THERMO TRILOGY CORPORATION
(original awardee: AgriDyne Technologies, Inc.)

Bioengineering of a Safe, Organic/Chemical Insecticide

Every year millions of tons of chemical pesticides are sprayed or irrigated onto plants in fields and gardens throughout the United States. Protected from weeds and insects, these plants flourish and grow to provide food and visual delight for us all. Chemicals used for pest control, however, sometime turn out to be poisonous for humans, and the results are often tragic. Consequently, efforts are under way to reduce the need for toxic chemical pesticides and, in the process, to eliminate the adverse side effects they can bring.

COMPOSITE PERFORMANCE SCORE
(Based on a four star rating.)

No Stars

Reducing the Risk of Toxic Pesticides

One promising approach to reducing the hazards of pesticides is to use genetically engineered organic compounds based on naturally occurring pesticides that are harmless to humans. The ATP project with AgriDyne Technologies offered a novel way to do this by taking advantage of large-scale biochemical production. AgriDyne, founded in Utah in the early 1980s as Native Plants, was a small company that would have been unable to pursue this research without the ATP award.

Scientific knowledge generated by the ATP project . . . is disclosed in two patents and may be important to the genetic engineering of other plant extracts.

A Nontoxic, Chrysanthemum-Based Pesticide

The technology AgriDyne developed during its ATP project is based on the chemistry of pyrethrins, a group of six closely related natural insecticides derived from pyrethrum, a type of chrysanthemum. Pyrethrins kill insects on contact, have low toxicity for mammals, degrade shortly after application, and produce no harmful residues. The only current source for natural pyrethrins is chrysanthemum from east Africa. But, according to AgriDyne's proposal to ATP, supplies were neither stable nor sufficient to meet the worldwide demand.

Although pyrethrins can be synthesized in the laboratory, production via traditional chemical processes is difficult and expensive. AgriDyne's alternative was to genetically engineer yeast cells to produce chrysanthemyl alcohol, a precursor that is then chemically converted to chrysanthemic acid. This, in turn, can be used to produce commercial quantities of pyrethrin.

Business Upheavals Stall Technology

AgriDyne achieved most of the technical goals of the project, but production costs were higher than predicted. The company encountered financial problems that forced it to close in 1995, just as the project was ending. AgriDyne apparently did not have enough management resources to handle the challenges of both developing the technology and commercializing a product. The firm was acquired by Biosys of Columbia, Md., another biopesticides company, which decided not to make the investment required to commercialize the ATP-funded AgriDyne technology.

The company encountered financial problems that forced it to close in 1995, just as the project was ending.

Biosys, in turn, declared bankruptcy in 1996. Its

PROJECT HIGHLIGHTS

PROJECT:
To develop a genetic engineering process for producing pyrethrin, a natural insecticide from chrysanthemums that is nontoxic to mammals but was available only from Africa in limited, unstable supplies. The technology would provide a less-costly, stable domestic source of supply.

Duration: 6/1/1992 — 5/31/1995

ATP Number: 91-01-0071

FUNDING (in thousands):

ATP	$1,200	37%
Company	2,012	63%
Total	$3,212	

ACCOMPLISHMENTS:
AgriDyne achieved most of its technical goals and received two project-related patents:

- "Storage Stable Pesticide Compositions Comprising Azadirachtin and Epoxide" (No. 5,352,697: filed 7/28/1992, granted 10/4/1994) and
- "Chrysanthemyl Diphosphate Synthase, Corresponding Genes and Use in Pyrethrin Synthesis" (No. 5,443,978: filed 6/25/1993, granted 8/22/1995).

CITATIONS BY OTHERS OF PROJECT'S PATENTS: See Figure 3.2.

COMMERCIALIZATION STATUS:
No commercial product has yet been produced.

OUTLOOK:
Commercialization is uncertain, owing to the dissolution of AgriDyne, current market conditions that make the new production approach too costly to compete with natural sources of supply, and lack of plans, at this writing, by Thermo Technology (which now owns the intellectual property) to pursue further development. Scientific knowledge generated by the ATP project, however, is disclosed in two patents and may be important to the genetic engineering of other plant extracts. The knowledge has potential applications in pharmaceuticals and specialized materials and chemicals, as well as in pesticides.

Composite Performance Score: No Stars

COMPANY:
AgriDyne Technologies, Inc.
(acquired by Biosys, Inc. in 1995; Biosys assets acquired by Thermo Trilogy in 1996)
Thermo Trilogy Corporation
7500 Grace Drive
Columbia, MD 21044

Contact: Ramon Georgis
Phone: (410) 531-4711

assets, including patents, were acquired by Thermo Trilogy, the second largest biopesticides company in the world. Thermo Trilogy officials reported having no current plans to commercialize the ATP-funded technology, since the cost today of procuring chrysanthemyl from Africa is lower than the expected cost of producing pyrethrin with the new technology. In addition, they say, detailed knowledge of the scale-up process for the technology (requirements for physical plant investment, as well as information on the predictability of a viable, consistent production yield) was unknown to them and their counterparts at Biosys, and they found it difficult to assess AgriDyne's ATP project. Both companies considered further pursuit of the technology too risky for them.

Although no commercial product has yet resulted from the ATP-funded technology, new bioengineering knowledge has.

Gains in Bioengineering Knowledge

Although no commercial product has yet resulted from the ATP-funded technology, new bioengineering knowledge has. Some of it has been disclosed through two patents. But AgriDyne's manufacturing know-how was apparently not passed on to the company's successors. Should events in Africa decrease the supply or increase the cost of natural pyrethrin, the AgriDyne approach may be resurrected by funding development of the needed manufacturing skills.

Figure 3.2 Patent Tree for Project Led by AgriDyne Technologies, Inc.: Citations by Others of AgriDyne Patents