



Bayer CropScience



What Research and Innovation can do for Industry

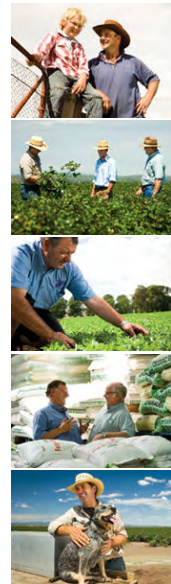
Rob Hall - General Manager BioScience Australia

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Bayer: Science For A Better Life

Agenda

- Research & Innovation in Agriculture
- Bayer's Capacity for Research & Innovation
- Research, Innovation & the New Agricultural Economy



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The long-term capacity of Australian agriculture to compete and succeed internationally will be determined by the ability of Australian farmers to recognise changing consumer preferences, adopt new technologies and production practices and maintain the sustainability of their operations by protecting their production environment.

To do this they need to be knowledgeable about the forces shaping international trade policy in key markets, the issues behind consumer sentiment and the technological advances being made by producers in other countries. They need to be able to digest this information and then use it to make rational management decisions, which position their farming enterprises to benefit from international opportunities as they arise. (source –Nuffield website .au)

Does this sound familiar???It's a message from the Message from the Nuffield Australia Farming Scholars Chairman....David Brown Hill

Now let's contrast this to a message from Prof. Dr. Dr. h.c. Friedrich Berschauer - Chairman of the Board of Management, Bayer CropScience AG.

Today, agriculture is about more than just producing food for a steadily growing world population. It also preserves landscapes and contributes to rural development. If our harvests are to produce food of high quality and sufficient quantity without harming environmental resources such as soil, water and air, they need to be protected from pests, weeds and disease. Bayer CropScience develops high-quality seeds and intelligent, environmentally sensitive solutions for protecting plants – all the way from seed to harvest. Our scientists are leveraging the latest crop protection research for tomorrow's marketplace. With the goal of finding even better solutions – for richer harvests all over the world. – Securing Harvests – Protecting Nature.

(source <http://www.bayer.com/en/Bayer-Mission-Statement.pdf>)



Research is a human activity based on intellectual investigation and is aimed at discovering, interpreting, and revising human knowledge on different aspects of the world. Research can use the **scientific method**, but need not do so (scientific method consists of the collection of data through observation and experimentation, and the formulation and testing of hypotheses).

The classic definitions of **innovation** include:

the act of introducing something new: something newly introduced the introduction of something new.

a new idea, method or device.

the successful exploitation of new ideas .

change that creates a new dimension of performance [Peter Drucker](#)

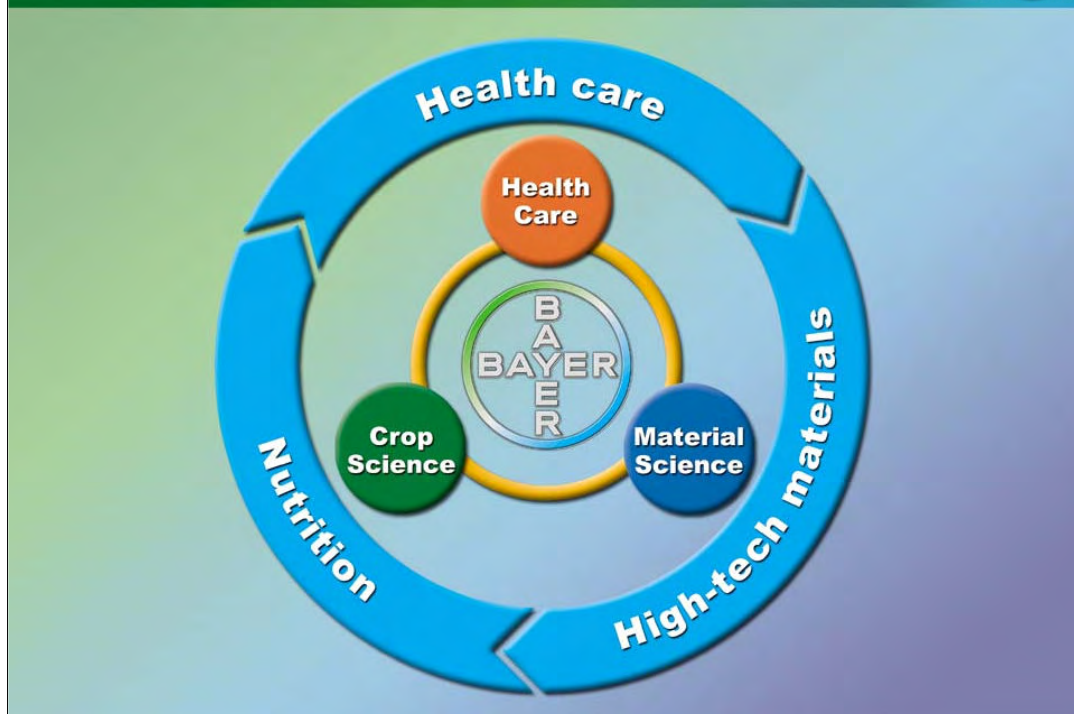
the process of making improvements by introducing something new.

