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RHÔNE-POULENC AGROCHIMIE: AN UNCERTAIN FUTURE

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Compared with other world agrochemical leaders, Rhône-Poulenc Agro (RPA) was characterized by a focus on its core business: crop protection. In order to reinforce its research capabilities while focusing on its core competencies, RPA developed numerous strategic alliances, like its alliance with Genoplante, the French public/private platform in plant genomics. However, the merger with AgrEvo which created Aventis CropScience, and the announced divestment by its mother company Aventis, has since increased the uncertainty of many key industrial and research and development (R&D) projects that it was formerly engaged in.

Key Words: crop protection strategy; plant biotechnology; genomics; industrial restructuring; Rhône-Poulenc Agro (RPA).

In 1998, Rhône-Poulenc Agro (RPA) was part of the Rhône-Poulenc Corporation (RP) which included two main divisions: (1) its life sciences division consisting of human, plant, and animal health, respectively; and (2) its Rhodia subsidiary which produced specialty chemicals. In the past few years, Rhône-Poulenc underwent important transformations. It divested its Rhodia subsidiary by placing it on the Paris stock market. The divestment was completed in two steps—32% was divested in 1998, the rest following in 1999. A major reason for this divestment was financial—the high level of debt of RP was considered a hurdle for further investment in its pharmaceutical, agricultural, and agrochemical activities. The restructuring was also a significant step in RP's strategy of refocusing on the life sciences.

As a major player in biotechnology and agrochemicals, Rhône-Poulenc described itself as a "life sciences company" with two main business focuses. The company had developed a human health focus, built around Pasteur Merieux Connaught, Rhône-Poulenc Rorer, and Centeon (a joint-venture with Hoechst). Its other business focus was in plant and animal health, which included three main companies—Rhône-Poulenc Agro, Rhône-Poulenc Animal Nutrition, and Merial (a 50/50 joint-venture with Merck).

In 1999, Rhône-Poulenc merged with the German pharmaceutical corporation Hoechst. As a result, RPA and AgrEvo[1] formed Aventis CropScience. In November 2000, Aventis' top managers announced their decision to divest Aventis CropScience. This case study focuses on RPA's innovation strategy before the creation of Aventis. Because of this, the past tense is used in the description and analysis of Rhône-Poulenc Agro. Although RPA does not exist any more as a single entity, the history of RPA is important in understanding the evolution of the agrochemical industry and plant biotechnology in Europe.

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Rhône-Poulenc Agro: A Competitive Company In Agrochemicals

In 1998, RPA represented 20% of Rhône-Poulenc's total turnover, while its contribution to operating profits was 45%. Despite such a contribution, in recent years the intensity of its R&D activity had decreased slightly. As a percentage of total R&D expenditures it had dropped from 6.85% in 1995 to 6.39% in 1998.

Table 1: RPA Sales and R&D Investment (Million Euro).

	1995	1996	1997	1998
Turnover	2,660	2,970	2,970	2,620
Operating Profit	290	380	470	540
R&D Expenditures	180	200	200	160
(& as a % of sales)	(6.85)	(6.66)	(6.66)	(6.39)

Note. From "Rhône-Poulenc Agro Annual Reports," by RPA, 1996 – 1999. Lyon, France: RPA.

Rhône-Poulenc Agro's product portfolio was a mix of established products (20 to 30 years old) and newer products, with annual growth in sales of established products being much slower than those of newly launched products. For example, sales of established products grew about 8% between 1997 and 1998, compared to 73% for those at the launch stage.

Table 2: RPA Key Plant Protection Product Sales (Million Euro).

Key Products	1997	1998
Established Products		
Temik (Insecticide)	170.1	178.3
HBN (Herbicide)	137.0	159.7
Iprodione (Fungicide)	121.0	126.0
Total	**428.1**	**464.0**
New Products		
Regent (Insecticide)	76.2	121.8
Fosetyl (Fungicide)	83.0	100.6
Balance (Herbicide)	5.6	62.8
Total	**164.8**	**285.2**

Note. From "Rhône-Poulenc Agro Annual Reports," by RPA, 1998 – 1999. Lyon, France: RPA.

As with most agrochemical companies, RPA was an international business. Forty-three percent of its turnover occurred in Europe, while the United States (US) accounted for 30%, and the rest-of-the-world (ROW) accounted for 25%. In terms of its world ranking (on the basis of its products) RPA was in the middle of the pack. It was a world leader in the market for growth regulators, but in the most important world market, that of herbicides, it ranked ninth—some distance from

the industry leaders. In the insecticide market, RPA occupied third place, although it had the potential to improve on this position with its new product called Regent. Its position in the fungicide market had been stable for some time—ranked fourth.

Table 3: RPA Plant Protection Products Per Category (% of Total Sales).

