

Strategies for Narrowing the Gap Between R&D and Commercialization of New Crops

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Developing crops with novel or modified quality traits, is an important objective of the National Program of the US Department of Agriculture. Plants like lesquerella [*Lesquerella fendleri* (Gray) S. Wats., Brassicaceae], guayule [*Parthenium argentatum* (Gray), Asteraceae], and cuphea (*Cuphea lanceolata*, Lythraceae) exhibit traits that can meet several consumer needs, and there are many promising opportunities, especially for crop products that could help reduce US dependence on petroleum. However, realizing the anticipated economic, societal, and environmental benefits of new crop technologies in the commercial sector often is impeded by an apparent gap between research and commercial interests. From the scientist's point of view, it's frustrating to those who invest their intellectual capital in producing innovative and valuable technology, only to find that they can see the promised land of commercialization, but have little idea of how to get there.

Often it is difficult to align all the links in the "supply chain" that are required for commercialization. So, the route to market for industrial crops can be long and lonely. Collaborative effort among stakeholders in the supply chain could help mitigate the "risk" in commercializing a new crop product. Connecting multiple links in the value-chain usually eases the uncertainties of growing a new crop or launching a novel product. However, developing strong coalitions require an understanding of the business environment, sound preparation and planning to shepherd the conversion of a promising academic idea into a successful commercial reality.

COMPONENTS OF BRIDGE BUILDING

At least four components are essential to the process of developing a successful research initiative and establishing markets for the products of that research. These components and their role may be outlined in the following scenario, which requires several assumptions. First, that there is sufficient interest in a new crop technology to support a research initiative, and that stakeholders and cooperators already have published a white-paper to document the issues and problems that need to be addressed. The Lesquerella Research Initiative (LRI) might be a good example. The lequerella research community has established an adequate and ready workforce to sustain the initiative; one that is composed of an appropriate mix of expertise and collaborators that effectively leverage resources among federal, university, industrial, and farming partners. In addition, it may be presumed this network has produced a useful and potentially valuable product. So, what are some of the building blocks the LRI will need to bridge the gap from the R&D side, and facilitate movement of new products into a commercial market? I suggest the infrastructure should include these four pillars: (1) administrative support in program coordination and technology transfer; (2) effective plans, developed with stakeholder input, to define and guide implementation of the Initiative; (3) credible processes to ensure the relevance, quality and performance of the program; and (4) business platform to promote acceptance of new technology.

Administrative Support

Most research organizations provide effective administrative support for program coordination and technology transfer. Dedicated administrative support is extremely important because scientists and their contacts with potential commercial partners usually do not have the time, experience or authority to enter into binding or mutually favorable agreements. Someone higher in the corporate structure often makes final decisions, which may lead in a contrary direction. Technology managers on both sides should be involved early in such discussions to ensure that agreements and negotiations are conducted at the proper level.

Using the USDA, Agricultural Research Service (ARS) as a model, research organizations should establish clear lines of communication between program, line, and technology managers and their scientists. Administrative policies should encourage the interaction of administrative support functions to facilitate technology transfer of public sector research. Program coordinators should contribute to that goal by helping scientists improve the efficiency and productivity of their research programs. This may be achieved through proper attention to planning prior to project implementation. As someone once said, "a goal without a plan is only a wish."

Strategic and Action Plans

Developing dynamic and functional plans is an art-form. These instruments can be quite useful documents, if constructed properly. Strategic plans, for example, serve several purposes. Strategic plans: (1) help establish a forum for an interactive, highly coordinated research communications network; (2) provide a framework for setting the research objectives or performance measures needed to address specific problems; and, (3) establish indicators of progress in the form of periodic milestones throughout the term of the program.

The milestones further define what the initiative promises to deliver, and when delivery may be expected. In effect, this provides a quantitative means to evaluate and assess research performance. Such information tends to reassure partners, consumers, legislators, and investors that an effective process is in place for oversight of the research effort on a national and community-wide level. For example, the strategic plan for lesquerella research has four goals that address customer needs: (1) development of competitive biobased products and biofuel additives; (2) economic analyses and market development; (3) genetic enhancement of crop quality and productivity; and (4) agronomic practices for crop production.

Each is supported by a number of performance measures that are needed to achieve the goal on an aggressive, but realistic timeline for delivery of measurable results. Putting this plan into practice, efforts are now moving forward to establish a production base and markets for lesquerella products. The credibility gained from this process also should better position a research initiative for sustained investment opportunities.

