

BAYER AG – CHEMICALS AND LIFE SCIENCES

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Bayer AG is a global pharmaceuticals, chemicals, and life sciences group. Its structure reflects important synergies based on core competencies within the field of chemistry. A number of research collaborations and joint ventures serve to expand this platform into agricultural biotechnology, which is expected to play a much more important role in the future, complementing rather than simply substituting for agrochemical crop protection.

Key Words: innovation; pesticides; plant biotechnology; seed dressing.

Bayer AG is an international chemicals and health care group with major businesses in life sciences, polymers, and specialty chemicals. After its foundation in Germany in 1863, the company soon established itself internationally. Bayer is now active in 150 countries throughout the world. It employs approximately 120,000 people and controls some 350 companies. The group's business activities are mainly concentrated in Europe, North America, and the Far East. It is still headquartered in Germany (in Leverkusen), and its largest production facilities are also located in this country. The group is present in all parts of the world, however, its largest subsidiary is the Bayer Corporation located in the United States (US) which employs about 23,000 employees at more than 50 different locations. Bayer intends to expand into Asia, first of all into China and Thailand, and then consolidate the company's position in Japan. It also plans to consolidate operations in Latin America.

Bayer's Agriculture Division in the US—the Crop Protection group—has been leading in the development of crop protection products for the cotton market since the early 1950s. In Latin America, Bayer produces crop protection products in Mexico, Guatemala, Colombia, and Brazil. Crop protection is also dominant in Bayer's activities in Africa.

Structure And Position

It would be misleading to think of Bayer as a specialized agrochemical company. The group is also a major supplier of chemicals for industrial purposes, and like AstraZeneca is an important producer of pharmaceuticals.

Bayer's operations are organized into four business segments: health care, agriculture, polymers, and chemicals—each segment consisting of a number of business groups as indicated in table 1. For 2000, the sales of the four business segments totaled 29.2 billion Euro. In comparison, the sales of the Crop Protection Business Group amounted to 2.5 billion Euro—or 8.5 percent of total sales (Bayer, 2000).

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Table 1: The Organizational Structure of Bayer AG.

Business Segment	Business Groups
Health Care	Pharmaceuticals; Consumer Care; Diagnostics
Agriculture	Crop Protection; Animal Health
Polymers	Plastics; Rubber; Polyurethanes; Coatings and Colorants; Fibers
Chemicals	Basic and Fine Chemicals; Specialty Products; Haarmann & Reimer; H.C.Stark; Wolff Walsrode

Note. From “Bayer Annual Report 2000,” by Bayer AG, 2000, p. 13. Leverkusen, Germany: Bayer. Available on the World Wide Web: <http://www.bayer.de/geschaeftsbericht2000/eng/index.html>.

The relative size of the four groups is shown in table 2 below. The table brings out quite clearly that the health care and polymers segments contribute substantially more, both in terms of turnover and profits, than the agriculture segment. Crop protection is by far the most important business group within the agriculture segment, however. The animal health group seems to benefit from synergies with pharmaceuticals, as well as from internal “spillovers” within the agriculture segment. Table 2 also reveals the allocation of research and development (R&D) funding among the various segments. As one might expect, the health care segment is by far the largest spender, both in terms of money and relative to sales.

Table 2: Relative Contributions of the Four Business Segments (Percentages).

Business Segment	Sales (2000)	Operating Results (2000)	Total R&D Spending (2000)	Total R&D Spending (1999)
Health Care	34	41	63	61
Agriculture	12	15	17	19
Polymers	39	31	13	13
Chemicals	15	12	7	7
Total	100	100	100	100

Note. From “Bayer Annual Report 2000,” by Bayer AG, 2000, p. 13. Leverkusen, Germany: Bayer. Available on the World Wide Web: <http://www.bayer.de/geschaeftsbericht2000/eng/index.html>.

