# Facts and figures – The status of global agriculture

CropLife INTERNATIONAL

1.7 billion more mouths to feed by 2030; the ratio of arable land to population declining by 40-55%; 1.8 billion people living with absolute water scarcity by 2025. These are a few of the key factors affecting the future of agriculture.

The plant science industry works together with international organisations for sustainable agriculture. Striving to play our part, the technologies offered by the plant science industry have been factors in tripling yields and reducing soil erosion. To meet future challenges in a growing world, plant science hopes to develop crops that can grow more efficiently such as requiring less water.

Explore the facts and figures of the plant science industry and global agriculture.

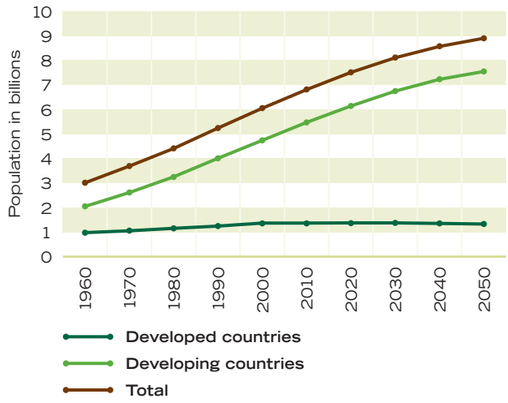
# We face increasing demand on the world's finite resources

As a global community, there are a multitude of issues to overcome along the path to sustainably providing for a diverse, growing population.

## DEMANDS OF A GROWING POPULATION

In the period from 1960 to 2005, the global population has grown from 3 billion to nearly 6.5 billion. Projections for future growth take that number to nearly 9 billion in 2050.[1]

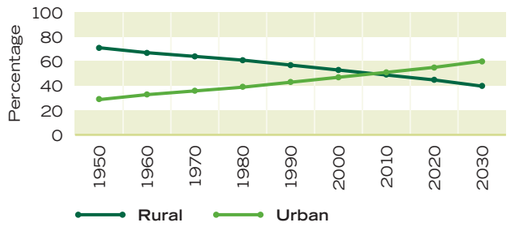

**POPULATION GROWTH, ACTUAL AND PROJECTED 1960-2050**




## SHIFT FROM A RURAL TO URBAN POPULATION BASE

For the first time in history more people are living in urban areas than in rural areas. In fact, the share of rural population is expected to be about 40% by 2030, with less than 25% of that in Europe, North America, Latin America and the Caribbean.[2]

**RURAL VS. URBAN POPULATION GROWTH 1950-2030**




## DIMINISHING AGRICULTURAL WORKFORCE

As rural populations decrease, so does the agricultural workforce. In Europe and North America, agriculture now represents about 5% of the workforce. In Africa and Asia, it is expected that the number of agricultural workers will have decreased from nearly 70% of the population in the 1980s to barely 50% by 2010.[3]

## RISE IN PER CAPITA CONSUMPTION

In the developing world, a factor which has a great impact on the global use of natural resources is the increase in food consumption. Available calories per capita have grown 37% since the 1960s in the developing world. On average, the increase is 21% worldwide.[4]

So with the growth in population and the increase in consumption patterns, the United Nations Environment Programme predicts that global demand for food will increase by at least 2.5 times the current amount by 2050.[5]

On top of increasing demand for food, increasing human population and a decreasing farm labour pool, we are also challenged with a dependence on limited resources.

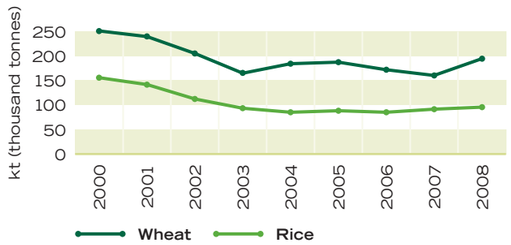
The World Bank estimates that **one hectare of land will need to feed 5 people in 2025**, whereas in 1960 one hectare was required to feed only 2 people.[6]

# Food crisis and sustainable development

## PRICES DRIVEN BY DECLINING STOCKS, POOR HARVESTS, AND GROWING DEMAND

Global commodity stocks have been steadily decreasing, contributing to increases in commodity prices. Between 2000 and 2008, global end stocks for wheat have decreased by 24%, reaching a long term low. Global end stocks for rice declined by 39% during the same period.[7]

