The Economist

Special report: Feeding the world

The 9 billion-people question

The world's population will grow from almost 7 billion now to over 9 billion in 2050. John Parker asks if there will be enough food to go round

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THE 1.6-hectare (4-acre) Broadbalk field lies in the centre of Rothamsted farm, about 40km (25 miles) north of London. In 1847 the farm's founder, Sir John Lawes, described its soil as a heavy loam resting on chalk and capable of producing good wheat when well manured. The 2010 harvest did not seem to vindicate his judgment. In the centre of the field the wheat is abundant, yielding 10 tonnes a hectare, one of the highest rates in the world for a commercial crop. But at the western end, near the manor house, it produces only 4 or 5 tonnes a hectare; other, spindlier, plants yield just 1 or 2 tonnes.

Broadbalk is no ordinary field. The first experimental crop of winter wheat was sown there in the autumn of 1843, and for the past 166

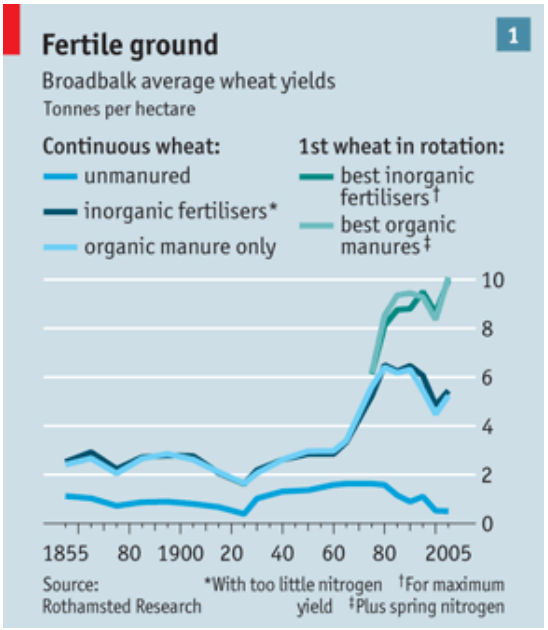
years the field, part of the Rothamsted Research station, has been the site of the longest-running continuous agricultural experiment in the world. Now different parts of the field are sown using different practices, making Broadbalk a microcosm of the state of world farming.

The wheat yielding a tonne a hectare is like an African field, and for the same reason: this crop has had no fertiliser, pesticide or anything else applied to it. African farmers are sometimes thought to be somehow responsible for their low yields, but the blame lies with the technology at their disposal. Given the same technology, European and American farmers get the same results.

The wheat bearing 4 or 5 tonnes a hectare is, roughly, like that of the Green Revolution, the transformation of agriculture that swept the world in the 1970s. It has been treated with herbicides and some fertilisers, but not up to the standard of the most recent agronomic practices, nor is it the highest-yielding semi-dwarf wheat variety. This is the crop of the Indian subcontinent and of Argentina.

The extraordinary results in the centre of the field are achieved by using the best plants, fertilisers, fungicides and husbandry. The yield is higher than the national average in Britain, and is as good as it gets.

Seeds of doubt



But the Broadbalk field shows something else. Chart 1 tracks its yields from the start, showing how the three different kinds of wheat farming—African, Green Revolution and modern—have diverged, sometimes quite suddenly: in the 1960s with the introduction of new herbicides for Green Revolution wheat, and in the 1980s with new fungicides and semi-dwarf varieties. Worryingly, though, in the past 15 years the yields of the most productive varieties of wheat in Broadbalk have begun to level out or even fall. The fear is that Broadbalk may prove a microcosm in this respect, too.

At the start of 2011 the food industry is in crisis. World food prices have risen above the peak they reached in early 2008 (see chart 2).

That was a time when hundreds of millions of people fell into poverty, food riots were shaking governments in dozens of developing countries, exporters were banning grain sales abroad and "land grabs" carried out by rich grain-importing nations in poor agricultural ones were raising awkward questions about how best to help the poor.

This time, too, there have been export bans, food riots, panic buying and emergency price controls, just as in 2007-08. Fears that drought might ruin the current wheat crop in China, the world's largest, are sending shock waves through world markets. Discontent over rising bread prices has played a part in the popular uprisings throughout the Middle East. There are differences between the periods, but the fact that agriculture has experienced two big price spikes in under four years suggests that something serious is rattling the world's food chain.

The food industry has been attracting extra attention of other kinds. For years some of the most popular television programmes in English-speaking countries have been cooking shows. That may point to a healthy interest in food, but then again it may not. The historian Livy thought the Roman empire started to decay when cooks acquired celebrity status.

At a meeting of the Group of Eight (G8) industrial countries in 2009 the assembled leaders put food alongside the global financial crisis on their list of top priorities, promising to find $20 billion for agriculture over three years. This year the current president of the Group of 20 (G20), France's Nicolas Sarkozy, wants to make food the top priority. The Gates Foundation, the world's richest charity, which had previously focused on health and development generally, started to concentrate more on feeding the world. At last month's World Economic Forum, a gathering of businesspeople and policymakers in Davos, 17 global companies launched what they described as "a new vision for agriculture", promising to do more to promote markets for smallholders —a sign of rising alarm in the private sector.

