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Seed Industry Consolidation: Who Owns Whom?

Issue: The first half of 1998 witnessed a dramatic consolidation of power over plant genetics worldwide, punctuating a trend that began over three decades ago. The global seed trade is now dominated by life industry giants whose vast economic power and control over plant germplasm has effectively marginalized the role of public sector plant breeding and research.

Impact: RAFI's ranking of the seed industry giants reveals that the top 10 companies now have \$7 billion - or 30% - of the \$23 billion commercial seed trade. For the leading 10 companies, that is a sales increase of 25% in just two years. But the consolidation drive - and impacts on farmers - are not over. The wave of acquisitions that characterised the second quarter of 1998 in the US market will force a response not only from the major European seed companies but also from other leading pharmaceutical and chemical enterprises in the US. By the time the industry holds its 75th anniversary convention in Cambridge, UK next year, the entire gathering might be able to meet over a wienie roast in someone's backyard.

Policy Implications: In 1999, the WTO is committed to reviewing a portion of the TRIPs ("patent") chapter of the World Trade Agreement. The target text is Article 27.3 dealing with the intellectual property protection of plant varieties. The escalating consolidation of the world seed industry should cause governments to reconsider the spread of intellectual property monopolies over plant varieties. Unless this trend is resisted - and the TRIPS text is amended to exclude plants - the South will find itself faced with a multinational oligopoly controlling a WTO-enforced monopoly over seeds - the first link in the food chain. If so, the WTO's review of its controversial agricultural chapter in 2000 could be moot.

Introduction

Seed industry concentration is taking place at such a feverish pace, by the time this *RAF Communique* reaches you, it will likely be out-of-date.

This issue of *RAF Communique* examines the leading commercial seed firms, and provides an in-depth look at who owns whom in the global seed industry. Although we attempt to include major seed industry players worldwide, our list of seed companies and their subsidiaries is by no means exhaustive, and focuses primarily on large seed companies based in the industrial North. In light of ongoing mergers and acquisitions, any industry ranking is short-lived. What appears in the following pages is merely a "snapshot" of the global seed industry in mid-1998.

Three-Tiered Industry Structure

After several decades of mergers and acquisitions, the structure of the seed industry is settling into three distinct tiers. The top tier is dominated by three life industry titans: Pioneer, Monsanto/American Home Products and Novartis. Pioneer Hi-Bred International continues to reign as the world's

number one seed corporation, though Pioneer is no longer an "independent operator." In 1997, agrochemical giant DuPont bought a 20% stake in Pioneer. The top three firms, Pioneer Hi-Bred, Monsanto, and Novartis have combined seed revenues of over \$4 billion per annum.

The second tier includes large, multinational firms who are major players in seeds, many of whom have parallel interests in agrochemicals and/or pharmaceuticals such as Advanta, AgrEvo, Dow AgroSciences, KWS AG, and Groupe Limagrain. This cohort also includes large companies whose primary focus is the commercial seed trade: Takii (Japan), Barenbrug (The Netherlands) Svalof Weibull (Sweden), Cebeco-Handelsraad (the Netherlands), Sakata (Japan). In the coming weeks and months we will undoubtedly see new alliances, mergers and acquisition involving both first and second tier companies in response to the meteoric rise of Monsanto to the number two position in mid-1998.

The third tier of seed companies includes the small and medium-sized independent seed companies - a vanishing breed in all parts of the world.

The "Monster"

Monsanto was the lead story in seeds and ag biotech during the first half of 1998. Dubbed the "Microsoft of microbiology" by RAFI, Monsanto has spent over \$8 billion acquiring seed and agricultural biotechnology companies since 1996. In May 1998, Monsanto accelerated its seed-buying binge, swallowing two of the world's top 10 seed companies, DeKalb Plant Genetics for \$2.3 billion, and the international seed business of Cargill for \$1.4 billion. Monsanto also acquired the world's largest cotton seed company, Delta & Pine Land, owner of the Terminator technology patent (for \$1.8 billion), and Plant Breeding International of Cambridge, UK from Unilever for \$525 million. In a span of eight weeks, Monsanto catapulted itself to become the world's second largest seed company in the world.

Monsanto's Estimated Annual Seed Revenues

Dekalb	\$451 million
Cargill Intl. Seed Division	\$300 million
Asgrow & Hartz (combined)	\$287 million
Delta & Pine Land	\$183 million
Holden's Foundation Seed	\$35 million
Plant Breeding Int'l (UK)	\$26 million
Stoneville Pedigreed	\$11.7 million
Total:	US \$1,320 million

Source: RAFI, with assistance from Mark Wiltamuth, agribusiness analyst of Furman Selz.