### GLOBAL STOCKS (kt) FOR WHEAT & RICE



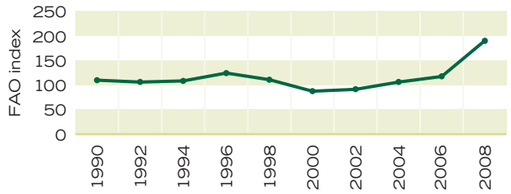

Global stocks of key crops have hit long term lows.


sustenance

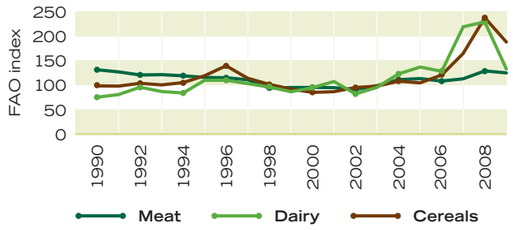
## HIGHER PRICES MAY PERSIST

The OECD forecasts higher than average prices for agricultural commodities over the long term. Potential for price stabilisation or decline could be severely hampered by many factors, such as those linked to climate change, price of gas and increasing water scarcity.[11] The IMF estimated in April 2008 that food prices represented 44% of global inflation in 2007, and as much as 67.5% in Asia.[12]

### FOOD PRICE INDEX 1990-2008




### PRICE OF MEAT, DAIRY & CEREALS 1990-2009




# Food and poverty alleviation

Small farmers are the most vulnerable. At a global level almost 90% of farms are small farms.[8] Higher food prices affect people differently. Some farmers may be able to benefit. But for households that buy more than they sell (net food buyers), higher prices are a threat. According to FAO data from nine developing countries, on average, roughly three-quarters of rural households and 97% of urban households are net food buyers.[9]

## INCREASE IN MALNUTRITION

FAO estimates that even before the surge in food prices in 2008, long-term trends of increasing hunger were already apparent. FAO estimates that 848 million people suffered from chronic hunger worldwide in 2003-05, representing an increase of six million from the nearly 842 million in 1990-92.[10]

In 2009, the FAO projects world hunger to reach a historic high with 1.02 billion people going hungry every day. This recent increase is a result of the world economic crisis that has lowered incomes and increased unemployment, combined with persisting high food prices.[13]

At the regional level, the largest increases in the number of undernourished people as a result of rising food prices have taken place in Asia and in sub-Saharan Africa. The two regions combined already accounted for 750 million, or 89%, of the hungry people in the world in 2003-05.[14] FAO estimates that in 2009, this will rise to 907 million people below the hunger threshold.[15]



# The limitations of our resources

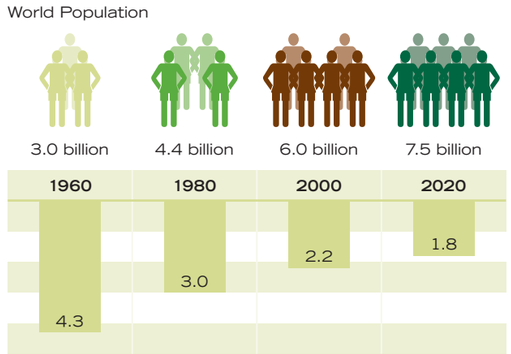
The challenge of meeting growing demand is compounded by the limited resources at our disposal. Expansion of land under cultivation damages natural habitats and threatens biodiversity while increased water use is making it a fragile and scarce resource.

In addition, the effects of climate change are contributing to the challenge of meeting our current and future needs. The increase in droughts, desertification, flooding, soil salinity and soil erosion endangers our capacity to meet demand and more than ever points to the necessity of finding sustainable ways of farming.

