FEEDING THE PLANET IN A SUSTAINABLE MANNER

Feeding more than nine billion people by year 2050 in a sustainable way is not an impossible task provided certain conditions are met. These include limiting agricultural price instability, increasing agricultural production, reducing losses and wastage from field to plate and securing international

How to feed more than nine billion people by 2050 while preserving natural resources and protecting the environment? Although the challenge is simply put, meeting it is no easy feat. It's not just a matter of calculating how much food is needed and then producing it. Everyone across the world must have access to enough food at affordable prices that is safe to eat and nutritionally balanced. This is not just an issue of supply and demand. Development of agricultural and food systems must be viewed in the context of sustainable development. They must account for the progressive depletion of fossil energy, the protection of soil and water resources, the preservation of biodiversity and the issue of climate change. While producing more, farmers around the world will have to produce using less fossil fuel and in an environmentally friendly way. They will also have to produce energy and industrial commodities to substitute petrochemical products, and provide environmental and rural services like water management, biodiversity protection, carbon sequestration and diversified and open landscapes. In addition, people's consumption habits will also need to adapt, notably in richer countries.

Feeding the planet in a sustainable way is possible, but it requires more stable agricultural prices, sustainable agricultural and food production methods, a reduction in losses and wastage at all stages of the food chain, and the development of international agricultural trade in a secure environment. Let us start with price instability.

Fighting agricultural price instability

Over the long term, the real price of agricultural raw materials has declined although the world population has increased. Of course, there have been periodic peaks, namely during the First World War, after the Second World War and during the oil crises of the

1970s and 1980s. But these peaks were followed by equally sharp, corrective declines. The spike in 2007-2009 and the subsequent dip followed the same pattern.

The sharp rise in agricultural prices at the end of 2006, which lasted through early 2008, was due to several short-term factors: adverse weather conditions and restrictive export policies decreased supply; the depreciation of the US dollar and the promotion of imports boosted demand; and the rising cost of fuel increased production costs, notably the price of fertilizers. This coincided with more than 10 years of slower growth in output, an increase in demand for food and non-food products, due in particular to development of biofuels, and market speculation in agricultural raw materials. The sharp correction from spring 2008 onwards happened because of favorable climate conditions in several production zones, an appreciation of the US dollar and a reduction in petroleum prices. In addition, the high agricultural prices in 2006 and 2007 encouraged producers to bring fallow land back into production and use land for agriculture that was earlier earmarked as forest or grassland (in Latin America, notably in Brazil, but also in South-East Asia and sub-Saharan Africa). Add to that, higher yields and the supply curve shifts again. In this context of renewed dynamism of supply, the downward adjustment of agricultural prices allowed countries to end their exceptional trade policies of encouraging imports and/or export restriction. Finally, if prices remain low today (first semester of 2010), it is essentially because of the economic crisis and the ensuing apathy in global demand.

What lessons can we learn from 2007-2009? Firstly, that there is a large instability over time, both up and down, of agricultural prices. This is unlikely to change in the next 10 to 20 years. To face these price risks and minimize their adverse effects, both private mechanisms and public policies should be developed in these areas: emergency stocks, virtual and physical world reserves managed by an independent international body, reduction of bio-fuel mandates when agricultural prices are particularly high, but also futures markets and insurance contracts. Secondly, the current low agricultural price levels do not mean that global agricultural production should not be increased. More than nine billion people will need to be fed in 2050 and the major part of the demographic growth will be in developing countries where agriculture can and must play a major role in economic development, particularly in rural areas.

Produce more, and better

There are six possible ways, or levers, to boost agricultural production: increase cultivated land areas, increase yields, reduce post-harvest losses, cultivate multiple

crops per year, combine various crop productions on the same land, and optimize land usage to maximize calories produced per hectare on a global scale.