Type of Product	1994	1998	World Ranking
Herbicides	41.6	39.5	9
Insecticides	25.7	31.5	3
Fungicides	20.8	20.9	4
Growth Regulators	11.9	8.1	1

Note. From "Rhône-Poulenc Agro Annual Reports," by RPA, 1995, 1999. Lyon, France: RPA.

Developing A World Crop Protection Company Through Combining Chemistry And Biotechnology

Alain Godard, CEO of Rhône-Poulenc Plant and Animal Health, declared in 1991,

> The future of crop protection passes through the combination of innovative chemistry with [different] biotechnologies…Rhône-Poulenc's strategy consists [of] focusing on innovation and investing in the development of genes that provide a clear competitive advantage. (Rhône-Poulenc Agro [RPA], 1992).

Indeed, an important difference between RPA and other agrochemical companies was that it continued to consider crop protection as its core activity. As a result, in 1994 it sold off its seeds subsidiary and developed a global partnership with Limagrain instead. Plant biotechnology was seen as a knowledge tool for improving the process of discovery of new molecules for plant protection, and an a means of finding desirable agronomic traits for major crops.

The Building Blocks of the Chemical Innovation Dynamic

Prior to its merger with AgrEvo, top RPA managers had identified what they considered to be "good" crop protection products,

> Good [crop protection] products [should be designed] for large markets: fungicides for cereals, herbicides for maize. We [can not] develop…product[s] for strawberries or raspberries, [because they are] too costly. We need profitable market[s] [in order to generate a return on our investment and payback] the development cost [of these products which are] about 50 million US$. R&D projects have to be cheap, [resultant] product[s] should not [leave any] remnant [or residues] in [the] soil and [should] be very efficient.
>
> In terms of [our] crop profile, the major changes [that will occur] within the next 5 years will happen in corn, soybean and cereals, where we still have gaps. We are not as strong as we would like: a new product is to be launched in the US corn market. In terms of [our] product portfolio, we have a quite diversified one. Our market share will grow in herbicides (1 new compound) and insecticides (1 new compound) and decrease in fungicides. In the seed business, GMO

> (genetically modified organism) [sales] will take place within Europe 5 [or more] years [from now]. (RPA, personal communication, 1999).

As this quote indicates, the company's innovation priorities were fully focused on the major industrial crops and their complementary chemical products. The company clearly wanted to increase market share in the agrochemical markets (i.e., in herbicides and insecticides). Minor crops, such as strawberries and raspberries, were not targets for RPA.

Rhône-Poulenc Agro Research Centers And R&D Activity

Rhône-Poulenc Agro, before its merger with AgrEvo, had five main research centers dispersed across Europe and the rest-of-the-world. In Lyon, France RPA's research capability focused on fungicides, food residues, product chemistry, biotechnology (specializing in herbicide tolerance genes), product formulation (specific to the European region), and bio-availability. In Antibes, France the focus was on human and environmental safety. At Ongar in the United Kingdom (UK), research was being conducted into herbicides and the environmental impact of pesticides. In addition to these European research centers, Rhône-Poulenc Agro was also located at Research Triangle Park in the United States and conducted research on insecticides, water monitoring, regulation, and product formulations for the North American market. In Akeno-Ami, Japan Rhône-Poulenc Agro was building expertise in rice protection products, regulation, and product formulations for Asian markets.

Breakthrough Active Ingredients

Agrochemical companies like Rhône-Poulenc screen more than 100,000 molecules per year in order to find viable products. Only a few molecules exhibit any kind of interesting activity. Once promising molecules are identified, they take a further two years in the evaluation stage. Field trials at experimental farms are used to define the profile, efficacy, safety, leaching, and early toxicity and eco-toxicity assessments. Total development expenditures average about US$50 million in investment per product. In RPA's case, a committee of company executives made the important investment decisions regarding product development because of the high cost and potential riskiness of such investments.

At the time of interviews, two products were considered by Rhône-Poulenc Agro to be blockbusters—Regent (or fipronil) and Balance (isoxaflutole). The company estimated that the two products would contribute approximately US$1 billion to sales by the year 2003. In the pipeline for 2001-2006 were also 5 new crop protection products based upon additional innovative compounds.

The Association of Existing Molecules

Another important source of innovation for RPA came from regenerated products derived from existing active ingredients in the company's and related companies' portfolios. Exercising this option allowed RPA to respond to country-specific requests by regenerating the range and optimizing the use of new compounds with existing ones. Such products can be developed more quickly and the registration procedure is usually less complex (as it is based on existing compounds that have already gone through the national regulatory process). This is often used as an alternative means of expanding product lines when breakthrough molecules are missing. Uncertainty introduced into the marketing schedule of some genetically modified (GM) crop varieties may have inhibited the development of new active ingredients in companies like RPA. As a result, linking existing active ingredients with new product developments represented a technical and commercial solution which allowed it to still compete in the chemical market.

