

Alternative Agricultural Research and Commercialization 5

Congress in FACTA gave major attention to the broad topic of new agricultural products and new uses for traditional agricultural products. This attention reflects widespread national interest in diversifying the agricultural production sector beyond traditional foods and fibers; expanding and intensifying the economic vitality of the agricultural and farm sector; and expediting technology transfer from laboratory to commercial use.

A number of FACTA provisions illustrate this interest and attention. For example, the purposes for the federal agricultural research and extension system (see chapter 2) specifically include a provision for developing “new agricultural crops and new uses for agricultural commodities” (Section 1602). The Supplemental and Alternative Crops program, designed “to develop and implement a pilot research program to develop supplemental and alternative crops,” was extended through FY 1995 (Section 1601). A related FACTA provision called for “developing...commercial uses of mesquite” (Section 1672). The Critical Agriculture Materials Act, “to carry out demonstration projects to promote the development or commercialization of critical crops,” was extended through FY 1995 (Section 1601). The Research on Alcohol and Industrial

Hydrocarbons program was authorized through FY 1995. One of the six priority research areas in the National Research Initiative Competitive Grants Program (NRICGP), established by FACTA, deals specifically with new crops, new uses, and value-added processes. It was funded starting in FY 1992. Generically, an Agricultural Science and Technology Review Board was established (Section 1605) which will, among other things, make assessments of technology transfer initiatives and the extent to which agricultural research and extension programs foster “a diversity of products that can be marketed by the farm operator” and “develop new farm crops and enterprises that are economically and environmentally advantageous and enhance agricultural diversity.” This interest by Congress is buttressed by two reports to Congress from the Office of Technology Assessment: *Agricultural Commodities as Industrial Raw Materials* and *Agricultural Research and Technology Transfer Policies for the 1990s* (25, 26).

Given this broad emphasis on new uses and products, two major initiatives were taken by Congress: (i) establishment of a program and organizational structure for Alternative Agricultural Research and Commercialization (subtitle G, sections 1657–1662) and (ii) establishment of

the Agricultural Science and Technology Review Board (section 1605). These two initiatives are the focus of this chapter

ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION (SUBTITLE G)

The purposes of subtitle G are to (i) “authorize research in the modification of plants and plant material...and other agricultural commodities...to develop and produce marketable products *other than* (emphasis added) food, feed, or traditional forest or fiber products”; (ii) commercialize these products to produce jobs; (iii) direct efforts “toward the production of new industrial products that can be raised by family-sized agricultural producers”; and (iv) foster “economic development in rural areas of the U.S. through the introduction” of these new products from agricultural commodities. Compared with provisions in previous farm bills, subtitle G provides substantially greater emphasis on alternative research and commercialization.

To achieve these purposes, Congress established the Alternative Agricultural Research and Commercialization Center (AARC Center). The center is to “operate as an independent entity” within USDA, and its director is to be appointed by a nine-person board, which in turn is appointed by the Secretary. The enabling legislation specifies that the director reports to the Secretary. Currently, there is a working arrangement for the director to report for organizational and administrative purposes to the Under Secretary for Rural Economic and Community Development. The board is to have one member from USDA, a scientist, a producer or processor, and persons privately engaged in commercialization. In addition, there are to be two scientists from a panel of four experts in applied research relevant to development and commercialization of non-food, non-feed products nominated by the Director of the National Science Foundation. Similarly, there are to be two persons from a panel of four who have relevant financial and manage-

ment expertise nominated by the Secretary of Commerce.

The center is authorized to undertake two major functions to aid commercialization. One function is to conduct research on developing products. The other is to aid the commercialization process through product development and prototyping, marketing and economic analysis, precommercial development, early stage manufacturing and testing, and product introductions. Of these two broad functions, the center has emphasized the second in the belief that it is currently the most cost-efficient manner of expediting commercialization and increasing the center’s revolving fund. The major research function is left, appropriately, with research and development agencies, either public or private. No research and development will be done until the fund is substantially larger; and even then, if such work is done, it will be distinctly different in priority and type to related work done in public sector agencies (3).

As its central financial resource, the center manages a revolving investment fund, initially provided by appropriations from Congress. The fund, which is used for making investments (usually for a five-year period which may be renewed annually) to assist the commercialization of new products, and which has been established through cooperative agreements with successful originators of technologies and products, is critically important. The center has the authority to make loans but at this time has not chosen to do so. Repayment is made through a percentage of future sales or equity in the company, such as stock. Returns to the fund are to be used to fund additional projects.

The center does not duplicate existing programs. It is designed to complement USDA’s research agencies and programs, and appropriately be a bridge between research and development and the commercialization of research results. As such, it has a central role in USDA’s overall program of technology development and transfer, whether the technologies are derived directly from USDA programs or not.