Monsanto was already considered a major player in agricultural biotechnology, but its \$33 billion merger with American Home Products in June 1998 solidifies the company's position as a colossus of the life industry. Monsanto/American Home Products (the "Monster") is the world's number one ranking agrochemical firm, the world's second largest seed company, the number four ranking pharmaceutical firm, and among the top 5 veterinary medicine firms.

Monsanto's insatiable appetite for seed companies is clearly driven by its quest to sell proprietary, genetically engineered traits in the global market. The seed business is the vehicle to deliver the technology. In the United States, Monsanto now holds 85% of the cotton seed market, 33% market share in soybeans, and 15% of the maize seed business. As one industry analyst observes, "Monsanto is creating a giant tollbooth" in front of the cotton, soybean, canola and maize market.¹

World's Leading Seed Companies

Top 10 account for 30% of \$23 billion seed trade worldwide (US \$6,933 million)

COMPANY	1997 Seed Revenue US Millions
Pioneer Hi-Bred Intl. (US)	\$1,784
Monsanto/American Home Products (US)	\$1,320 (estimate)
Novartis (Switzerland)	\$928
Groupe Limagrain (France)	\$686
Advanta (UK and Netherlands)	\$437
AgriBiotech, Inc. (US)	\$425
Grupo Pulsar/Seminis/ELM (Mexico)	\$375
Sakata (Japan)	\$349
KWS AG (Germany)	\$329
Takii (Japan)	\$300 (estimate)

Source: RAFI

Farmers are paying the toll in the form of higher seed prices and licensing fees.

One seed industry analyst confidently predicts that by the year 2000, "nearly all commercial seeds of all major crops will contain one or more bioengineered traits."² The potential market is huge. The International Seed Federation says that the world market for genetically engineered seeds is expected to reach \$2 billion by the year 2000, and predicts that the market will explode to \$20 billion in the year 2010.

According to Hendrik Verfaillie, president of Monsanto, over 26 million hectares (65 million acres) of genetically engineered crops will be grown worldwide in 1998. Over 20.2 million hectares (50 million acres) of that total will be planted in Monsanto's bioengineered seeds.³

Seed Industry Trends – At a Glance

1. Going Global and Going South

As the supply of independent seed companies dries up in the United States and Europe, industry giants are making strategic acquisitions in major seed markets in the South. For example:

- In 1997, Monsanto took a 30% share of the Brazilian maize seed market with the acquisition of Sementes Agroceres. With its July, 1998 purchase of Cargill's international seed division Monsanto gained plant breeding and seed testing operations in 24 countries and seed multiplication and distribution operations in 51 countries. This doubled the potential acreage for Monsanto seed technology worldwide. Monsanto now controls over half the Argentine maize seed market.

- In 1998, Dow AgroSciences acquired Morgan Seeds, Argentina's second largest maize seed company, and Brazil's Dinamilho Carol Produtos Agricolas, another key South American maize firm. Phytogen (majority owned by Dow Agrosciences) recently acquired a major cotton seed breeding program in the Chaco Province of Argentina.

- In 1998, Mexico-based agribusiness giant, *Empresas La Moderna* (ELM) bought two South Korean vegetable seed companies, and Nath Sluis (agricultural biotech company) of India. The company says it plans to invest heavily in Asian seed companies.

2. Inputs to Outputs

We are moving to a second generation of genetically engineered seed products. The first generation of high-tech, proprietary seeds focused on the development of "input" traits, primarily genetically engineered herbicide tolerance and insect resistance, that are highly compatible with the agrochemical business. The combined interest in seeds and agrochemicals has allowed companies like Dow, Dupont, Monsanto, Zeneca, Novartis, AgrEvo, to manage proprietary crop genes and chemicals as a pair.

A second wave of bioengineered seeds will focus increasingly on "output" traits that are tailored for specific end uses such as custom fibers, feed grains with specific nutritional qualities, oilseeds with modified oils, plants that produce biodegradable plastics, etc. As the seed industry exerts greater control over biological traits, traditional commodity crops like maize, soybeans and wheat are being "de-commodified." Grains and oilseeds will no longer be marketed as generic commodities, but as proprietary, custom-made products designed to meet the requirements of industrial processors – whether food processor, petrochemical company or pharmaceutical.

