sector and rural economies. In addition, tax policy can be used to improve the general economic climate for research, development, and commercialization of new technologies.

Current Legislative Activity

Congress passed a Farm Bill in the fall of 1990, just as this report was going to press. The report, in draft, was made available to the Senate and House Agricultural Committees prior to passage of the Farm Bill. A compromise version of the House and Senate Alternative Agricultural bills was passed as part of Title XVI, the research title of the Farm Bill. The final bill (the Alternative Agricultural Research and Commercialization Act) is similar to the Senate proposal with minor changes. There are provisions for two to six regional centers rather than up to nine as was previously proposed. Additionally an explicit category of finding exists for new animal products. And, eligibility for commercialization funds is no longer restricted to small farms.

Because of incompatible timing of the Farm Bill and Appropriations legislation, funding for the new Alternative Agricultural Research and Commercialization Center was not provided. Instead, the Critical Agricultural Materials Act was reauthorized through FY 1995 and the 1991 funding for the Office of Critical Materials is \$800,000. Other funding provided for new crops and uses of traditional crops include \$668,000 for guayule research and \$500,000 for *Crambe* and rapeseed research. Research funds for kenaf (\$1,106,000), meadowfoam, jojoba, milkweed, soybean oil inks, and plastics from cornstarch are also provided for in the ARS budget and special grants. Additionally, there is a grant program for research on the production and marketing of ethanol

and industrial hydrocarbons from agricultural commodities and forest products authorized at \$20,000,000 per year for fiscal years 1991 through 1995. It is likely that Congress will take up the issue of funding the new programs authorized in the Farm Bill in 1991.

Changes were also made in the agricultural commodity programs. Congress passed a Triple Base Option plan, to begin in 1992. Under the plan, the base acreage for program crops (wheat, corn, grain sorghum, oats, barley, upland cotton, or rice) is established. Acreage Reduction programs (ARP) will remove a percentage of that acreage from production. Program crops or other designated crops (i.e., oilseeds and industrial or experimental crops designated by the Secretary of Agriculture), can be planted on 15 percent of the base acreage, but are not eligible for commodity support payments. An additional 10 percent of the base acreage can be planted to designated crops without loss of program base. This new flexibility provision, and removal of acreage that is eligible for support payments will help to remove some of the disincentives to the planting of new industrial crops. Additionally, target prices were nominally frozen at 1990 levels, but changes in the method of calculating deficiency payments may effectively lower target price levels.

In addition, Congress created a new Agricultural Science and Technology Review Board consisting of 11 representatives from ARS, CSRS, Extension Service, Land Grant Universities, private foundations and firms involved in agricultural research, technology transfer, or education. The purpose of the Board is to provide a technology assessment of current and emerging public and private agricultural research and technology-transfer initiatives, and determine their potential to foster a variety of environmental, social, economic, and scientific goals. The report of the Board is to include an assessment of research activities conducted, and recommendations on how such research could best be directed to achieve the desired goals. Establishment of this Board is an attempt to address some of the fundamental problems existing in the USDA research and extension system.

Conclusion

Using agricultural commodities as industrial raw materials will not provide a quick and painless fix for the problems of agriculture and rural economies.

They can provide future flexibility to respond to changing needs and economic environments, but many technical, economic, and policy constraints must be overcome. Many of the new industrial crops and uses of traditional crops are still in relatively early stages of development. Several years of research and development will be necessary before their commercialization will be feasible. The lack of marketing strategies and research to assess the impacts of new technologies complicates decisions on research priorities and appropriate policies and institutions needed to achieve success. Potential impacts on income reallocation and the environment, as well as regional effects need further study before large-scale funding for commercialization is required. Successful commercialization will require not just funding assistance, but a systemic policy that articulates clear and achievable goals and provides the instruments needed to reach those goals.

An encompassing research and development strategy is needed and must be designed to meet market needs; hence a strategic, multidisciplinary, multiregional approach should be taken with both public and private sector involvement. Changes in agricultural commodity programs, in addition to those already made, may still be needed to remove disincentives to the adoption of many new crops. Because of research information still needed, and the time still required to develop many of the new crops and products, a two-step approach to commercialization might be useful. The European community is taking this approach by first establishing a pre-commercialization program to determine feasibility, and then following up with a later program to encourage commercialization. The U.S. Small Business Innovation Research Program also takes a multistage approach to the commercialization of new technologies. In the United States, initial primary emphasis could be given to the basic, applied and precommercialization research needed to develop new crops and uses. A high priority should be an early technology assessment of products and processes to analyze potential markets, socioeconomic and environmental impacts, technical constraints, and areas of research needed to address these issues fully. The establishment of the USDA Science and Technology Review Board should improve the prospects for this type of assessment. The technology assessment would lay the groundwork for development, and provide the

information needed to make intelligent decisions about commercialization priorities, possible impacts of new technologies, and further research or policy actions needed.

Interdisciplinary, and in appropriate cases, multiregional research should be given the highest funding priority. This could include: chemical, physical, and biological research needed to improve production yields and chemical conversion efficiencies, and to establish quality control and performance standards; agronomic research to improve suitability for agricultural production; germplasm collection and maintenance research; and social science and environmental research. Technology transfer issues should also be addressed. These issues include funding for cooperative agreements, database management, and Federal laboratory-industrial conferences.

Once information is available to identify market potential and technical, economic, and institutional constraints, the second step to commercialization can be made. A strategic plan can be developed to commercialize the most promising technologies. Financial aid for commercialization and the role of regulations may need to be considered. Industrial adoption and diffusion of new processes may require additional technical assistance and technical extension programs. For new industrial crops and uses, additional changes may be needed in agricultural commodity programs.

Because many new industrial crops and uses of traditional crops are still in the early stages of development, there is time for a thorough analysis of the actual potential of these new products, the constraints to commercialization, and the potential impacts of development. This information, once it is available, will permit the design of appropriate policy and institutions needed to achieve the benefits that may exist.

Chapter 6 References

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