Compared to its competitors, the agriculture segment of Bayer is quite research intensive as well. Within this segment alone some 400 million Euro¹ was spent on R&D during 2000. For a number of years, R&D spending within this segment has amounted to some 12 percent of sales, somewhat above the average for agrochemical companies. Like other major players in this sector, Bayer employs high-throughput screening technologies, gene expression analysis, and other enabling technologies to appropriately target its R&D.

In Japan, research and development focuses on the life sciences, which include health care and agriculture. The life science business segment accounts for more than half of the Bayer Group’s revenues within the country, and constitutes a major part of Bayer’s activities in Japan. In 1995, Bayer completed construction of its pharmaceutical research center in Kansai Science City—a facility designed to establish the company’s pharmaceutical-related R&D activities in Japan. The

crop protection research center in Yuki has already proven itself to be a successful global contributor to research and development of agrochemical products. These two facilities are expected to make further important innovations in the life sciences area.

Bayer AG has concluded a five-year research agreement with Heidelberg-based LION Bioscience AG in the life science fields of pharmaceuticals and diagnostics. The objective is to make more efficient use of leading-edge genomics and information technologies to identify and develop innovative drugs and diagnostic markers. This is expected to accelerate the pace of research considerably and enhance product development. In the field of genome analysis of insect pests, fungal diseases, and weeds, Bayer cooperates with United States-based Exelixis on the development of selective insecticides, and with Paradigm Genetics on genetic codes in weeds. In Germany, Bayer cooperates with LION Bioscience in fungicides research. Within the pharmaceutical industry, a comprehensive research partnership with the American biotechnology company Millenium Pharmaceuticals was concluded in 1998.

In 1999, Agfa (formerly the fifth business segment of Bayer) was spun off from Bayer AG. Yet, despite the divestment of Agfa, Bayer AG remains a large and highly diversified corporation, covering a very broad range of business areas. The common denominator of these activities is chemicals, reflecting the company's history as a chemical enterprise. It has core competencies within chemicals and is clearly a technology leader in agrochemicals. Research collaborations, such as those mentioned above, serve to establish a technological basis within biotechnology.

The Path Into The Future

In recent years, crop protection markets have been stagnant. Bayer has responded to this tendency by acquiring product lines from competing suppliers. For example, a corn herbicide (MIKADO) was acquired from Syngenta earlier this year.

Bayer expects agrochemicals to continue to play an important role in crop protection, however. The group expects a further rapid growth of world population (with another 83 million people being added every year), an increasing demand for higher quality food, and a decline in the availability of arable land which will necessitate productivity increases of about 2-3% a year in order to avoid food shortages. At present, productivity in food production is estimated to grow by around 1.5% annually (Bayer AG, 1998). Bayer therefore sees an important business opportunity and mission for itself in helping feed the world.

In Bayer's opinion, a broad range of advanced technologies must be orchestrated according to the principles of integrated crop management in order to resolve the dilemma of accelerating productivity growth and intensifying food production on a sustainable basis. These technologies include satellite-based monitoring of crops and fields, genetic modification, and agrochemicals.

While acknowledging that to some extent biotechnology and agrochemical crop protection represent competing technological paradigms, Bayer does not expect green biotechnology to simply take over the role of agrochemicals. For some years, the group has had a team look at how biotechnology may develop through to the year 2010. The present popular anxiety about biotechnology, especially in Europe and Japan, is expected to fade over the coming years. Two reasons were given for this. First, it was argued that a major breakthrough in pharmaceutical biotechnology, for instance, in the treatment of cancer or other serious diseases, could reduce the widespread skepticism about biotechnology in other areas as well as among the general public. Thus, "red" (i.e., medical) biotechnology could pave the way for "green" (i.e., agricultural) biotechnology.

Second, while focus had been on input-trait biotechnology up until now, benefiting the farmer but not the consumer, a shift towards output-trait biotechnology could bring very substantial benefits to consumers in terms of higher quality food products. The possibility of producing healthier

food, for instance by reducing cholesterol problems is one such example. This ought to have a favorable impact on consumer acceptance. Bayer was convinced, therefore, that agricultural biotechnology will have a significant role to play in the future.