In **economics**, **business** and **government policy**,- something new - must be substantially different, not an insignificant change. In economics the change must increase value, customer value, or producer value. Innovations are intended to make someone better off, and the succession of many innovations grows the whole economy. (Source –Wikipedia.com)

Research & Innovation have occurred in Agriculture for at least 10,000 years undergoing significant developments since the time of the earliest cultivation. Evidence points to the **Fertile Crescent** of the Middle East as the site of the earliest planned sowing and harvesting of plants that had previously been gathered in the wild. Independent development of agriculture occurred in northern and southern **China, Africa's Sahel, New Guinea** and several regions of the **Americas**. **Agricultural practices** such as **irrigation, crop rotation, fertilizers**, and **pesticides** were developed long ago but have made great strides in the past century. The Haber-Bosch method for synthesizing **ammonium nitrate** represented a major breakthrough and allowed crop yields to overcome previous constraints. In the past century agriculture has been characterized by enhanced productivity, the substitution of **labor** for **mechanization, synthetic fertilizers** and **crop protectants, selective breeding**, and of course **Biotechnology**.

Summary

In summary the main advances in agriculture have been termed revolutions, these include the **Neolithic Revolution; Muslim Agricultural Revolution; British Agricultural Revolution; Green Revolution** and today we are on the cusp of the new Agricultural economy (but more about that later). (Source –Wikipedia.com)



“At Bayer we have set our course for the future”

Bayer is a multinational company (three main divisions)

385 – Subsidiaries

105,100 –Employees

29 Billion Euro Sales (2006)

2.8 Billion Euro R&D(I) 2007 Budget

Bayer CropScience, (divisions include crop protection & bioscience).