## LAND

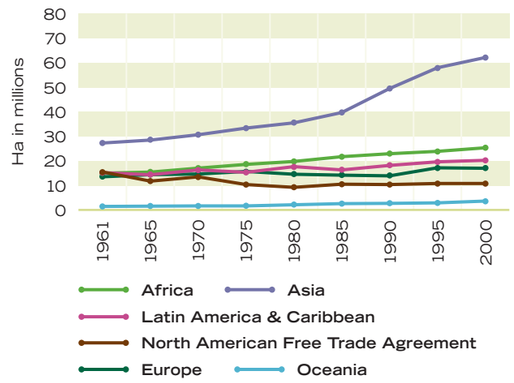
Around the world, the ratio of arable land to population is steadily declining. Between 1960 and 2000, it declined by about 40%, but in developing nations the decline has been fastest. In Africa, for example, the ratio of arable land to population declined by 55% in the same period.[16]

### MORE FOOD MUST BE PRODUCED ON LESS LAND[17]




While available arable land decreases in developing nations, the area under permanent cropping has remained relatively stable in Europe and North America. In other regions, permanently cropped land has increased dramatically. In Asia the growth is 127% since the 1960s.[18]

### AREA UNDER PERMANENT CROP




## WATER

Currently, 70% of the world's water is used for agriculture.[19] This is dramatic given that many people have access only to limited water or water of poor quality. By 2025 it is estimated that about 1.8 billion people will be living in countries or regions with absolute water scarcity.[20]

A **1% increase** in water productivity in food production can potentially make available an

**extra 24 litres** of water per day per person. On average it takes about 3,000 litres of water per person to produce our daily intake of food.[21]

## CHALLENGES TO BIODIVERSITY

Due to the increase in cultivated land, population growth and other environmental pressures, the diversity of plant and animal life is at risk. In animals, current rates of extinction are estimated to be 100 times higher than previously. General estimates indicate that at current rates, the conversion and deforestation of tropical forests and dry forests may wipe out 100,000-450,000 species within the next 40 years.[22]



# Worsening impact of climate change

The strains from the food crisis come at a time when climate change is already expected to worsen poverty, by as many as 40 to 170 million people worldwide.[23] Climate change is also expected to increase water scarcity. In Africa, between 75 and 200 million people could be affected by additional water scarcity by 2020.[24]

Cereal yields are expected to decline in more than 40 developing countries with average losses of 15% and projections show that land suitable for wheat production may almost disappear in Africa.[25]

Climate change will also have an impact on pest prevalence and hence on human health. Every year, around 250 million people get sick with malaria and more than one million people die because of it every year.[26]


A child dies of malaria every 30 seconds in the world. Through climate change, **an additional 220 to 400 million people could be exposed to malaria.**

## DESERTIFICATION AND EROSION

About 1 billion people, or about 15% of the global population, have become affected by land degradation since 1981. The UN (UNCCD) estimates that by the year 2050, half of the current arable land will become unusable.[27] Globally, between 20,000-50,000 sq km of arable land is estimated to be lost annually through degradation, in particular, soil erosion. The rate of degradation is two to six times higher in Asia, Africa and Latin America than in Europe and North America.

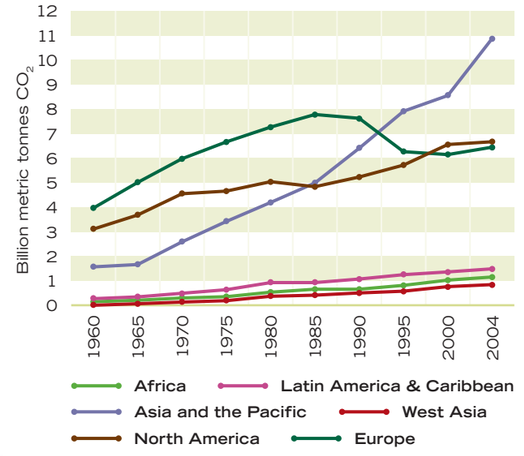
## SALINITY

Salinity is increasing due to excess irrigation and from the intrusion of sea water into land. Worldwide, some 20% of irrigated land (450,000 sq km) is salt-affected, with 2,500-5,000 sq km lost from production every year as a result of salinity.[28]

## CARBON EMISSIONS AND AIR POLLUTION

A rise in carbon emissions has resulted in a current level of 380 parts per million globally, much higher than the pre-industrial 18th century level of 280 ppm. Losses in crop yield caused by air pollutants such as tropospheric ozone have been estimated to cause economic losses for 23 arable crops in Europe totalling US$5.72-12 billion/year.[29]