Anything for dinner?

Some of this public and political attention has been sporadic, but it is

justified. An era of cheap food has come to an end. A combination of factors—rising demand in India and China, a dietary shift away from cereals towards meat and vegetables, the increasing use of maize as a fuel, and developments outside agriculture, such as the fall in the dollar—have brought to a close a period starting in the early 1970s in which the real price of staple crops (rice, wheat and maize) fell year after year.

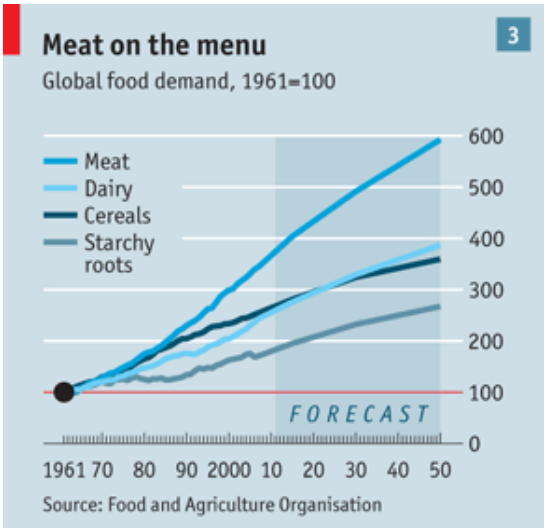
This has come as a shock. By the 1990s most agricultural problems seemed to have been solved. Yields were rising, pests appeared under control and fertilisers were replenishing tired soil. The exciting areas of research in life sciences were no longer plants but things like HIV/AIDS.

The end of the era of cheap food has coincided with growing concern about the prospects of feeding the world. Around the turn of 2011-12 the global population is forecast to rise to 7 billion, stirring Malthusian fears. The price rises have once again plunged into poverty millions of people who spend more than half their income on food. The numbers of those below the poverty level of $1.25 a day, which had been falling consistently in the 1990s, rose sharply in 2007-08. That seems to suggest that the world cannot even feed its current population, let alone the 9 billion expected by 2050. Adding further to the concerns is climate change, of which agriculture is both cause and victim. So how will the world cope in the next four decades?

That question forms the backbone of this special report. The answer to it cannot be a straightforward technical or biological one because food is basic to life. In the Maya creation myth, the first humans were made of maize dough. In the slang of Marathi, a language of west central India, the man on the street is known as “fried bread”—after the workers' favourite snack.

Because food is so important, agriculture—more than any other form of economic activity—is expected to achieve a series of competing and overlapping goals that change over time and from place to place. The world looks to farmers to do more than just produce food. Agriculture is also central to reducing hunger (which is not quite the same thing) and provides many people's main route out of poverty. Food is probably the biggest single influence on people's health, though in radically different ways in poor countries and in rich ones, where the big problem now is obesity. Food is also one of the few pleasures available to the poorest. In the *favelas* (slums) of São Paulo, the

largest city in South America, takeaway pizza parlours are proliferating because many families, who often do not have proper kitchens, now order a pizza at home to celebrate special occasions.



Given these conflicting aims, it is not surprising that the food crisis has produced contradictory accounts of the main problem and radically different proposals for solving it. One group is concerned mainly about feeding the world's growing population. It argues that high and volatile prices will make the job harder and that more needs to be done to boost supplies through the spread of modern farming, plant research and food processing in poor countries. For those in this group—food companies, plant breeders and international development agencies—the Green Revolution was a stunning success and needs to be followed by a second one now.

The alternative view is sceptical of, or even downright hostile to, the modern food business. This group, influential among non-governmental organisations and some consumers, concentrates more on the food problems of richer countries, such as concerns about animal welfare and obesity. It argues that modern agriculture produces food that is tasteless, nutritionally inadequate and environmentally disastrous. It thinks the Green Revolution has been a failure, or at least that it has done more environmental damage and brought fewer benefits than anyone expected. An influential book espousing this view, Michael Pollan's "The Omnivore's Dilemma", starts by asking: "What should we have for dinner?" By contrast, those worried about food supplies wonder: "Will there be anything for dinner?"

This special report concentrates on the problems of feeding the 9 billion. It therefore gives greater weight to the first group. It argues that many of their claims are justified: feeding the world in 2050 will be hard, and business as usual will not do it. The report looks at ways to boost yields of the main crops, considers the constraints of land and water and the use of fertiliser and pesticide, assesses biofuel policies, explains why technology matters so much and examines the impact of recent price rises. It points out that although the concerns of the critics of modern agriculture may be understandable, the reaction against intensive farming is a luxury of the rich. Traditional and organic

farming could feed Europeans and Americans well. It cannot feed the world.

Listen to an interview with the author of this special report (http://www.economist.com/blogs/multimedia/2011/02/special_report_food)

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