



INTRODUCTION

Feeding the Future

FEEDING THE 9 BILLION PEOPLE EXPECTED TO INHABIT OUR PLANET BY 2050 WILL BE an unprecedented challenge. This special issue examines the obstacles to achieving global food security and some promising solutions. News articles take us into the fields, introducing farmers and researchers who are finding ways to boost harvests, especially in the developing world. Reviews, Perspectives, and an audio interview done by a high school intern provide a broader context for the causes and effects of food insecurity and point to paths to ending hunger.

We have little time to waste. Godfray *et al.* (p. 812) note that we have perhaps 40 years to radically transform agriculture, work out how to grow more food without exacerbating environmental problems, and simultaneously cope with climate change. Although estimates of food insecurity vary (Barrett *et al.*, p. 825), the number of undernourished people already exceeds 1 billion; feeding this many people requires more than incremental changes (Federoff *et al.*, p. 833).

Scientists and engineers can make a big difference at every step from field to fork, from providing new strategies to smallholder farmers who must balance the needs of livestock and crops (Herrero *et al.*, p. 822) to helping farmers get the most from fertilizers, water (Vince, p. 800), soil (Hvistendahl, p. 801), and seeds (Tester and Langridge, p. 818; Pennisi, p. 802). Innovation will be key to monitoring all stages of food production (Gebbers and Adamchuk, p. 828), from defending harvests against pests and disease (Pennisi, p. 804; Normile, pp. 806 and 807) to providing critical information and infrastructure (Stone, p. 808). And training enough scientists in all these areas will be essential (see associated *Science Careers* profiles at www.sciencecareers.org).

As Vince's profile (p. 798) of one Ugandan farmer illustrates, science and technology alone cannot guarantee food security. Economic, political, and psychological issues also play key roles. Yet there is optimism that a Green Revolution is possible in Africa (Ejeta, p. 831), although maintaining good governance throughout the world is crucial to success (see the associated Policy Forum by Smith *et al.*, p. 784).

Much of this special issue focuses on how to increase the supply of basic staples. But Stokstad (p. 810) examines one idea for reducing demand: eating less meat; and Vogel (p. 811) highlights an alternative source of protein: insects. These alternatives are possibly unappetizing to many, but the quest for food security may require us all to reconsider our eating habits, particularly in view of the energy consumption and environmental costs that sustain those habits. As this special issue shows, science can help to make the choices less unpalatable.

—CAROLINE ASH, BARBARA R. JASNY, DAVID A. MALAKOFF, ANDREW M. SUGDEN

Food Security

CONTENTS

News

- 798 From One Farmer, Hope—and Reason for Worry
- 800 Getting More Drops To the Crops
- 801 China's Push to Add by Subtracting Fertilizer
- 802 Sowing the Seeds for the Ideal Crop
- 804 Armed and Dangerous
- 806 Holding Back a Torrent of Rats
- 807 Spoiling for a Fight With Mold
- 808 Dialing Up Knowledge—and Harvests
- 809 What It Takes to Make That Meal
- 810 Could Less Meat Mean More Food?
- 811 For More Protein, Filet of Cricket

Reviews

- 812 Food Security: The Challenge of Feeding 9 Billion People
H. C. J. Godfray et al.
- 818 Breeding Technologies to Increase Crop Production in a Changing World
M. Tester and P. Langridge

Perspectives

- 822 Smart Investments in Sustainable Food Production: Revisiting Mixed Crop-Livestock Systems
M. Herrero et al.
- 825 Measuring Food Insecurity
C. B. Barrett
- 828 Precision Agriculture and Food Security
R. Gebbers and V. I. Adamchuk
- 831 African Green Revolution Needn't Be a Mirage
G. Ejeta
- 833 Radically Rethinking Agriculture for the 21st Century
N. V. Fedoroff et al.

See also Editorial, p. 761; Policy Forum, p. 784; *Science Express Report* by Guo *et al.*; and *Science Podcast*, *Science Careers*, audio slideshow, and other online features at www.sciencemag.org/special/foodsecurity/

Science