### $CO_2$ EMISSIONS FROM FOSSIL FUELS, PER REGION




## SOME PROGRESS

A study in the U.S. indicates the sustainability of U.S. agriculture is increasing in some areas including safeguarding soil, energy and land required per acre of production, as well as water use efficiency.[30]

- The land needed to grow a bushel of corn has **dropped by 37%** in just 20 years.
- A bushel of soybeans can be produced today using **26% less land** than was used 20 years ago.
- Soil loss through corn cultivation has **plummeted 69%** per bushel in the past 20 years.
- Cotton production is **66% more energy efficient** per pound today than it was 20 years ago.
- Greenhouse gas emissions from soybean farming have **fallen 38%** per bushel in 20 years.

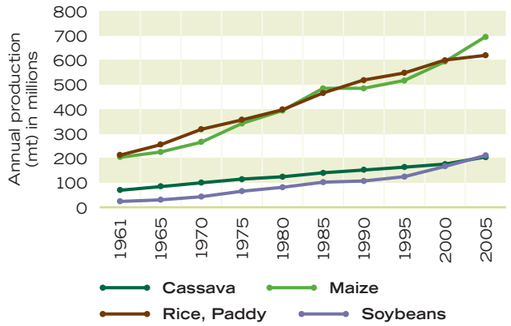
# Plant science and the future of food production

The plant science industry has a long history of seeking to improve agriculture, not only in terms of output but also in terms of quality and safety. New technologies and production techniques account for dramatic increases in yields in many crops and many countries.

## YIELD INCREASE

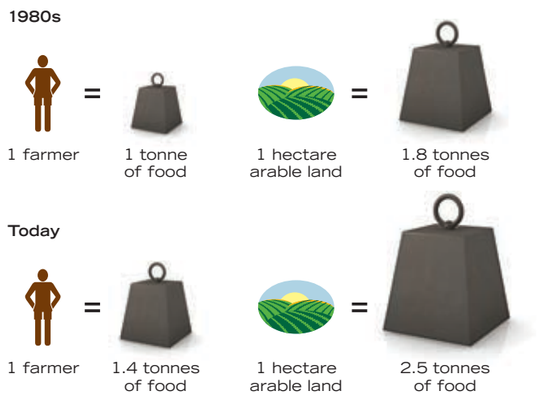
Globally, production of major crops has more than tripled since 1960. Yields for rice have more than doubled and yields for wheat have gone up about 160%.[31]

### INCREASE IN YIELD FOR KEY CROPS 1961-2005




In the 1980s, one farmer produced one tonne of food, and one hectare of arable land produced 1.8 tonnes, annually on average. Today, one farmer produces 1.4 tonnes, and one hectare of land produces 2.5 tonnes.[32]

### FOOD PRODUCTION




This has come about as a result of both an increase in yields and a reduction in post-harvest losses. In some regions, losses can be as low as 20%. Conversely, losses can amount to 100% of a harvest if no crop protection is available or unaffordable.

## RESEARCH AND DEVELOPMENT

Plant science is one of the most research-intensive industries in existence. During 2008, research and development expenditure for the fifteen leading companies in plant science reached an estimated $5 billion. It is equivalent to over 8.5% of sales. $2.4 billion was spent on seed and traits R&D, and $2.7 billion was spent on agrochemicals.[33]

Overall, bringing a new crop protection product to market costs approximately $200 million and takes eight to nine years, although these costs continue to rise steadily.

**Improved varieties can make crop yields more stable.**
The annual benefits from better yield stability in maize and wheat alone are estimated at about $300 million.[34]

## LOOKING TO THE FUTURE

Innovations are needed to meet the challenges of climate and human demand, such as biotech crops, innovative farming and management techniques, and improved crop protection products.

- Conservation agriculture can help improve soil quality and reduce erosion. It is estimated that conservation tillage can reduce soil erosion by 50 to 98%. This is important for the environment as well as farm business, as erosion reduces yields by 10 to 30%.
- No-till agriculture, one form of conservation agriculture, also has a great impact on carbon emissions. In 2006, global fuel savings associated with the switch to no-till farming, reduced carbon dioxide emissions by about 1,215 million kg – equivalent to removing 0.54 million cars from the road.[35]
- Fruits and vegetables can be fortified with extra vitamin C and E to protect against risks of cancer and heart disease.
- The development of drought resistant crops and the better management of water resources could greatly help in addressing the issue of water shortages.



