Biopesticide Contribution to Agricultural Production, Quality and Safety

Denise C. Manker  
V.P. of R & D  
AgraQuest, Inc.

2003 Global Pesticide Market by Crop and Region

Global Chemical Pesticide Market ($ Billions)

- Turf, Ornamental: Home & Garden 21% (6.5)
- Sugarbeet (4%)
- Cotton (1.9%)
- Cereals (5.0%)
- Maize 3.1 (10%)
- Rice 3.1 (10%)
- Fruits, Nuts, Vegetables 8.0 (20%)
- Others 10.3%
- North America 29.6%
- W. Europe 21.9%
- Asia/Pacific 25.4%
- Latin America 12.8%
- Others 10.3%

2003 Global Pesticide Market by Crop and Region

- 23 24 25 26 27 28 29 30

1999 2000 2001 2002 2003
Average Cost to Develop a Chemical Pesticide ($Millions)


Number of Synthetic Chemicals Screened Per Year

Shift from in-vivo to more target site screens
Shift to “Reduced Risk” Chemicals

**Azoxyistrobin fungicide from Zeneca (now Syngenta)**

**Tebufenozone insecticide from Rohm and Haas**

**Spinosyn insecticide from Dow**

But only 4 of 11 new active ingredients scheduled for 2004 EPA approval are “reduced risk”

Growth of Biopesticides and Organic Food

+20% Compounded Annual Growth

**Biopesticides**

**Organic Food Sales**

Consumers and the globalization of food are driving the trend
Biological Pesticide Market

- Microbials: $160M
- Pheromones: $60M
- Beneficial Insects: $40M
- Biochemicals: $40M

Use of Natural Pest Control Garden Products

- Millions of People
  - 1997: 0
  - 1998: 2
  - 1999: 4
  - 2000: 8
  - 2001: 10
  - 2002: 12

Biopesticides:

- Safety issues
- Environmental Impacts
- Waste Reduction
- Lower Hazardous substances
- Health effects

Sustainable Processes
Opportunities for Biopesticides

- Contribution to less synthetic chemistry
- Resistance management
- Improved worker safety
- Low environmental impact
- Exportation advantages, ISO, CODEX
- Replacement of FQPA or deregulated products

Registration and Costs

- EPA’s Biopesticides and Pollution Prevention Division [Microbials, Biochemicals]
- Quicker and less expensive registration requirements than chemical pesticides
- Approval time is 1.5-2.5 years vs. 3-5 years
- Total development time 3 yrs. vs. 7-10 yrs.
- $6-$10 million vs. $150-$200 million
AgraQuest’s Mission:

AgraQuest discovers, develops, manufactures and markets effective, safe, and environmentally friendly natural products for farm, home and public health pest management.

Overview of AGRASEARCH

- Founded in 1995
- 5th fastest growing co. in Sacramento region (2003)
- 52 full-time employees
- 4 products on the market; 1 approved for sale on 4000 acres; 2 pending at the EPA; 20 more candidates identified
- 26 U.S. patents and 2 U.S. patent applications; 11 foreign patents and 60+ foreign patent applications
- $49 million of invested capital
- Headquartered in Davis, CA
- Manufacturing in Tlaxcala, Mexico
Developing Effective Natural Pest Management Products From Microorganisms

**Discovery**
- Collection and Isolation
- Fermentation
- Primary Screening
- Natural Product Chemistry

**Product Development**
- Preliminary Toxicology
- Pre-Development Testing
- Process & Formulation
- Advanced Toxicology
- Commercial Development
- Field Testing

---

22,000 microbes screened

---

**Natural Product vs. Synthetic Chemical Screening**

<table>
<thead>
<tr>
<th>Synthetic Chemical Screening</th>
<th>AgraQuest’s Microbial Natural Product Screening</th>
</tr>
</thead>
<tbody>
<tr>
<td>150,000+</td>
<td>7000</td>
</tr>
<tr>
<td>1 Product From &gt;200,000 Chemicals</td>
<td>4 products From &lt;7000 Microbes (713 to 6047)</td>
</tr>
<tr>
<td>One Product</td>
<td>4800  2808  713  6047</td>
</tr>
<tr>
<td>Four Products</td>
<td></td>
</tr>
</tbody>
</table>