Recent alliances illustrate a growing emphasis on output traits:

- Monsanto recently announced a joint venture with Cargill to manufacture commercial livestock and poultry feeds produced from Monsanto's proprietary germplasm.
- Pioneer and DuPont announced a \$400 million joint venture in 1997. Called Optimum Quality Grains, it will focus on the development of value-added grain and oilseeds, including feed grains to optimize livestock production, seeds to produce biofuels, seeds with modified starch content, healthy oils and nutritionally-enhanced foods. In a separate agreement, DuPont purchased Protein Technologies International, the world's leading supplier of soy proteins to the food and paper processing industries.

The shift to output traits, will likely stimulate further re-structuring in the seed industry and the entire food chain. In the future, we could see food and beverage giants, petrochemical firms and others become major players in the global seed trade.

3. Eliminating the Right of Farmers to Save, Exchange and Breed Crops.

The seed industry continues to use, develop and promote a variety of legal and technological tools

that are designed to give the seed industry greater control over plant genetics and eliminate the right of farmers to save and re-plant seed from their harvest. (For further background on this issue, see *RAFI Occasional Paper, "Terminator Trends – The Silent Spring of Farmers' Rights"* Vol. 5, No. 1, June 1998.) The trend is not new, but the assault on the right of farmers to save seed is accelerating worldwide.

• *Restriction of farmers' rights*

Historically, plant variety protection regimes (a type of plant "patenting") guaranteed the right of farmers to save seed from their harvest. But the farmers' exemption or farmers' right is disappearing from international plant patenting regimes. Earlier this year, the 1991 Act of the International Union for the Protection of New Plant Varieties (UPOV) entered into force, replacing the 1978 Act. UPOV is the international body that coordinates a common legal regime to protect the interests of plant breeders, known as "plant variety protection" (PVP). The 1978 Act explicitly allowed farmers to save seed for their own use. But under the 1991 Act, the right to save and re-plant seed is recognized only if member countries make special provision for it in national legislation – it is not an automatic feature of the new Convention. Today, many South nations are under intense political pressure to join UPOV to satisfy their obligation to adopt some form of intellectual property for plant varieties as required by the World Trade Organization. *RAFI* and other NGOs warn that the 1991 Act of UPOV significantly strengthens the rights of corporate plant breeders, at the expense of farmers and biodiversity.

The 1991 UPOV Act states that the "legitimate rights of the breeders" must be recognized when farmers save seed of a proprietary variety. Under the plant variety protection system of the European Union, larger farmers are now obligated to remunerate the corporate breeder for farm-saved seed. In the UK, for example, the seed cleaning/conditioning firms are now entitled to collect fees from individual farmers who use their services, for the purpose of remunerating corporate breeders.⁴

• *Strong-arm tactics to prevent farm-saved seed*

In the US, Monsanto is leading the assault on the right of farmers to save proprietary seed. Under US patent law, it is illegal for farmers to save patented seed from their harvest, and Monsanto says that it will "vigorously prosecute" farmers in court.⁵ The penalties, warns Monsanto, may include criminal charges, on-farm field inspections, and damages that could exceed \$1 million dollars. In some areas, the company has hired Pinkerton investigators – hired detectives – to root-out farmers who are saving the company's seed. Monsanto says it also gets tips from seed cleaners, farm supply dealers, seed company salesmen, and other farmers. In short, farmers are being turned into criminals, and rural communities are becoming corporate police states.

- *Emerging Genetic Technologies: "Terminator" and "Verminator."*

In March, Delta & Pine Land Co., together with the US Department of Agriculture, proudly announced that they had received a patent on a seed-sterilizing technology that will prevent farmers from saving and re-planting their seeds. In other words, the seed industry has developed plants that are genetically engineered to kill their own seeds, thereby forcing farmers to return to the commercial seed market every year. Because this technology is lethal – in more ways than one – it is popularly known as the "Terminator technology." Delta & Pine Land, a Monsanto subsidiary, predicts that its seed sterilizing technology could be applied to over 400 million hectares (1 billion acres) worldwide. The company says that the Terminator will be targeted for use in the Third World, especially in countries with giant, untapped seed markets like China, India and Pakistan.⁶ (For complete background on the Terminator technology, please see the March/April, 1998 *RAFI Communiqué*, "The Terminator Technology" and RAFI's WWW at <http://www.rafi.ca>).