The last three propositions require only a mention since their benefits are very likely limited. Wherever it has been possible to increase the number of harvests per year, it has already been done; and constraints like the lack of water in areas where it might be theoretically possible to increase the number of harvests make this very difficult in practice. Combining various agricultural productions on the same area is interesting, especially from an environmental point of view. However, environmental benefits will be maximized if complementarities between crops, animal productions and forests are developed on a territorial or regional scale and not at the farm level. Optimizing land use on a world-wide scale seems an unlikely option as it would require global agricultural and environmental governance of such things as agricultural production, water management, carbon sequestration and/or preservation of biodiversity. Better to concentrate on the first three options though option one, bringing unused land into production, has particular problems.

Contrary to popular belief, there is land available for cultivation that does not encroach on forests or protected areas. These 'land holdings' are, however, limited and unequally distributed. They are almost non-existent in South Asia, the near and Middle East, and North Africa. More are to be found in Latin America (Argentina, Bolivia, Brazil and Columbia) and sub-Saharan Africa (Angola, Democratic Republic of Congo and Sudan). However, cultivation here faces many hurdles, including lack of fertility, shortages of water, difficult topography, problems with land property or exploitation rights, etc.

There are also many competing uses for spare land; for example, exploitation for non-food products as substitutes for petrochemicals, or spaces for recreational and environmental services. There is already competition today between cultivating land for food and first generation biofuels made from sugar, cereals and oilseeds, and this could continue in the future with second generation biofuels (as long as they are not produced from wastes and residues) and if the volumes needed for biofuels are great.

So should food production win out over bio-fuel development? The answer is no. Food production must not undermine the challenge that the scarcity of fossil resources, notably petroleum, presents. Clearly, we should promote energy saving measures and a reduction in demand, but we must also develop new sources of energy that are environmentally friendly and economically viable. Public support for the development of biofuels can then be justified as it promotes a nascent industry whose objectives are

clean energy, a better environment and economic efficiency. Research efforts must be prioritized towards new generation biofuels, which use wastes and residues, lingo-cellulosic plants, macro- and micro-cellular algae as they offer better outcomes in terms of energy, environmental and economic efficiency than the current generation of biofuels.

As in the past, the main way to increase food supply is to increase yields, though there must be simultaneous efforts to reduce post-harvesting losses – our second and third options. But this time around, increased yields must not come at the expense of the environment, which happened in the past. Agriculture of the 21st century should be intensive, economical and ecological.

This new agriculture is still in the making. It will need heavy investments in research, notably in biology, genetics, green and white biotechnologies as well as in the production, management and exploitation of large amounts of data. (Green biotechnologies have to do with plants and growing; white biotechnologies primarily focus on using biological organisms to produce or manipulate things.) In all these areas, research is promising and should allow diversifying selection goals and developing plants that can combat harsh conditions, such as droughts and extreme temperatures, and are better adapted to a large spectrum of agro-ecosystems. In this context, using genetically modified organisms (GMOs) cannot be ruled out a priori, provided they do not threaten the environment and health. GMOs may solve some very difficult problems such as salinity or drought. However, they do not represent the miracle solution and they are not automatically synonymous with sustainable food. In a general way, it is crucial to continue developing our expertise in plant biology and biotechnology and not just focus on GMOs.

We also need a global approach to studying farming systems and practices. New practices have to adapt to local conditions and local ecosystems rather than attempting to change the surroundings to fit with new plants and animals. This will require a whole raft of activities including greater diversity in species and varieties, extension of crop rotations, diversification of spatial distribution of crops, planting vegetation cover and catch crops, increased connectivity between ecological infrastructures, etc.

In poor countries, it is just as important to invest in infrastructures, mechanization, water, fertilizers and crop treatment processes as well as basic research. Clearly better storage and transportation will reduce post-harvesting losses and facilitate access to bigger markets over longer time periods.