Formulation and Packaging Innovations

Rhône-Poulenc Agro also engaged in reformulation and repackaging strategies. In creating new formulations and new packages there were two very different concerns. The first concern was marketing oriented—finding new packaging that was both innovative and attractive. One interviewee said, "There was often disappointment with this approach because there was no great revolution in terms of product presentation." A major trend in the industry had been to develop wettable granules or soluble sachets in order to meet the demand for recyclable packaging. Protecting intellectual property embodied in innovative repackaging strategies like these was a serious problem for the company because such packaging was easily copied. This tended to inhibit real packaging innovations.

The second concern was that new formulations often attempted to fulfill different objectives: (1) To reach a specific target price by reducing the doses of active ingredients; or (2) to meet evolving regulations which addressed water contamination, or which addressed user protection, for instance. Nevertheless, such innovations have been a major objective of RPA over the last twenty years.

Accelerating the Discovery Process

As part of its strategy to enlarge its product line, RPA invested in and developed new research methods. Two programs called "New Approaches" and "High-Throughput Screening" became operational in 1998. These programs enable increased screening capacities in its various research centers while targeting molecules that had positive plant-health action at very low concentrations. Rhône-Poulenc Agro also developed a predictive methodology for the early assessment of a molecule's toxic and eco-toxic profiles.

In addition to developing its own innovative research methods, Rhône-Poulenc Agro strengthened its potential to innovate through partnerships and alliances with public institutions and private laboratories which were recognized for their cutting-edge technologies and innovative capacity. The life science sector had been in a state of fast and ongoing change since the mid-nineties. For this reason, it was vital for RPA to have access to the most advanced technologies. Such research alliances were part of this strategy.

Rhône-Poulenc Agro's goals immediately prior to its merger reflect this strategy and were as follows,

- To enhance scientific knowledge, particularly in emerging technologies; and
- To accelerate the development process through the acquisition or pooling of research techniques.

In addition, the Scientific Affairs Department had organized different strategy and innovation working groups. These groups, which included Rhône-Poulenc researchers and outside consultants, identified the usefulness of common life science platforms in order to,

- Access a diverse range of compounds, develop combinatorial chemistry methods, and enable primary screening methods in order to detect *in vitro* activity; and
- To discover new biological targets through the coordination of functional genomics and bioinformatics technologies.

Innovation Strategy in Plant Biotechnology

By 1998, 15% of the Rhône-Poulenc Agro R&D budget was devoted to agricultural biotechnology research, or approximately 25 million Euro. This was a 25 percent increase over its

1996 budget of 20.5 million Euro. The biotechnology division worked mainly on the valorization of agronomic genes. The company saw itself as a pioneer in the field of herbicide tolerance, with the first genetically modified organism (GMO) (bromoxynil-resistant tobacco) being approved in France in 1994. Its first large industrial GM crop was herbicide (bromoxynil) tolerant cotton introduced in the US in 1995.

Rhône-Poulenc Agro set up its first molecular and cellular plant biology laboratory in Lyon in 1984, reinforced by a joint laboratory between Rhône-Poulenc Agro and the Centre National de la Recherche Scientifique (CNRS) in 1986. In 1994 it created, together with Limagrain, a joint economic structure for plant biotechnology (Groupement d'Intérêt Economique). In this way, Rhône-Poulenc Agro had built a patent portfolio of more than 40 patents mainly in the field of herbicide tolerance (in oxynils, isoxazoles, asulam, glyphosate, and so on) and also in plant disease resistance genes, quality genes (fatty acid composition) and genetic engineering technologies.

In a 1999 communication (RPA, 1999), Rhône-Poulenc Agro commented that its alliance strategy was a key element of its success in the field of biotechnology,

> Based on technological innovation, RPA['s] strategy in this field follows a logic of alliances…In 1998, RP signed several major partnership agreements… [to allow a] presen[ce] in all the stages of the creation of a genetically modified variety, from [the initial] genome study [to] the delivery to the seed producer, through [to] the "mother-plant." This strategy should allow RPA to have in 2006 15% (or US$ 400 million) of its sales based on products derived from biotechnologies.

This prediction was based on a number of factors—its existing patent portfolio in herbicide tolerance, the programs developed between Biogemma and Rhobio on disease resistance, and from access to insect *Bacillus thuringiensis* (Bt) resistance genes through third parties. The predicted sales of US$ 400 million should be compared with Rhône-Poulenc Agro's own estimation of the future world market for biotechnology-derived crop protection by 2005—which it estimated at US$ 5 billion, out of a total crop protection market of US$ 35 billion.