Not to be outdone, Zeneca of the UK (which, together with VanderHave, owns the world's fifth largest seed company), has indicated it will seek patents in more than fifty countries for its "Improved Plant Germplasm" invention. As with the Terminator, Zeneca's technology deliberately prevents plant reproduction. Dubbed, the "Verminator" by RAFI, Zeneca's patent includes utilizing a rodent's gene from rat fat tissue. Zeneca's patent puts it bluntly "This invention enables the production of plant varieties which are rendered non-viable..." "Verminated" seed requires exposure a chemical to deactivate a blocking process that prevents normal plant growth. The patent appears to be wider and more flexible than the Terminator but the results could be the same.

- ***On the Horizon: Hybrid Wheat***

The "Holy Grail" of crop genetics, hybridization of wheat, has remained elusive for the commercial seed trade. Wheat is the world's most widely cultivated crop, covering 219 million harvested hectares in 1995. New advances in biotechnology, coupled with seed industry consolidation, are now accelerating the drive to commercialize hybrid wheat varieties and the privatization of wheat germplasm worldwide.

- DuPont is investing in wheat at all levels of the agricultural supply chain. In January, DuPont purchased the Cereals Innovation Centre (specializing in wheat-based food ingredients) from the UK-based food processor, Dalgety. In May 1998 DuPont acquired Hybrinova, the hybrid wheat business of Lafarge, S.A. (France), and announced plans to extend its hybrid wheat business in the future.
- Monsanto officials claim that the company's \$550 million takeover of Plant Breeding International

(PBI) Cambridge Ltd. was prompted by the desire to gain control of PBI's valuable wheat germplasm and expertise in wheat breeding. Monsanto's hybrid wheat subsidiary, Hybritech, is aggressively marketing new, hybrid wheat varieties in the US, offering cash rebates to farmers who try hybrid wheat seed in some areas of the US. "Eventually we think a large percentage of wheat can be converted from varietal wheat to hybrid, just like corn has," explains Monsanto president, Hendrik Verfaillie.⁷

3. Control of crop genomes

Seed industry giants are turning to "advanced genomics" as a means of identifying, mapping and controlling key crop genes and their link to agronomically important traits. The danger is that a handful of companies will secure a virtual high-tech stranglehold on plant germplasm at the molecular level.

- Pioneer and DuPont have on a major research alliance on plant genomics. In addition to in-house efforts, the company has contracts in excess of \$40 million with smaller genomic companies such as Human Genome Sciences. According to Ben Bowen, Pioneer's Genomic Coordinator, the company has identified over 300,000 partial gene sequences for maize alone. DuPont holds half a million more gene fragments for diverse species. Bowen declined to comment on related patent applications, but another Pioneer spokesperson told *Seeds and Crop Digest* that the company is "being fairly aggressive in filing for patents on genes we discover."⁸
- In September 1997 Monsanto and Millennium Pharmaceutical announced a 5-year partnership worth up to \$218 million to identify patentable crop genes using genomic technologies. The exclusive deal is not limited to a single crop or geographic location, it covers all crop plants in all countries.⁹
- In July 1998 Novartis trumped its leading competitors by announcing that it will spend \$600 million to establish the "Novartis Agricultural Discovery Institute," a new in-house effort dedicated to plant genomics. The company says will be the world's biggest crop gene mapping project. The California-based institute will employ about 180 scientists. Novartis also committed \$3 million to support rice genome mapping at Clemson University (US).

Conclusion – The Cost of Consolidation

Next year, on the occasion of the International Seed Trade Federation's 75th anniversary, the seed industry will hold a "World Seed Conference" in Cambridge, UK, 6-8 September 1999. Given the current rate of consolidation, it may be a very cozy and intimate gathering.

Industry consolidation is not unique to the seed trade. Mergers and acquisitions are taking place in all sectors of the economy. Given the furious pace of corporate super-sizing, analysts predict that the dollar value of mergers and acquisitions could easily surpass \$2 trillion worldwide, well beyond last year's record of \$1.6 trillion. Indeed, mergers in the first half of 1998 in the USA roughly equaled the total of all US mergers in 1997.

Possible Fora for International Discussion

WIPO Assembly, Geneva - September 7-15
WTO/TRIPS Council, Geneva - September 17-18
UPOV Council, Geneva - October 28
FAO Council, November 23-28