Employees17,900

5.7 Billion Euro Sales

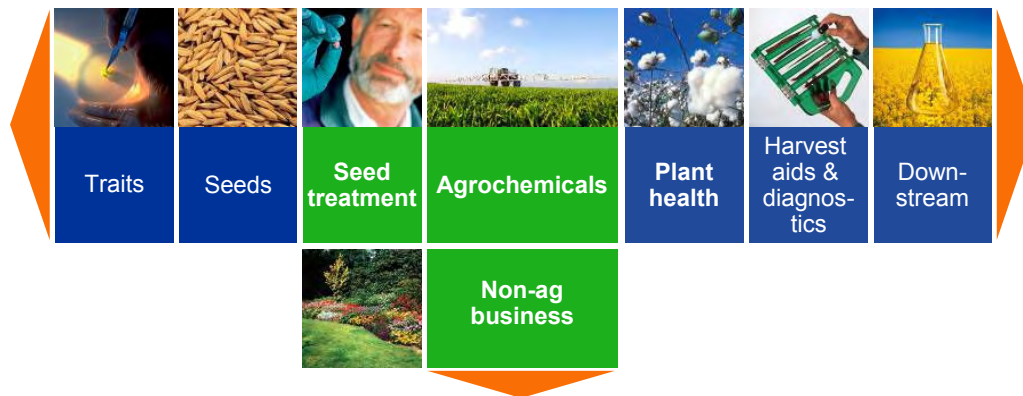
600 Million Euro R&D

Bayer is an inventor company infused with a pioneering spirit. We invest extensively in technology because innovation is the foundation for competitiveness and growth, and thus for our future success. By focusing our resources on the expanding areas of our innovative HealthCare, Crop-Science and Material-Science businesses, we lay the foundations for sustained, long-term growth in future markets.

We believe synergistic potential exists in the use of our technologies by more than one of our subgroups. Here we draw on the expertise that our scientists have acquired over decades of interdisciplinary research.

Innovative applications for biotechnology and nanotechnology also hold promise for us in the future. Supplementing the subgroups' targeted R&D activities is our subsidiary Bayer Innovation GmbH, set up specifically to turn innovative project ideas into new business concepts.

Bayer CropScience Capacity for Research & Innovation



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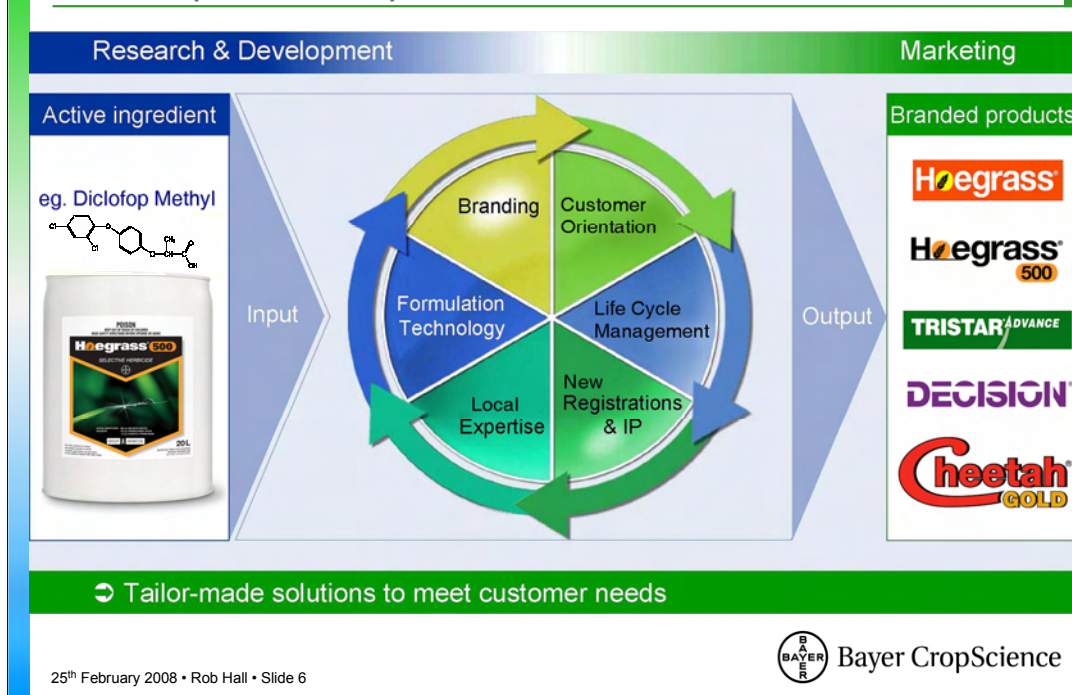


Our CropScience subgroup is strongly positioned in the insecticides, fungicides, herbicides and seed treatment segments. In addition, our Environmental Science business has a leading position in non-agricultural markets, for example in pest control.

In the **BioScience business group**, we are active in the **seed segment** and in the rapidly expanding field of **plant biotechnology**. We focus on crops for which we already have cutting-edge technologies and solid market positions – particularly cotton, canola, rice and vegetables.