As research initiatives expand in scope and accomplishment, there often is need for a higher level of coordination, and with increased budgets, that translates into an even greater need to ensure that stakeholders and investors are shown what they will get for their money, who will do the work, and when they may expect results. There are several examples now, of effective research action plans, such as the ARS Peanut Genome Initiative.

Basically, an action plan becomes a holy grail for a research Initiative. It represents the integration of stakeholder needs into a program strategy for a certain period of time. An action plan is a very important document, among other things, it: (1) sets the scope of the initiative; (2) links the initiative to the USDA strategic plan; (3) states research priorities, stakeholder and customer needs; (4) basis for project development; (5) assigns accountability for project coordination; and (6) platform for internal and external program assessment.

The overall impact of an initiative, the payout to those who invest in the process, largely depends on how well the strategic and action plans meld the resources and ancillary research projects into an integrated approach, where individual projects make successive contributions toward solving a particular problem. This concept fosters teamwork. In an integrated approach, projects should not stand alone. They should complement one another. And contribute to practical outcomes that help achieve the vision and goals of the initiative. This system also facilitates collaboration with any number of federal labs, universities, industry, NGOs, or international partners.

Addressing R&D Investment Criteria

A third pillar of the bridge between R&D and commercialization of new crop products should embody a process for ensuring that all aspects of the initiative are sound, and have the best chance to meet the needs of US agriculture. Because of the serendipitous nature of research, subjective evaluation of research accomplishments always makes it difficult to evaluate progress toward the development of useful technologies. To overcome this dilemma, all federal research programs apply the OMB (Office of Management & Budget) R&D Investment Criteria (Relevance, Quality, Performance) to demonstrate program performance at an acceptable level, and to implement performance based budget decisions. This process begins with program planning and priority setting at stakeholder workshops, to ensure the goals and objectives of the initiative are relevant to high priority needs of US agriculture. Quality of the program may be judged by independent peer review of proposed projects that address specific performance measures in the action plan, and external peer assessment of program accomplishments, in regard to the deliverables that were promised in the plan. Then, program, project, and personal performance are evaluated routinely to ensure a high degree of productivity. There can be no doubt that attention to all these details enables success through accomplishment. In turn, this enhances the credibility of the program and its ability to deliver anticipated products in a timely manner.

Business Platforms and Funding Opportunities

Finally, joint efforts to reduce a new technology to practice are significantly strengthened when there is a business platform to promote acceptance of the new technology and reduce risk. There are several federal and state programs that provide assistance to increase private sector commercialization of R&D innovations. SBIR, the Small Business Innovation Research program is one example within USDA. About \$2 billion in grants are made available each year, on a competitive basis, to fund worthy projects that are not in a position to attract investment capital. Awards up to \$100,000 may be made for feasibility studies. If continued, awards up to \$750,000 may be granted for research activities, pursuant to commercialization of the product.

In addition, non-profit organizations may organize coalitions among sectors of the value-chain to help move technology into commercial use. QUALISOY, a corporate spin-off from the United Soybean Board, is emerging as an effective means for that purpose. The QUALISOY Board is a unique coalition of 21 members who come from all parts of the soybean value chain: farmers, seed companies, processors, and end users. Their mission is to proactively address major market issues, and to improve the global competitiveness of US soybeans with specialized seed quality traits.

One of the issues QUALISOY has actively engaged is the reduction of trans-fat in our diets with modified soybean oils that do not require hydrogenation. Currently, the QUALISOY initiative has brought a critical mass of parties together in the supply-chain for low linolenic variety production and product development. Monsanto markets these low-linolenic varieties under the VISTIVE™ label, DuPont/Pioneer has the TReUS™ brands, and Asoyia™ is marketing ultra-low lin using technology from Iowa State University. Several processors like Cargill, Bunge, AGP, CHS, and Zeeland process and market these oils. Kellogg's and Wendy's are among the first customers to join the campaign to eliminate the challenge of trans fat with low linolenic soybean oil. So, business platforms like QUALISOY are a major factor in closing the gap between R&D and commercialization.

CONCLUSIONS

As innovations in new crop technology becomes available, it is certain that commercial production will be accelerated by strategies that help prepare the public R&D sector to better understand the market and stakeholder needs, and to apply highly credible, integrated research approaches to the problem. If all components of the process are present and work together, it is possible to bridge the gap, and achieve the pinnacle of success in bringing new crop technologies to market.