Reducing losses from field to plate

Less than half of the calories produced by farmers ever make it onto the dinner table. In the late 1990s, farmers globally produced an average of 4,600 kcal per capita and per day. Of this, nearly 600 kcal were lost at the time of harvesting or just after. At this stage, the percentages in losses were strikingly higher in developing countries compared to developed countries. The remaining 4,000 kcal were divided between animal feed, 1,700 kcal (43 percent), and human feed, 2,300 kcal (57 percent). The 1,700 kcal used for animal feed produced in return 500 kcal in the form of eggs, dairy products or meat. Of the 2,800 kcal (2,300 from vegetable products and 500 kcal from animal products) available for human consumption, another 800 kcal were lost through distribution and final consumption. At this stage, the percentages of losses were much higher in developed countries than in the developing world. So on average, of the 4,600 kcal produced from vegetal products for each inhabitant of the world, only 2,000 kcal ended up for actual human consumption. This means that reducing losses and wastage from field to plate will make a huge difference.

It is relatively easy to reduce post-harvesting losses through disease control and the development of infrastructures for storage, transportation and marketing. At this stage, it is essentially a question of investments and thus of budgetary resources. It is much more difficult to reduce wastage at distribution and final consumption levels since this requires profound changes in food consumption patterns and possibly an easing of regulations (as long as food safety requirements are met).

Decreasing the amount of animal production would also help but there are caveats. Firstly, reducing the consumption of meat products is not advisable on health grounds, except for the well-off. Many poor households, in developing countries but also in developed ones, lack protein in their food rations. Secondly, animals have other advantages, especially in poor countries that have limited access to mineral fertilizers and mechanization: they use large herbaceous areas; they provide organic fertilizers and work as draught animals, etc. Finally, as mentioned above, we need to keep the big picture in mind and what role balancing vegetal and animal production plays alongside other uses of land.

Safeguarding international trade

Of course, it is not just the average number of calories that have to be produced that matters. There is also the question of how accessible they are (because of prices, political unrests, etc.) and how they are distributed.

The INRA-CIRAD Agrimonde foresight study predicts a substantial increase in the global trade of agricultural and food products by the year 2050. Currently, international agricultural markets are tight, segmented and concentrated in a few countries. In future there will be larger volumes but the direction of trade will be the same as today: originating in OECD and Latin American countries and going to Asia, the near and Middle-East and Africa.

Even if there is a significant increase in domestic production, many developing countries will still need to import to meet the needs of their populations. The challenge that lies ahead is thus to safeguard agricultural trade. This requires regulations on a global scale to guarantee security of purchases when supplies are short and prices high, and to ensure that local production does not decline when prices are low. At the same time and irrespective of the price situation, efforts will be needed to reconcile production goals with the necessity to protect environment and natural resources. The first two points require public facilities for storage of agricultural commodities, managed on a global scale and de-linked from governments and firms (something like a world independent agricultural world bank). The third point requires a better integration of environmental concerns within the rules governing international trade, and a reorientation of scientific and technical research in order to minimize the negative effects of increased agricultural production and trade on natural resources.

This renewed global governance of international trade in agricultural and food products may appear an illusionary, even utopian idea, but it is necessary. The public and private sectors should not use the difficulty of the task as a pretext to shirk from their responsibilities.

From ideas to actions

The global food challenge is made even harder by a plethora of unforeseen circumstances. We cannot predict with certainty the spread of new human, animal and plant diseases, the effects of climate change or the future development of economies and markets. These uncertainties have a tendency to multiply at a fast pace. There must be

more research into how to develop agricultural and food systems that are more resilient to global changes.

But uncertainty must also not be a pretext for inaction. Global food security concerns may have won the battle of the mind, but there is still little concrete action (investments, innovations, global governance, etc.). Research must show the way by increasing its effort, and by mobilizing stakeholders – farmers, industrialists, consumers, non-governmental organization etc. – in a coordinated manner.

The courses of action that will ensure long-term food and energy supplies, containment of environmental deterioration, and the reversal of the rise of inequalities are being decided today. In a world of scarce resources, the rarest commodity is undoubtedly time. In order to feed more than nine billion human beings by 2050 under a sustainable development framework, we have to act now. Basic research and research and development can propose solutions, but it is not be enough. To win this race against time, the world needs above all a firm political will and courage.

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