<u>Rhobio</u>

The main biotechnology research activities for industrial crops (maize, wheat, sunflower, rape seed) were shared between RPA and Biogemma, a biotechnology platform of French seed companies within a 50/50 joint venture called Rhobio. The joint research program had the following research priorities,

- To expand disease plant resistance programs.
- To continue development of genetic engineering technologies.
- To continue development of industrial crop genome analysis technologies (such as, gene expression and plant transformation technologies).

Rhobio had some 100 researchers, located in the two shareholders' research labs. They worked on generic technologies that could be applied to plant disease resistance and plant genomics. In addition, there was a separate Rhobio laboratory at Evry near Paris, with 22 researchers. In March 1998, Rhobio signed an agreement with the US company, Celera Aggen, to discover maize genes associated with agronomic and quality traits of interest. Rhône-Poulenc Agro hoped to benefit from the research program that had already identified an insect resistance gene and three new genes for herbicide tolerance in several crops.

Genoplante

Genoplante is a national program which is open to other European partners, and is oriented towards plant genomics. It involves public research actors, such as, INRA, CNRS, CIRAD (Centre International de Recherche en Agronomie et Développement), IRD (Institut de Recherche sur le Développement); and private companies such as, Rhône-Poulenc Plant and Animal Health, Biogemma, and BioPlante. Its goal is to accumulate new knowledge about the main crops cultivated in Europe and to discover agronomic and quality genes of interest. Genoplante is supposed to allow France (and also Europe) to preserve its independence in relation to the large American and Japanese genomics programs. Clearly, RPA has been a major beneficiary of the Genoplante government initiative, which is an expression of public support for plant biotechnology.

Strategy And Visions For The Future Of Crop Protection

The company profile of RPA prior to its merger can be characterized as follows,

- It was strong in its crop protection innovation, marketing, and industrial strategies.
- It was modestly engaged in biotechnology through external ties to Biogemma and Rhobio.
- It had a medium ranking among the top ten agrochemical companies worldwide. Its major weakness was in herbicides.
- It had a strong position both in Europe and the US in the pesticide markets.

Significant organizational initiatives were carried out to make the company more flexible, more decentralized, and more transversal in terms of market knowledge and information gathering for decision making processes. The strongly decentralized style of the company structure was considered an internal protection system for dealing with the complexity of quality and regulatory standards needed to be addressed all along the production chain. Despite this, decision making processes were still relatively centralized and top-down.

Policy signals which were taken into account by the company mainly concerned crop protection regulation (i.e., in regard to pesticides and GMOs) rather than economic signals, such as the Common Agricultural Policy (CAP) reforms. Policy signals worked like a green-red light for the company. A conditional green light from regulators allowed the company to transform a research project into a product development decision, to get the product approved, and to develop its regulatory profile—i.e., its eco-toxic and toxic characteristics. If a potential product was considered high risk from a regulatory standpoint, the decision was a "no-go" and the research project did not proceed to the product development phase. Other green lights that a potential product had to receive relate to economic and market factors—the product had to be profitable in the major European agricultural markets.

According to the top managers interviewed for this study, European Union policies and directives needed to be clearly separated from societal concerns and pressures. The interaction between these two dimensions was considered a source of high uncertainty for managers and for the development of future products which utilize chemicals and transgenes. Several types of unforeseeable interactions or influences induced the strategic uncertainty concerning medium and long-term R&D decisions. Societal concern about GMOs raised the following questions for the company,

- How will public concerns influence public policies?
- How can the industry effectively participate in the elaboration of such public policies. Is the current context favorable to such participation?

- What kind of reaction may be expected from the major competing stakeholders, may be provoked by rising public concerns about crop protection products, and by changing policy processes?

Another level of major uncertainty for the company was the impact of GM crops on the evolution of plant protection markets in Europe. In addition, European uncertainty about the future of GM crops made it difficult for the company to build projections about its traditional pesticide market.

Conclusion

At the time of this study, RPA and AgrEvo were at the stage of merging to form Aventis Crop Science. A significant change for RPA from the merger will be the establishment of a seed division (CINT) within the new company to integrate AgrEvo's seed activities. Also, the R&D budget devoted to plant biotechnology is scheduled to increase significantly, from 16% of the total R&D budget at the time of the merger to 26% within 3 years.

Existing alliances between RPA and research partners like Limagrain and Genoplante are to be maintained. Nevertheless, the new focus of Aventis on seeds and GMOs is perceived as a threat by Limagrain. Whereas the strategy of RPA was complementary to that of Limagrain (thus, favoring the stability of the partnership) Aventis can be considered as a potential competitor in the seed market. The current uncertain future of Aventis CropScience as an independent company reinforces these concerns. Likewise, its formation weakens the French plant genomics strategy based on the creation of Genoplante, a public/private research platform.

Endnotes

[1] The agrochemical subsidiary of Hoechst (see also AgrEvo casestudy in this issue).

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