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Genetic Engineering of Pyrethrins: Early Warning for East African Pyrethrum Farmers

ISSUE: Research on genetic engineering of pyrethrins, the insecticidal compounds derived from the pyrethrum flower. A U.S.-based biotechnology company seeks to produce "unlimited supplies of pyrethrin" in the laboratory.
IMPACT: U.S. is world's largest importer of natural pyrethrins. Development of "bio-pyrethrin" substitute could displace over 200,000 small farmers who grow pyrethrum flowers in Kenya, Tanzania, Rwanda, and Ecuador. New pyrethrum plantations also located in Tasmania, Australia.
ECONOMIC STAKES: Approximately (US) $100 million annually.
PARTICIPANTS: AgriDyne Technologies, Inc. of Salt Lake City, Utah (USA), with financial support from the U.S. Department of Commerce.
WHEN: Company predicts sales of bio-pyrethrum could reach (US) $100 million by the late 1990s.

A U.S.-based plant biotechnology company, AgriDyne Technologies, Inc. of Salt Lake City, Utah, recently announced that it will spend over $3 million in the next 3 years to develop a genetically-engineered pyrethrum product. With a grant of $1.2 million from the United States Department of Commerce, the company seeks to use genetic engineering "to produce almost unlimited supplies of pyrethrin," enabling the United States to become "self-sufficient in the supply of an environmentally friendly pesticide," according to AgriDyne's press release of 21 April 1992.

Given the fact that the United States is the world's largest buyer of pyrethrum, this technological development could prove economically devastating to some 195,000 East African farmers who cultivate pyrethrum flowers. If AgriDyne's "bio-pyrethrum" research is commercially successful, the impact would be especially severe in Kenya, which accounts for over two-thirds of the $100 million annual trade in natural pyrethrum.

What is Pyrethrum?

Pyrethrum is derived from the dried flower heads of Chrysanthemum cinerariaefolium, a daisy-like perennial. The flowers of C. cinerariaefolium contain six insecticidal compounds collectively called "pyrethrins." These insecticidal compounds are extracted and used as a "natural insecticide" that is lethal to insects yet is relatively safe for consumption by humans and mammals. Due to growing environmental concerns about the harmful effects of synthetic pesticides, worldwide demand for pyrethrins currently exceeds the supply.

Pyrethrum: A Smallholder's Crop

Today, over two-thirds of the $100 million world pyrethrum production comes from flowers grown or dried in Kenya. (The balance is divided between Tanzania, Ecuador, Rwanda and Tasmania, Australia.) Approximately 50% of Kenya's pyrethrum is grown in the Rift Valley province, including the districts of Nakuru, Mau Narok, Londiani, and Elgeyo Marakwet. Pyrethrum is a rainfed crop, and highly labor intensive. In Kenya alone, the crop is grown by an estimated 100,000 small-scale farmers, on approximately 16,000 hectares.

The Kenyan Pyrethrum Board, founded in 1935, is a farmer-owned commodity organization that oversees research,

International Office: Suite 750, 130 Slater St., Ottawa, Ontario K1P 6E2, CANADA, Tel: 1-613-565-0900 Fax: 1-613-594-8705 E-Mail (Geonet): Geo4:rafican
RAFI-USA: P.O. Box 655, Pittsboro, North Carolina 27312, USA, Tel: 1-919-542-1396 Fax: 1-919-542-2460 E-Mail (Geonet): Geo4:rafi-usa

processing and marketing of pyrethrum. It sets the producer price for pyrethrum and operates the only pyrethrum processing facility in Kenya.

In recent years, the Pyrethrum Board has developed cloned pyrethrum varieties offering higher pyrethrin content, more uniform flowering, and disease resistance. Kenya's use of micro-propagated pyrethrum plantlets is often cited as an example of a beneficial application of biotechnology to Third World agriculture. Over 1.5 million plantlets have been introduced in recent years. As a result of the superior clones, pyrethrum production in Kenya is projected to expand to record levels in the next few years (20,000 hectares by the end of 1993), and the producer price for pyrethrum continues to climb. (The current producer price is nearly double the price level paid by the Board three years ago.)

The United States is the largest importer of Kenya's pyrethrum extract, accounting for two-thirds of all shipments in 1991. If commercially successful, AgriDyne Technologies, Inc. claims that its genetically engineered "bio-pyrethrum" product would cost less than East African pyrethrum and capture a substantial share of the natural pyrethrum market:

"The current wholesale price for technical grade pyrethrum extract is $187.50 per pound on a 100% basis. It is estimated that the AgriDyne process will produce bio-pyrethrum within a price range of $55.00-$75.00 per pound. It is also possible that the AgriDyne product may have a higher price point, than the plant extract, due to controllable purity levels. The Company anticipates that sales of biosynthetic pyrethrum could potentially reach $100 million by the late 1990s." (Source: AgriDyne Technologies, Inc., "Bio-Pyrethrum Research," p. 2, undated.)