That global corporate consolidation is now commonplace and a pandemic affecting everyone from bankers to bomb-makers is no reason to dismiss consolidation in seeds. To be sure, mega-mergers among financial institutions, within the arms industry, or even in the automotive empire have alarming consequences for peace and prosperity. Moving from country to country, however, mortgages, missiles and Mercedes require little modification. Not so with seeds that live in and adapt to every micro-climate. Mergers in the seed industry have serious consequences for farmers and are a direct attack on the food security of the poor. Global breeders are primarily interested in capturing the wealthier markets and breadbaskets of the American Great Plains, the Aussie Outback, and the farmlands of Europe. Secondly, they will breed for the steppes of Eurasia, the pampas of the Southern Cone, and, the major cereal lands of the Punjab and China. Even within these vast and complex crop lands, there are tremendous variations in growing conditions. Global breeders find such

variations a nuisance and will target only the most affluent farmers on the best soils. While this maybe their breeding target. Their advertising target will remain regional or global. Global companies will also imperil other private and public breeding initiatives. As the "traits" priority becomes more important, the needs of the food producer will be subordinated to the interests of the food processor. Agricultural biodiversity, in general, and plant variety diversity in particular, will suffer.

The rapid formation of a seed oligopoly would be sufficient cause for government concern. But oligopoly hand-in-hand with intellectual property monopoly is a matter of grave concern. Even as the ranks of the seed industry implode, exclusive monopoly over varieties and genetic traits is exploding. Many of the consolidations in the industry of late have been driven by the need to capture patents - not markets or distribution systems. Both the patent rules administered by the World Intellectual Property Organization (WIPO) and the Plant Breeders' Rights rules governed by UPOV (Union for the Protection of New Varieties of Plants) threaten scientific research and the right of farmers to save and develop seed. In combination with the global trade clout of the WTO, the global seed industry is positioning itself to dictate the future of plant breeding. When governments review the WTO's TRIPS provisions with respect to plants, they will be determining a key element in the fate of world food security. Clearly, the world is not now as it was perceived to be when governments accepted TRIPS back in 1994. The 1999 TRIPS review should acknowledge this major change and eliminate the requirement that member states grant intellectual property protection to plant varieties or microorganisms. When the WTO's agricultural chapter is reviewed in 2000, governments should move on to consider the wider threat of corporate concentration in agribusiness.

NOTES:

- ¹ James H. Wilbur was quoted in an article in the *St. Louis Post-Dispatch*, May 17, 1998
- ² Wheat was quoted in article by Andrew Wood and Peter Fairley, "Biotech Crops Flourish," *Chemical Week*, February 4/11, 1998, p. 27
- ³ Robinson, Elton. "Will Monsanto and Cyanamid merge genes, too?" *Delta Farm Press*, Vol. 55, No. 27, July 3, 1998.
- ⁴ Jeroen van Wijk, "Plant patenting provision reviewed in WTO," *Biotechnology & Development Monitor*, No. 34, March, 1998, p. 6.
- ⁵ Monsanto News Release, "Monsanto Taking Seed Piracy to Court," May 11, 1998.
- ⁶ Freiberg, Bill, "Is Delta and Pine Land's Terminator Gene A Billion Dollar Discovery?" *Seeds and Crop Digest*, May/June, 1998.
- ⁷ Verfaillie was quoted in "Monsanto Sees Plant PlantBreeding Buy Furthering Hybrid Wheat," *Dow Jones Newswire*, July 15, 1998.
- ⁸ Knudsen, N., "Pioneer Invests in Genome Research for the Future," *Seeds & Crops Digest*, June/July, 1997, p. 35.
- ⁹ Marshall, A., "Millennium signs away plant kingdom to Monsanto," *Nature Biotechnology*, Vol. 15, December, 1997, p. 1334.

NEW OCCASIONAL PAPERS FROM RAFI

- Vol 5, No. 2: **Repeat the Term! Governments at FAO's CGRFA Fail to Make the Grade (July 1998)**
- Vol 5, No. 3: **The Terminator File: A Chronology and Collection of RAFI Publications on the Terminator Technology (August 1998)**
- Vol 5, No. 4: **The PBR Scandal File: A Chronology, News Releases, and List of Questionable Plant Monopolies Issued in Australia and Other UPOV Countries (August 1998)**

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RAFI's Seed Company Chart

(from RAFI Communiqué, July/August 1998)