Taking this major step for technology and product commercialization is consistent with initiatives throughout the country that aim to bridge similar technology-commercialization gaps. The Cooperative Research and Development Agreements for federal agencies aim to do this. Similarly, universities across the nation have taken similar steps by creating research parks, establishing aggressive patenting and licensing programs, and modifying longstanding policies to be more involved and/or helpful to the commercialization process, including assisting formation of start-up companies (12,32).

USDA established the center in March 1992. Operations began soon thereafter. The board was established at the outset, and there have been changes in it since then to reflect new emphases and make operations more effective. As of June 1995, 45 projects had been selected and funded. During FY 1994–95 (the first two years of full operation), the center reports that it invested \$15.3 million, matched by \$43 million from private partners, in 39 projects. Project selection, management, and funding is presented below.

Congress in FACTA authorized funding of \$10 million for the center for FY 1990, \$20 million for FY 1991, and then \$75 million annually for FY 1995–2000. Appropriations have been far short of these authorized amounts. Total appropriated funds have been \$4.5 million (for FY 1992), \$7.25 million (FY 1993), \$9 million (FY 1994), and \$6.5 million which was rescinded to \$5 million (FY 1995). These funds have been matched, overall, in a 2–3:1 ratio by private partners, with matching on specific projects ranging from 1:1 (the minimum permissible match) to 7:1 (private:public). For example, the \$9 million appropriation for FY 1994 has been matched by \$25 million from private partners. Given the rapid start-up of the program and the staff effectiveness in selecting and managing the projects, it is clear that more funding is justified. The staff estimates that the minimum number of staff in place can handle substantially more projects. It is too early for projects already funded to know whether the investments have been successful. The results should be clear in the next year or

two. At that time, decisions can be made about adhering to the original authorization schedule. Until then, it is reasonable to support the center at the \$10–20 million level per year.

No formal evaluations have yet been done by the center on rates of return for technologies in which investments have been made. It would be prudent to do this evaluation using sound accounting and financial management principles as early as possible, both to ascertain returns to the revolving fund, to assess effectiveness of the investment strategy to date, and to guide any necessary program modifications during the next two years.

Emphases of the center are on non-food, non-feed products derived mainly from plants (as noted above). Products derived from animal-based materials can be no more than 25 percent of the investments. A specific aim is to encourage the development of “bio-friendly” products.

Project selection is the key step. Rather than choosing or targeting technologies itself, the center has opened its doors to proponents of technologies and products. This is a wise approach, based on accumulating experience throughout the country, where the “push” of initiative, drive, and commitment of the inventor-entrepreneur is generally the first, key component in developing technologies and products. Without that personal commitment and capacity, technologies and products have a substantially decreased possibility of being effective.

The center solicits proposals in the usual way and also accepts those that come in over the tansom. Proposals must be accompanied by a business plan. Proposals are first evaluated by outside reviewers (selected by center staff) who are knowledgeable about the proposed technology and product. If the first reviews are negative, the board does not receive the proposals. If they are positive, the board selects proposals for its own review of financial capacity and probity and for further technical evaluation. This review is done through a site visit that includes one board member and relevant technical experts from outside the board and center staff. Of the projects evaluated, about 10 percent are selected for fund-

ing. The quality of proposals, however, are such that center staff estimates 35–40 percent warrant funding using existing criteria.

There is no requirement for geographic distribution of the investments. However, it is center policy that the location be “blind” to the extent possible in initial evaluations. Currently there are projects throughout the country, including Pennsylvania, Texas, California, Florida, Michigan, Arizona, and the grain belt. By definition, all projects must be in rural areas. There is no requirement as to size and stage of development of firms. Current projects are concentrated in firms that range from early start-ups to medium-size enterprises. One project has been with a large manufacturing company, and it was done in the first year of the center’s operation.

After reviews are completed and the board gives final approval, contractual relationships are established between the center and the applicant. Among other considerations, terms of repayment and any equity interest to be retained by the center are established.

Funding is provided through repayable investments. Generally the amount is in the \$250,000–\$300,000 range. One million dollars is the maximum any project should receive. As noted, although the minimum private sector match is to be 1:1 (private:public), it has ranged to date from 1:1 to 7:1. Of the appropriations from Congress, not more than 15 percent can be for administrative services, and not less than 85 percent is to be for the revolving fund.