History of Pyrethrum Substitutes

Historically, East African pyrethrum producers have weathered competition from a variety of sources. Beginning 30 years ago, chemists first developed synthetic "pyrethroids," chemical substitutes which are similar to the natural product, but not as effective. In addition, Australia has captured 15% of the world's pyrethrum production over the last decade. With support from the Australian government, Commonwealth Industrial Gases, Ltd. of England has established a 2,500-acre pyrethrum crop on the island of Tasmania.

It is important to stress, that AgriDyne Technologies, Inc. seeks to develop a "natural" pyrethrin substitute--not a synthethic pyrethroid. The company's bio-engineered process uses a genetically engineered microbe containing a plant gene from the chrysanthemum flower. According to company literature, however, the novel bio-pyrethrum process also has the potential to benefit the current and future production and development of many synthetic pyrethroids.

Several years ago, RAFI reported on research funded by McLaughlin Gormley King Co. of Minneapolis, Minnesota (USA) to develop a tissue culture process for production of bio-pyrethrins in the laboratory. The company is no longer pursuing this research. Based on years of fruitless research, McLaughlin Gormley King Co. president, William D. Gullickson, Jr. believes that AgriDyne will not be commercially successful. "I don't think they'll ever be able to produce pyrethrins economically," Gullickson told RAFI.

Conclusion

It is impossible to predict with certainty if and when AgriDyne Technologies, Inc. will achieve commercial success in the development of genetically engineered pyrethrins. Nonetheless, it is crucial that farmer's organizations, planners and policymakers be fully appraised of the potential impacts of new biotechnologies on the lives of thousands of farm families and the rural economies of several East African nations.

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SOURCES

AgriDyne Technologies, Inc., Press Release, "$1.2 Million Grant Awarded to Agridyne for Pyrethrin Research," 4 April 1992.

Report from David I. Rosenbloom, U.S. Agricultural Attache, to Foreign Agricultural Service, Washington, D.C., "Kenya Pyrethrum Industry," dated 20 February 1992. The author is not aware of bio-pyrethrin research in the U.S. The report gives an overview of the Kenyan industry and prospects for the future.

AgriDyne Technologies, Inc., "Bio-Pyrethrum Research," undated, 4 pages. Company literature providing background information on company's research and development of bio-pyrethrum.

Eisner, Robin, 1991, "Natural Insecticide Research: Still Working Out the Bugs," The Scientist, June 10.

"AgriDyne Technologies Awarded Grant for Botanical Insecticide Research," Genetic Engineering News, May 15, 1992, p. 28.

Personal communication with William D. Gullickson, Jr., President, McLaughlin Gormley King Co., Minneapolis, MN, USA.

Resources

Now Available from RAFI: ***"The Seed Map: Dinner on the Third World,"*** a 3' by 5' color wall map showing the centres of genetic diversity of the world's most important food crops, and graphically illustrating the geopolitics of plant genetic resources. Each of the 12 centres of genetic diversity is described in detail in border maps, and dinner plates indicate the degree to which each region of the world is dependent upon the other regions for its long-term food security. Additional charts give examples of crop genetic erosion in the field, major gene collections held by U.S, and estimated dollar value of Third World crop genes to U.S. farmers. The cost of the Seed Map is (US) $25.00 postpaid, outside of North America. ($20.00 in the U.S.) To order, write: RAFI, P.O. Box 655, Pittsboro, NC 27312 USA.

RAFI highly recommends ***Growing Diversity: Genetic Resources and Local Food Security,*** edited by David Cooper, Renee Vellve and Henk Hobbelink of GRAIN. This important book documents the achievement of small-scale farmers worldwide in developing crop varieties tailored to their needs, and demonstrates how grassroots approaches can be built upon to promote both conservation and sustainable development. The book includes articles by RAFI staffer Pat Mooney, as well as RAFI board members Rene Salazar of the Philippines, Camila Montecinos of Chile and Melaku Worede of Ethiopia. ***Growing Diversity*** is available from: Intermediate Technology Publications, 103/5 Southhampton Row, London WC1B 4HH, UK.

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Hope Shand, RAFI, Box 655, Pittsboro, NC 27312 USA.
telephone: (919) 542-1396, fax: (919) 542-2460