Parent Company	Subsidiaries
<p>Advanta</p> <p>UK</p> <p>In 1996 Zeneca (UK) and Royal VanderHave (Netherlands) merged their seed businesses to form Advanta.</p> <p>Advanta is the 5th largest seed company in the world</p> <p>1997 annual sales of US \$437 million.</p>	<ul style="list-style-type: none"> • VanderHave • Garst • ICI Seeds • Interstate Payco • Olds Seed • Michigan State Seeds • Advanta Seed West • Shamrock Seed • Zenco • Mogen • Sharpes International
<p>AgrEvo</p> <p>Germany</p> <p>AgrEvo is owned by Hoechst and Schering.</p> <p>Nunhems is #4 ranking vegetable seed company in the world.</p> <p>AgrEvo had 1997 seed revenues of \$76 million.</p>	<ul style="list-style-type: none"> • Plant Genetic Systems • Nunhems • Sunseeds • Cannon Roth • Pioneer Vegetable Genetics • Dessert Seed • Castle Seed • Keystone Seed • AgrEvo Cotton Seed Intl. (Australia)
<p>Agribiotech Inc.</p> <p>US</p> <p>The company's goal is to achieve 45% market share in forage and turfgrass by the year 2000.</p> <p>The company has completed 29 acquisitions since January, 1995.</p> <p>With annual revenues approaching \$425 million, Agribiotech ranks 6th largest seed company in the world.</p> <p>The company had no seed-related interests prior to December, 1994.</p>	<ul style="list-style-type: none"> • Peterson Seed Co. • Geo. W. Hill & Co. • Fine Lawn Research, Inc. • Willamette Seed Co. • Kinder Seed Inc. • Olsen-Fennell • W-L Research • Burlingham • Germain's • Clark Seeds • Lofts Seed • Great Western • Green Seed • Sunbelt • Budd • Sexauer • Halsey Seed Co. • Seed Mart Inc. • Arnold-Thomas • Beachley-Hardy • Seed Resource Inc. • Hobart Seed • Sphar Seed • Scott Seed Co. • Seed Corp. of America • Seedbiotics • LaCrosse Seed Corp. • Azjac Performance Seed • Ohio Seed Co. • Van Dyke Seed Co. • Kinder Seed, Inc. • J&M Seed Co. • Oseco, Inc.
<p>Anheuser-Busch</p> <p>US</p> <p>Major US brewery, food & beverage corporation</p>	<ul style="list-style-type: none"> • Busch Agricultural Resources

Ball Horticultural

US

- Pan American Seeds
 - Ball Seeds
 - ColorLink
 - Seed Technology
 - Linda Vista (Costa Rica)
 - Vegmo Plant (Netherlands)
-

Barenbrug Holding B.V.

The Netherlands

Barenbrug had 1997 revenues of approximately \$200 million.

The company is privately-held.

- Barenbrug Belgium
 - Barenbrug China RO
 - Barenbrug France
 - Barenbrug Holland BV
 - Barenbrug Luxembourg
 - Barenbrug Polska
 - Barenbrug South East
 - Barenbrug UK
 - Barenbrug US
 - Garfield Williamson, called Barenbrug North East
 - Barenbrug Production
 - Heritage Seeds Pty
 - Modern Forage Systems Inc
 - New Zealand Agriseeds
 - Palaversich y Cia (Argentina)
 - Cargill Seeds
-

Cargill

US

International seed business sold to Monsanto/AHP in 1998. US seed revenues estimated at just under \$100 million.

Cebeco-Handelsraad

The Netherlands

Cebeco Agricultural Seeds Group is a subsidiary of Cebeco-Handelsraad.

1997 seed revenues: \$225 million US

- Cebeco Saaten GMBH
 - Cebeco Seeds S.R.O.
 - Cebeco-Verneuil GMBH & Co. KG
 - Cebeco Zaden B.V.
 - International Seeds, Inc.
 - La Maison Des Gazons S.A.
 - N.V. Zaden Van Engelen S.A.
 - Oliver Seeds Ltd.
 - Proco Sem S.A.
 - Seed Innovations Ltd.
 - Wiboltt Fro A/S
-

Central Garden & Pet

US

A major lawn and garden supplier in the US, with sales of approximately \$830 million.

Pennington Seeds and seed subsidiaries are recent acquisition.

- Pennington Seeds
 - Seeds West
 - Bio-Plus
 - Mid-South Seeds
-

ConAgra

US

ConAgra is one of the world's largest food corporations.

- United AgriProducts
 - Helm Bean & Seed
-

Dow AgroSciences

US

Mycogen (Dow AgroSciences owns 69%) and subsidiaries had 1997 seed revenues of \$162 million.

Mycogen owns 35% of Verneuil, a French seed co with about \$80 million in sales.

- Mycogen (69%)
 - Agrigenetics
 - United Agriseeds
 - Morgan Seeds (Argentina)
 - Kelten & Lynks
 - Delta & Pine Land (corn & sorghum only)
 - Dinamilho Carol Productos (Brazil)
-

DuPont

US

In addition to its own breeding/biotech work, DuPont owns 20% of Pioneer Hi-Bred.