# Growing with a responsible partner

The plant science industry has strong commitment to human and environmental safety. One example is an extensive network of stewardship programmes that reach farmers, their families and other industry participants.

- Our stewardship programmes reach over 40 countries and train more than 350,000 individuals each year.
- Training farmers in Integrated Pest Management and responsible use of crop protection products is a key focus of our stewardship programmes – managing pests and reducing unnecessary pesticide use across the world.
- A recent study in China found that stewardship training cut improper disposal of used pesticide containers by more than half.


Deb Carstoiu

education

Fact: In the 1980s and 1990s, **improved varieties are estimated to have accounted for as much as 50% of yield growth**, compared with 21% in the preceding two decades. Without those gains in yields, world cereal prices would have been 18-21% higher in 2000, caloric availability per capita in developing countries would have been 4-7% lower, 13-15 million more children would have been classified as malnourished, and many more hectares of forest and other fragile ecosystems would have been brought under cultivation.[36]

Globally, the plant science industry is also an active participant in the efforts to stop climate change. We are committed to being part of the solution.

- Technological innovation allows more renewable resources to be used in everyday objects, reducing our carbon footprint. For instance, using corn sugar instead of petroleum-based feedstocks to create polymers consumes 40% less energy and reduces greenhouse gas emissions by 20%.
- Improvement in crops also means more sustainable production of biofuels. This comes about by increasing yields, high starch and oil content, and limiting the need to expand the land under cultivation.
- Creating plants that use nitrogen more efficiently can reduce the need for added fertilizer, reducing greenhouse gas emissions from agriculture.
- We are part of several initiatives, including UNEP's Global Programme of Action for the Protection of the Marine Environment. We also take part in the Sustainable Agriculture and Rural Development (SARD) Initiative as part of Commission on Sustainable Development Partnerships.
- In addition, we take part in public-private partnerships for development such as with the International Fund for Agricultural Development.
- Our industry is also involved in preserving biodiversity. Member companies support the Global Crop Diversity Trust to help financially support an endowment of US$260 million for gene banks around the world.

conservation

CropLife is a part of **UNEP's Global Programme of Action for the Protection of the Marine Environment.**

# Global market performance

## CROP PROTECTION

The trend of increasing crop commodity prices that began in early 2007 continued into 2008, with the price of grain and oilseed crops reaching an all time high. The rise in crop prices coupled with a higher planted area in the EU following the decision to suspend set aside land, and the relatively stable economic situation in Latin America, resulted in a significantly improved crop protection market in 2008.

In Latin America, crop protection growth was led by Brazil where the market benefited from a rise in the planted area of soybean, maize and wheat, as well as favourable weather conditions. The crop protection market in Asia benefited from continued expansion of developing agriculture based economies, notably China and India, as well as from modest growth in the Japanese market. The European market made gains due to higher crop prices and an increased intensity in product usage, as well as a rise in crop planted areas in both the EU and Eastern Europe. In the NAFTA region, the Canadian sector benefited from an increase in wheat and canola plantings. The U.S. sector was also buoyant, however much of the growth in input use was in sales of seed and traits.

Source: Phillips McDougall, 2009

### GLOBAL CROP PROTECTION MARKET GROWTH BY PRODUCT SECTOR 2008

| | 2008($m) | 2007($m) | Growth '08/'07(%) |
|---|---|---|---|
| Herbicides | 19,625 | 16,115 | 21.8 |
| Insecticides | 9,235 | 8,016 | 15.2 |
| Fungicides | 10,355 | 8,105 | 27.8 |
| Others | 1,260 | 1,154 | 9.2 |
| **TOTAL** | **40,475** | **33,390** | **21.2** |

During 2008 the global market value for conventional crop protection products rose by 21.2% in nominal US dollar value to reach $40,475 million. This represents the most significant increase in the market since 1975.