Through the use of plant **biotechnology** and **modern breeding**, we are enhancing plants to increase the quantity and quality of food, feed and fibre. Plant biotechnology also affords us innovative opportunities for partnering within the Bayer Group, including plant-based production. (source <http://www.bayer.com/en/Bayer-Mission-Statement.pdf>).

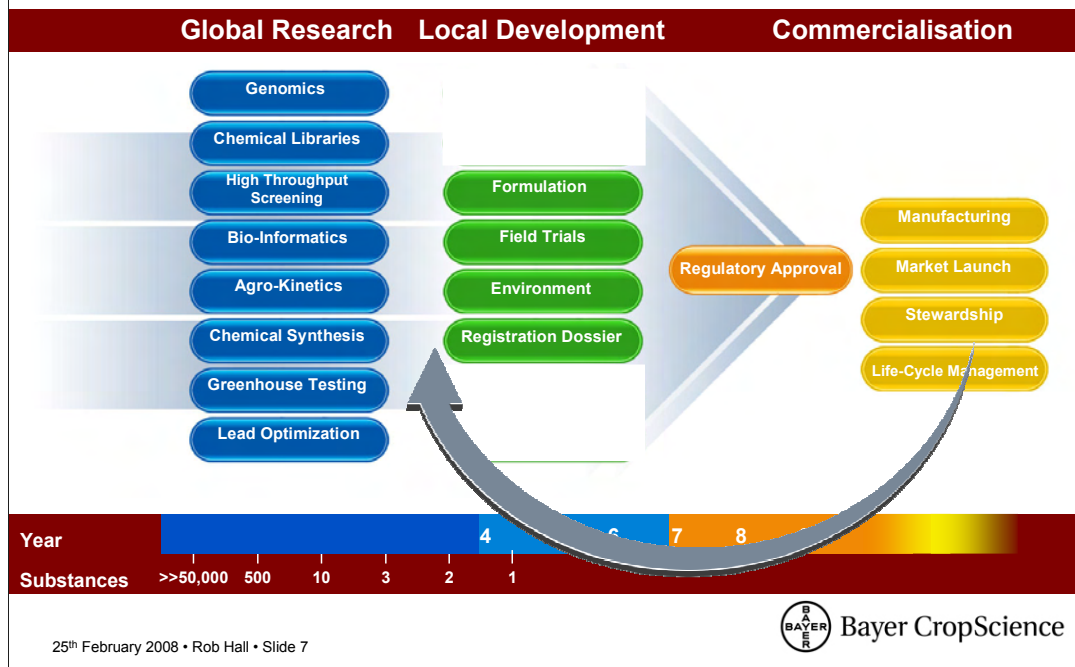
Research & Innovation for Industry – Example Diclofop



As an example of what research can do for industry through Innovation and Life Cycle Management, let's have a look at a crop protection product that you may be familiar with.– Diclofop (Source – Bayer CropScience, Marketing Manager, personal communication)

When Hoegrass hit the market over 30 years ago, it was a revolutionary product for industry. A product which allowed for selection grass control in cereal crops. This product was what is known in the industry as a 'block buster' and anyone who has been involved in cropping since the 70's would have used or at least heard of this product. When I started my career, it was not uncommon to sell semi trailer loads of this product. Over the years, through research and innovation the basic active ingredient has been modified and adapted to allow for the evolution of new formulas and products (see left of slide) Branding, customer orientation, life cycle management, new registration and IP, local expertise, formulation technology are all factors that form the mix producing localised innovation in a global company. (Source – Bayer CropScience Marketing Manager, personal communication).

The Development and Registration of a New Crop Protection Product in Australia





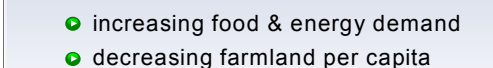
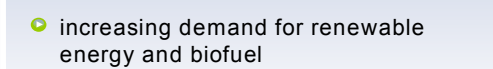

The next slide aims to provide you with a concept of how research and innovation works in a global company, you'll notice the global and local components, as well as the time frames.