- 20% stake in Pioneer Hi-Bred Intl.
 - Hybrinvoa, S.A., France (hybrid wheat subsidiary)
-

George Ball Jr.

US

George Ball Jr. was spun off from Ball Horticultural and became a separate company.

- W. Atlee Burpee
-

Golden Harvest

US

Approximately \$75 million annual seed revenues, primarily maize and soybeans.

Goldkist

US

Goldkist is a major poultry integrator in the US.

Goldsmith Seeds

US

Largest flower seed business in the US.

Grupo Pulsar, Seminis, Empresas La Moderna

Mexico

A giant multinational conglomerate, Grupo Pulsar is owner of Empresas La Moderna (ELM).

ELM owns 62% of Seminis Inc., the remaining share is owned by George J. Ball Inc. (see separate listing).

1997 seed sales: approximately \$375 million.

- Agratech

- Resource Seeds

- Seminis Inc.
- Royal Sluis
- Petoseed
- Asgrow-Bruinisma
- Incotec International
- Genecorp
- Bionova
- DNA Plant Technology
- FreshWorld
- Nath Sluis (India)
- Hungnong Seed Co. (S. Korea)
- ChoongAng Seed Co. (S. Korea)

J.R. Simplot Co.

US

Privately-held agribusiness with total annual sales of \$2.8 billion.

Kleinwanzlebener Saatzucht AG (KWS)

Germany

KWS is largest supplier of sugar beet seed - with approximately 25% market share.

KWS seed revenues were US \$329 million in 1996/97.

- Agrar Consulting GMBH (DE)
- Betamag Vetomag KFT (Hungary)
- Betaseed Inc. (US)
- Cambridge Plant Breeders Twyford Ltd (UK)
- Great Lakes Hybrids Inc (US)
- Interagrarkooperation GMBH (DE)
- Intersaat AG (Germany)
- KWS Austria Saatzucht Gesellschaft MBH (Austria)
- KWS Benelux BV (NL)
- KWS Chile Ltda , KWS France SARL
- KWS Italia SPA, KWS Polska SPZOO
- KWS Seeds Inc (US)
- KWS Semena SRO (Slovakia)
- KWS Semences SARL (France)
- Lochow-Petkus France SARL
- Lochow-Petkus GmBH (Germany)
- Lochow-Petkus Polska SPZOO
- Mod Management Organisation Und Datenverarbeitung Consulting (DE)
- Pan Tohum Islah Ve Uretme AS (Turkey)
- Peragis Saatzucht Und Handels-Gesellschaft MBH (DE)
- Planta Angewandte Pflanzengenetik Und Biotechnologie GMBH (DE)
- Ragis Kartoffelzucht Und Handels-Gesellschaft MBH (DE)
- Razes Hybrides SARL (France)
- Saka-Ragis Pflanzenzucht GBR (DE)
- Semena AG (Switzerland)
- Semillas Seleccionadas De Remolacha SA (Spain)
- Societe Des Mais Europeens SARL (France)
- Intellicoat
- Fielder's Choice

Landec

US

- Intellicoat
 - Fielder's Choice
-

Limagrain

France

Limagrain is a French cooperative; the 4th largest seed company in the world.

World's largest vegetable seed company.

The company's 1997 seed revenues were \$686 million.

- Akin (US), Akin Callahan (US)
- Auvergne Creations (France)
- Belloy (France)
- Biocem (France), Biocem Lab. De Biologie Moleculaire (France), Biocem Lab. De technologies des semences (France)
- Biogemma (FR), Biogemma les Cezeaux (FR), Biogemma Toulouse (FR)
- Biotechnical/LG Seeds (US)
- Ble Or (France)
- Cave St. VERNY (France)
- Clause (UK), Clause Semences (France)
- Elidia (France)
- Ferry Morse (US)
- Harris Moran (US)
- GBC Jacquet (France), Jacquet Belgique (Belgium), Jacquet Cereales Technologies (France), Pain Jacquet (France)
- King Agro (Canada)
- Groupe Limagrain Holding (France), Cooperative Limagrain (France), Force Limagrain (France), Limagrain Canada Seeds (Canada), Limagrain Genetics Grandes Cultures (France), Limagrain Genetics Research (US), Semillas Limagrain de Chile
- M.C. Technologies (France)
- Maicentre (France)
- Mais Angevin (France)
- Meristem Therapeutics (France)
- Mu Laboratoire (France)
- Nickerson Biocem (UK), Nickerson International Research GIE (France) Nickerson SA (France), Nickerson Seeds (UK) Nickerson Zwaan Ltd. (UK)
- Oxadis (France)
- Progalim (France)
- Sapa/Dafa Associes (France)
- Selia (France)
- Suttons (UK)
- Tezier (France)
- ULICE (France)
- Valgrain (France)
- Vilmorin (France), Vilmorin & Cie (France), Vilmorin (US)
- Seeds of Change

M&M-Mars, Inc.

