The Economist

Feed and food

How to provide a protein-rich diet to a growing population

What goes onto people's plates matters. So does what gets fed to animals

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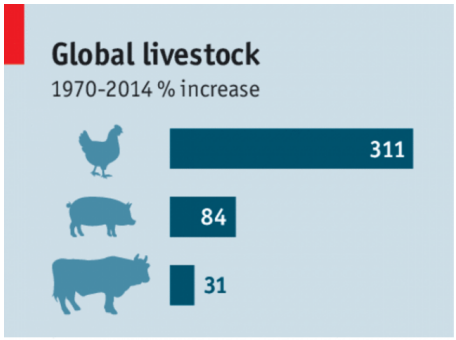

BETWEEN now and 2050 the planet's population is expected to rise by a third, from 7.6bn to 9.8bn. Those extra mouths will need feeding, and not just with staples. As people grow richer, their demand for protein rises, particularly for meat and fish. Beef consumption in Asia, for example, is expected to jump by 44% over the next decade alone.

Raising animals to be eaten already has huge effects on the world's environment. The number of farm animals soared during the 20th century. More than 20bn chickens, 1.5bn cattle and 1bn sheep are alive today. A quarter of the world's land is used for grazing them. They consume 30% of the world's crops. They guzzle water—you need about 15,000 litres of the stuff to produce a kilo of beef, compared with only 1,500 litres for a kilo of maize or wheat. And their eructations do nothing for the climate. Livestock are responsible for 14.5% of all anthropogenic greenhouse gases, according to the UN Food and Agriculture Organisation (FAO).

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How then may the planet be fed sustainably? One set of answers revolves around convincing people to put different things on their plates. Vegetarians have the simplest solution of all, but try telling people in sub-Saharan Africa that they

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should stick to cassava. Encouraging people to eat more fish rather than more meat is a better answer. Human consumption of fish has now overtaken that of beef, and aquaculture accounts for half of all the fish people eat. But almost 90% of wild stocks are fished either at or beyond their sustainable limits. And farmed fish, particularly salmon, are often fed on smaller fish that themselves are caught at sea. A fashionable idea is for Westerners to eat more insects, which contain up to three times as much protein as beef and already form an integral or supplementary part of up to 2bn people's diets, according to the FAO. But for that to happen, many will have to get over the "yuck" factor.

Another set of answers involves using technology to create artificial protein. Investors such as Bill Gates and Richard Branson have backed artificial-meat startups that grow beef and poultry from animal cells. Tyson Foods, a meat processor, is an unlikely fan of plant-based proteins. Scientists are also looking at genetic modifications to animals—to increase the muscle of cattle or to reduce infections among farmed fish.

Innovations such as these have enormous potential, if they can be industrialised and win over wary consumers. But changing what humans eat is not the only route to feeding a growing population more sustainably. Another, less obvious, approach is to alter what animals themselves eat. It is here that technology may have the biggest impact soonest.

One source of improvement lies in the more efficient use of crops to feed animals. The proliferation of mills that process grain into feed is helping in places such as sub-Saharan Africa, for example. Data-intensive farming is helping improve agricultural yields of feed crops like soyabeans by carefully monitoring the use of water and fertiliser.

Eat shit and diet

A more radical approach is to change animals' diets. Efforts to reduce the amount of fish meal used in aquaculture have already paid dividends. In 1990 90% of salmon feed used in Norway was fish meal, but by 2013 greater use of plant matter had reduced that figure to 30%. More can be done. At most 20% of protein in grains fed to animals is converted to edible protein; the rest is turned into waste products. Cargill, an agricultural giant, broke ground this year on the world's largest gas-

fermentation facility, in partnership with Calysta, a Californian firm that makes feed out of natural gas (see article (http://www.economist.com/news/business/21727935-epitome-big-agriculture-tries-predict-future-food-cargill-intensely-private)). After feeding bacteria called methanotrophs with methane, they can be turned into protein pellets for fish and livestock. Insects are also an option. Flies and maggots can be raised on manure and organic waste, instead of grains, and then fed to cattle, chicken and fish.

The FAO has warned that by 2050 the planet will need to produce 70% more food than it did in 2009. The idea of chomping on more bugs and eating lab-grown meat may capture the imagination. But the path to food sustainability also runs through animals' stomachs.

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