An interesting point to note here, is that the development of seeds and traits is very similar, with global and local processes including regulatory dossiers and plant breeding activities. (Source – Bayer CropScience Marketing Manager, personal communication)

Summary

So, with a Global background, and a 600 million Euro R&D spend (2006) (which is increasing), Bayer CropScience is serious about the agricultural industry, and primed to contribute to the new Ag economy.

Challenges in the New Ag Economy

 <p>Growing world population</p> <ul style="list-style-type: none"> ▶ increasing food & energy demand ▶ decreasing farmland per capita 	 <p>Need for alternative energy feedstocks</p> <ul style="list-style-type: none"> ▶ increasing demand for renewable energy and biofuel
 <p>Growing wealth</p> <ul style="list-style-type: none"> ▶ increasing meat consumption and need for feed ▶ decreasing stocks to use 	 <p>Climate change</p> <ul style="list-style-type: none"> ▶ yield losses through adverse weather conditions ▶ need to reduce greenhouse gas emissions, such as CO₂
<ul style="list-style-type: none"> ▶ Acreage competition between food, feed, bio-energy crops and fiber ▶ Price increase of crop commodities 	
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Extensive media reporting in recent months about acute shortages of agricultural raw materials, the growing demand for plant sources of energy, and rising commodity prices has clearly demonstrated how firmly attention is focused on what is happening in agriculture.

The discussion about more widespread cultivation of plants for energy is probably only the trigger and not the sole deciding factor in the overall increase in demand. The high level of demand for energy-producing plants and agricultural commodities and the recent shortages have led to a situation in which premium prices are currently being paid for many agricultural products. Producers' prices in Europe are increasingly falling into line with prices on the international raw material markets, creating in many segments an agricultural economy in which pricing is once again free of the constraints imposed by quotas, subsidies and intervention.

It is not going too far to describe this development and the resulting improvement in the allocation of resources in the economy as a "silent agricultural revolution."

We are indeed on the threshold of a new agricultural economy - one that offers enormous opportunities but is also going to present the industry with some major challenges.

If we look at the factors which determine the demand for agricultural raw materials, we can distinguish two major types. Firstly the fundamental growth trends in agriculture, and secondly factors which are largely politically motivated, such as the discussion surrounding renewable energy sources and measures to combat the effects of climate change.

The fundamental factors that are driving longer-term market development are the world's growing population and changing consumer habits which are manifesting as a preference for better-quality food and a shift in demand from vegetable protein to animal protein. On the other side of the equation is the political will to exploit new energy sources that do not rely on mineral oil and to reduce dependence on the oil-exporting countries by using plant-based fuels. At the same time, many people believe that the production of biofuels could be one way to reduce global emissions of greenhouse gases. These gases are suspected of causing greater variability in the weather, which in turn leads to fluctuating productivity and major harvest losses.

In this context, climate change and the demand for biofuels are intensifying the impact of the long-range determinants of growth on the agricultural markets. The result is greater competition for land between food and feed crops on the one hand and energy plants on the other, and consequently rising prices for agricultural raw materials as they become scarcer.

(Source Prof. Dr. Dr. h.c. Friedrich Berschauer; Chairman of the Board of Management, Bayer CropScience AG; "Challenges of the New Ag Economy - Securing Harvests, increasing Yields")

Let's take a brief look at these factors in more detail.

There can be no doubt that the need to safeguard an adequate supply of food for a global population that continues to grow strongly is one of the most pressing questions of our time. We need only look at population growth and the amount of agricultural land available for each person to see the extent of the problem. Current forecasts published by the United Nations show that the amount of agricultural land available worldwide is likely to remain at approximately **1.5 billion hectares**, which means that the amount available per person will diminish to just **0.16 hectares by 2050**. In other words, the land available for growing food in 2050 will be just **30 percent of the area that was available per person in 1950** - in spite of the tremendous progress that has been made in agricultural productivity in recent decades, without which the per capita figure would be even more dramatic.