US

Food giant acquires small, organic New Mexico seed co.

Marubeni

Japan

- Agripro (except wheat)
- Helena Chemical Co.
- Hyperformer Seeds

Monsanto

American Home Products

US

Monsanto/American Home Products now ranks 2nd largest seed corporation in the world.

Estimated seed revenues exceeding \$1.3 billion.

- Asgrow (soybean & corn)
- Holden's Foundation
- Stoneville Pedigreed
- Jacob Hartz
- Hybritech
- Calgene
- Plant Genetics Inc.
- Ameri-Can Pedigreed
- AgriPro (wheat only)
- Monsoy (Brazil)
- First Line Seeds (Canada)
- Plant Breeding Intl. (UK)
- Forage Genetics Inc. (collaborative agreement)
- Agroceres (Brazil)
- Dekalb Genetics (US)
- Custom Farm Seed
- Delta & Pine Land
- Ellis Brothers Seed
- Arizona Processing
- Mississippi Seed Co.
- Hartz Cotton
- Sure Grow Seeds
- CDM Mandiyu
- Cargill's international seed division

Mycogen and J.G. Boswell

US

See Mycogen under Dow Agrosiences.) Phytogen had international 1997 cotton seed sales of approx. \$9 million.

- Phytogen (Mycogen owns 51%, Boswell owns 49%).
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Novartis

Switzerland

Swiss giants Sandoz and Ciba-Geigy merged in 1996 creating Novartis. With 1997 sales of (US) \$928 million, Novartis is world's third largest seed company.

- Northup King
 - Rogers NK Seed, Rogers Seed Co.
 - Sluis & Groot (S&G)
 - Funk Seeds Intl.
 - Vaughn Seeds
 - Gallatin Valley
 - Hilleshog
 - Sturdy Grow Hybrids
-

Pickseed Group

Canada

- Pickseed Canada Inc., Pickseed West, Inc. (US)
 - Mapleseed Inc. (Canada)
 - Robert's Seed Co. (US)
-

Pioneer Hi-Bred Intl.

US

World's largest seed company, 1996 sales of \$1.7 billion. DuPont owns 20% of Pioneer.

Operates on every crop producing continent. Markets hybrid maize in nearly 100 countries worldwide (also sorghum, sunflower, soybean, alfalfa, canola, wheat).

Sakata Seed Corp.

Japan

Ranks 8th largest seed company in the world.
1996/97 annual sales (US) \$349 million.

- Agroflore SA (Brazil)
 - Chung Won Seed Co. Ltd. (South Korea)
 - Sakata Centraamerica SA (Costa Rica), Sakata de Mexico, SA, Sakata Seed do Brasil Ltda, Sakata Seed Chile SA, Sakata Seed Europe BV (NL), Sakata Seed France SARL, Sakata Seed Iberica SL (ES), Sakata Seed New Zealand Ltd, Sakata Siam Seed Co. Ltd. (Thailand)
 - Samuel Yates (UK)
-

Svalof Weibull AB

Sweden

1997 seed revenues \$150 million (US)

- DNA Landmarks Inc. (Canada)
 - Newfield Seeds Co. Ltd. (Canada)
 - Plantevolution AB (Sweden)
 - Riding Valley Agro Ltd. (Canada)
 - Saatzucht Hadanersleben GmbH (Germany)
 - Semundo Ltd. (UK), Semundo Italia SRL (Italy), Semundo Saatzucht GmbH (Germany)
 - Sursem S.A. (Argentina)
 - Svalof Weibull Seed Ltd. (Canada), Svalof Weibull B.V. (NL), Svalof Weibull Havefro A/S (DK), Svalof Weibull Semillas SL (ES), Svalof Weibull Semundo SARL (FR), Svalof Weibull SIA (LV), Svalof Weibull Torv (SE), Svalof Weibull Tradgard AB (SE)
 - Svenska Cereallaboratoriet AB (Sweden)
 - Wheat City Seeds Ltd. (Canada)
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Takii & Co.

Japan

Privately-held. Ranks 10th largest seed company in the world with estimated 1997 seed sales of (US) \$300 million.

- American Takii
 - Takii Europe (NL)
 - Takii Research France
-



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