Green biotechnology is not seen as an unequivocal threat to agrochemistry, however. In important respects, biotechnological and agrochemical plant protection are expected to be complementary solutions. This has been the case with input-trait biotechnology, such as the development of herbicide-resistant crops. Certainly, input-trait technology may have reduced the quantity of herbicides applied, but without herbicides the technology would not have made any sense at all. Bayer anticipates rather different forms of interaction between chemical and biotechnological crop protection in the future, however. For example, Bt-cotton may be protected chemically against some early season pests at a highly vulnerable stage of the growth process.

Moreover, it is expected that with a higher added value of seeds, the need for crop protection will also increase. Although biotechnology (input traits) can to some extent replace chemical crop protection, experience suggests that there is still an important role for chemical substances to play. One interviewee added that the price of seeds might even double, which would give farmers a stronger economic incentive to protect their seeds.

In an interview with leading Bayer representatives, three possible strategic elements were discussed,

- Whether Bayer would invest in classical agrochemicals.
- Whether Bayer would invest in input-trait biotechnology.
- Whether Bayer would invest in output-trait biotechnology.

Bayer expects the focus in biotechnology research to shift towards output-trait biotechnology, that is, biotechnology used to improve the characteristics and, hence, the quality of the final product. Bayer itself intends to invest mainly in the agrochemical area but use biotechnology to develop new so-called lead structures or “modes of action.” Lead structures are classes of chemicals (e.g., Zuzuki herbicides) with a broad range of applications.

The decision to stay in agrochemicals was based on the long-term market forecasts referred to above, suggesting that agrochemicals will continue to play an important role in crop protection. Also, interesting new products coming out of Bayer’s pipeline, and the fact that neither fungicides nor herbicides are seriously threatened by competitive solutions, count in favor of the decision to stay in agrochemicals. In practice, the strategy of using biotechnology in the development of new lead structures has given rise to new joint ventures, as explained above.

Seed dressing is a key element of Bayer’s crop protection strategy. By coating seeds with, say, insecticides (rather than spreading the insecticide on the field), much smaller doses can be applied with much less harmful side effects. For example, seeds dressed with Gaucho (an insecticide) have a number of advantages over conventional insecticide methods,

- The farmer buys seed that has already been protected; he/she saves a lot of work and does not have to apply crop protection products separately.
- The consumer can be confident that there are no residues left in the crop when it is harvested.
- The environment is protected because only tiny amounts of the active substance are used, and they are delivered directly on the location in which they are needed to protect the crop. (Bayer AG, 1997, pp. 77-78).

The seed dressing technology is seen as highly promising, producing substantial gains not only for producers and consumers but for the environment as well.

Conclusions

Bayer AG, unlike AgrEvo, remains committed to its core competencies within agrochemicals, expecting green biotechnology and chemical crop protection to coexist in the future. This is seen as a necessary precondition for the food productivity growth required to feed a growing world population in an environmentally responsible way. However, Bayer's interest in seed dressing technologies is based on the assumption that biotechnology will increasingly replace agrochemicals as a vehicle for crop protection. In addition, Bayer anticipates that environmental pressure to reduce the volume of pesticides applied to agricultural crops will continue and may even increase in the future. As a result, Bayer's traditional core business area in agrochemicals is liable to come under increasing pressure. While the seed dressing technology is an obvious response to this threat, it is one that inevitably makes Bayer dependent on complementary competencies within biotechnology and seeds. Against this background, the recent acquisition of Aventis in 2001 seems quite logical since it internalizes competencies within these fields.

Bayer's own future lies in the field of agrochemicals, however, and the company does not see a future for itself as a seed producing company. Its strategy of focusing on seed dressing requires close cooperation with seed producing companies, which would be hard to reconcile with the competitive relationship that would emerge, should Bayer decide to become a seed producing company.

Endnotes

¹ 100 Euro is approximately 85 US\$ at current exchange rates.

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