### GLOBAL CROP PROTECTION MARKET GROWTH BY REGION 2008

| | 2008($m) | 2007($m) | Growth '08/'07(%) |
|---|---|---|---|
| NAFTA | 8,325 | 7,507 | 10.9 |
| Latin America | 8,405 | 6,170 | 36.2 |
| Europe | 12,850 | 10,568 | 21.6 |
| Asia | 9,360 | 7,815 | 19.8 |
| Rest | 1,535 | 1,330 | 15.4 |
| **TOTAL** | **40,475** | **33,390** | **21.2** |

At the regional level, crop protection market growth was led by Brazil, and to a lesser extent Argentina, as both countries benefited from the favourable market environment.

growth

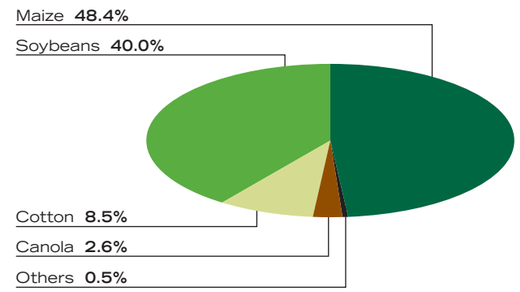


## PLANT BIOTECHNOLOGY

During 2008 the overall planted area of biotech crops rose by 10.3% to reach 296.4 million acres. This in turn was a major contributing factor to the rise in value of the sale of biotech seed, which rose by 29.5% to reach $9,150 million.[37] In addition to the higher planted area, another key factor contributing to this rise in value was an increase in the adoption of stacked trait varieties of maize and to a lesser extent cotton.

In 2008, the number of countries planting biotech crops reached a historic milestone of 24 countries. They were, in order of hectarage, USA, Argentina, Brazil, India, Canada, China, Paraguay, Uruguay, Bolivia, Philippines, Australia, Mexico, Spain, Chile, Columbia, Honduras, Burkina Faso, Czech Republic, Romania, Portugal, Germany, Poland, Slovakia and Egypt. Developing countries out-numbered industrial countries by 15 to 10, and this trend is expected to continue in the future with 40 countries, or more, expected to adopt biotech crops by 2015.[38]

### BIOTECH SEED MARKET BY CROP

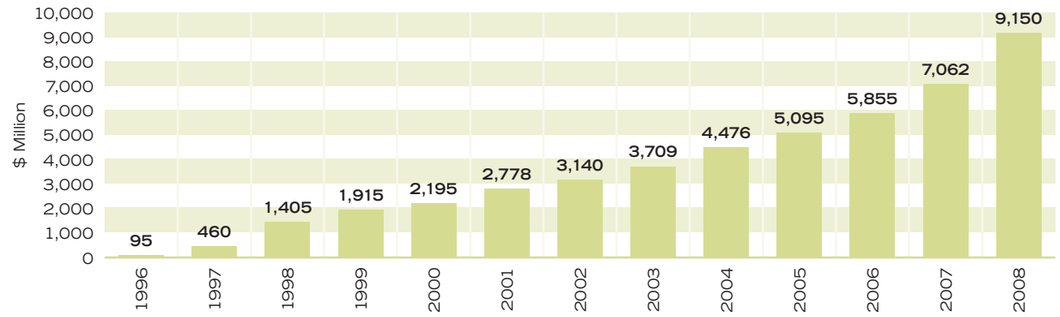



**TOTAL = $9,150 million**

In 2008 the value of the market for plant biotechnology-based products rose by an impressive 29.5% to reach $9,150 million.

Source: Phillips McDougall, 2009

### GROWTH OF THE BIOTECH SEED MARKET




The largest share of the biotech crop sector is attributed to herbicide tolerant crop varieties which represented 51.8% of the value of the sector in 2008. However, over the last few years the overall share attributable to stacked trait crop varieties of maize and cotton has increased at a rate ahead of the overall market, to reach a value equivalent to 34% of the overall biotech seed market.

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There are no easy ways to solve issues such as rapid population growth, climate change or increased human demand on the earth's resources. CropLife International is committed to looking beyond the traditional paths to help provide crop production solutions to meet the challenges of a growing world.

**CropLife International aisbl**

326 Avenue Louise, Box 35
1050 Brussels, Belgium

croplife@croplife.org
www.croplife.org

Published 2009
Printed on 100% recycled paper with vegetable-based inks.

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07/09-11708