Another important factor that is affecting demand is increasing **economic growth and prosperity**, which in turn is changing consumer habits. Per capita calorie consumption in developing countries and emerging economies continues to rise and is approaching the level in industrialized countries. This is leading to greater demand for animal protein, so an increasing proportion of the world's grain harvests is being used to feed animals. This development is particularly striking in China at the moment, where the demand for animal protein is increasing dramatically and leading to greater demand for animal feed. In simplified terms we can say that it takes **7 kg of plant-based feed to produce 1 kg of beef**. This differential is known as the processing loss and increases the pressure on the demand side.

On the other side of the equation, however, it is not possible to increase the **supply** of agricultural raw materials at short notice. On the contrary, consumption of the major crops wheat, corn and rice is currently exceeding annual production of these goods. As a result, global inventories are continuing to decline markedly. At the moment, for example, the **global wheat stockpile is at a 25-year low**. Declining harvests in Canada and Australia and cereal harvests in Europe which have been lower than expected are further reducing the supply of wheat this year. In the 1980s the global wheat stockpile was sufficient for more than 130 days; **today the figure is just 67 days**. This means that there is enough wheat available in the world for around two months. Any major loss of harvest, any delay in harvesting important crops in the coming season because of adverse weather, could thus precipitate an alarming supply crisis if we do not succeed in expanding production considerably.

Prices have risen recently, in some cases sharply, in response to the growing shortages of important agricultural raw materials. Price increases for corn on the commodities markets have been particularly steep, with a 45 percent rise in the price per ton in the past 12 months. Soybean prices increased by about 30 percent during the same period. Wheat and rice prices are also at their highest level for many years. International research institutes are forecasting further increases in the prices for major agricultural products in 2008 and 2009. Corn prices of up to US\$ 200 per ton are expected during the five-year period 2005 to 2009, which represents an increase of 89 percent over the first quarter of 2005. Rice and soybean prices are expected to exceed US\$ 350 in 2009, and the forecast is for wheat to peak at around US\$ 230 per ton – 41 percent above the 2005 level.

(Source Prof. Dr. Dr. h.c. Friedrich Berschauer; Chairman of the Board of Management, Bayer CropScience AG; "Challenges of the New Ag Economy - Securing Harvests, increasing Yields")



We can summarize the challenges facing the "new ag economy" as follows: Against a background of limited arable land and a continually growing global population which will need increasing volumes of food, clothing and energy, our primary concern will be to safeguard and expand the volume of agricultural raw materials being harvested. If we are to achieve this aim, our task will be to optimize the targeted use of crop protection products within a program of integrated crop management; this will create a basis for successful resource management which will include an efficient approach to irrigation and fertilization. Without modern crop protection, global agricultural production would not achieve even half of the yields that are possible today. We are convinced that we also need to seize the opportunities presented by modern plant breeding techniques to develop new high-yielding hybrid varieties and, more particularly, to make much greater use of the possibilities inherent in plant biotechnology. This is the only way to push back the frontiers of cultivation and to make agricultural production possible in marginal regions in which climatic conditions have made farming impossible in the past. The development of new crops with better resistance to the stresses caused by drought and extremes of temperature will play an enormously important role in this context.

(Source Prof. Dr. Dr. h.c. Friedrich Berschauer; Chairman of the Board of Management, Bayer CropScience AG; "Challenges of the New Ag Economy - Securing Harvests, increasing Yields")

As a research- and innovation-based company, we want to offer these promising approaches as a major contribution to solving the food and energy challenges of the future.

Research and innovation have contributed to advance Agriculture for 10,000 years.

Bayer is well positioned to develop agricultural innovations that benefit society.

Research and innovation can provide industry with solutions to solve the food & energy challenges of the future.

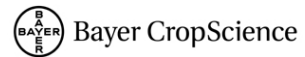


The future is bright for the agribusiness industry. We must attract, develop and retain the best and brightest to take the mantle for the future.



Science For A Better Life

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Thankyou.