Projects funded in FY 1993 include the following representative examples: ethanol as a replacement for methanol in windshield washer fluid; ethanol from woody plant materials; a new material for furniture and decorative ware from waste newspaper and soybean meal; biodiesel fuel from soybean oil; biodegradable polymers from wheat; biodegradable kenaf mats for application of grass seed and nutrients; wool waste as material for cleaning up oil spills; kenaf paper; wood strands flaked from pulpwood timber molded into furniture parts; conversion of kenaf into paneling; oil from the new crop *Lesquerella* as a basis for lubricants and cosmetics; and

blending of *Bacillus thuringiensis* with biodegradable carriers to provide environmentally friendly pesticides. Projects funded in FY 1994 include: building panels from straw; bacteria endemic in cotton cellulosic waste that degrades oil; mesquite briquettes as a substitute for coal briquettes; utility poles made using a plywood-like core and skin technique; crambe oil for personal care products and surfactants; wheat straw and recycled plastic to form composite sign posts; potting soil made from tree and yard trimmings combined with animal manure and inoculated with plant disease-combating microorganisms; and, similarly, compost from agriculture and forestry wastes as a carrier for bacterial biocontrol agents (3).

FACTA provides for regional centers. These were not established initially because of the start-up of the center and the limited funds. Collaboration has recently been established with two Midwest centers—the Agricultural Utilization Research Institute (Crookston, MN) and the Kansas Value-Added Center—which were selected through a competitive process. Initial agreements were established in summer 1995. Under the current agreements, the major purposes of these regional centers are to assist in review and evaluation of proposed technologies; to establish a database and clearinghouse for new uses; and to provide strategic investment information to the board on the potential for business opportunities for new uses and products. They are not, however, functioning in the full regional center role as envisioned in the enabling legislation.

Overall, implementation of the AARC Center is proceeding satisfactorily. Prudent decisions regarding mechanisms for project review and selection have been made. Sound investment policies are in place, both as to the private-public match ratios and the form of repayments expected. The portfolio of technologies and their widespread geographic distribution is appropriate. It is too early to determine the success of the investments. However, it is useful to note that two companies are already making payments to the center based on the signed agreements, and a

third will begin repayments as of January 1, 1996 (3).

AGRICULTURAL SCIENCE AND TECHNOLOGY REVIEW BOARD (SECTION 1605)

The Agricultural Science and Technology Review Board was established in FACTA (section 1605) for the purpose of providing “technical assessment of agriculture science issues and...[considering]...the impact of technologies on agriculture and the social and economic well-being of communities.” It is designed to advise the Joint Council on Food and Agricultural Sciences and the National Agricultural Research and Extension Users Advisory Board. In addition, it is to provide assessment of “public and private agricultural research and technology transfer initiatives...”

The board was established by the Secretary in 1992 and has had five meetings to date, including a public forum early in 1995 to review its proposed technology assessment protocol (24). In accordance with Congressional requirements, the majority of the 11 board members are from the private sector and represent technology assessment, technology transfer, the agricultural and environmental sciences, and international programs. The board gave its first report (for 1994) to the Secretary in 1995. Appointments to the board are made by the Secretary through the Joint Council on Food and Agricultural Sciences, which provides the board with some staff support. Current budget constraints have, however, meant little personnel support for the board. If there is not more personnel support, it is difficult to believe that the board can make much of a contribution. Compounding this problem is the fact that the board maintains minimal or no relations with other entities in USDA. This is to be expected, given the early stages of development of the board’s program, but changes must be made in the future.

A fundamental issue is the optimum location within USDA for technology assessment. At

least five different approaches can be considered: (i) make technology review and assessment everyone’s responsibility, and institutionalize it as such throughout USDA; (ii) create a separate board outside the operational components of USDA, such as the Technology Review Board; (iii) incorporate technology assessment directly into the Joint Council on Food and Agricultural Sciences, rather than have the board a companion entity to the council; (iv) provide strong institutional support for the board, or an equivalent entity at the Secretary level, and give it enough staffing to do its work in respectful relationship with the operating agencies; (v) create technology review and assessment functions within each of the operating agencies (such as ARS, FS, and CSREES) to assist with these functions *and* create a coordinating mechanism that ensures commitment and collaboration throughout USDA.

Clearly, technology assessment and review are major interests. Consequently, it is reasonable to focus on approaches (i), (iv), and (v) because they are “closer to where the action is.” Approaches involving the current board (ii) or a variant of it (iii) seem less appropriate because they are separated from the agencies, even though the current board has a broader mandate than simply providing advice to the Joint Council. Whatever is considered, approach (i)—institutionalizing the mandate, importance, and responsibility for technology assessment, review, and transfer throughout USDA—should at a minimum be taken. Approach (v)—creating technology assessment and review functions—is also appropriate. It is substantially more problematic, however, because so much of CSREES’ work is done through the state and land-grant partners. By virtue in the 1980s of federal legislation and subsequent USDA action, the primary technology review and assessment function for these partners rests with them, not with USDA. Given the emphasis on technology review, assessment, and transfer at the state and university levels, this should not be a problem.