

Despairing optimism

Feeding the Ten Billion: Plants and Population Growth

by L. T. Evans

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In 1798, Thomas Robert Malthus, the first economist, wrote an essay about the interaction between human population growth and agricultural production. At that time, the world's population numbered less than one billion and the majority were chronically hungry. Malthus's pessimistic essay, claiming that humans would always reproduce up to the constraints set by hunger, provoked much further debate.

Today's six billion people are, on the whole, vastly better fed, healthier, better educated and materially more prosperous. Enough food is currently produced to feed about ten billion people an adequate vegetarian diet. Approximately 40% of cereal grains are fed to domestic animals, and about three-quarters of a billion people (one person in eight) are believed to be chronically hungry.

The 1998 median projection of the United Nations Population Division foresees a world population of 8.9 billion in 2050.

Population sizes of eight or ten billion are probably equally plausible. The added billions will live mostly in the poorest regions of today. The number to be added depends on individual and political choices now and in coming decades. Most economists and agricultural scientists agree that the rich regions will continue to be able to feed themselves. The great unanswered question – one that keeps Malthus's concerns vivid – is how well the rapidly growing populations of the presently poor countries will eat and live.

Feeding the Ten Billion: Plants and Population Growth aims 'to understand how the evolution of agriculture has both shaped and been shaped by the course of world population growth'. Evans, a distinguished plant physiologist and a former President of the Australian Academy of Sciences, achieves this aim by describing the past interactions of population and agriculture. He writes with authority, subtlety, accuracy, clarity, a marvelous richness of detail and a very engaging human touch. Evans has read widely, and good literature has shaped his perceptions and style. Separate chapters describe the progress of food production as the population grew to five million, 50 million, half a billion, and each successive billion up to the present six billion. His 227 pages of text are armed with 228 excellent references.

Evans shows that up to 1960, when the population was three billion, humans increased the area of arable land in proportion

to population size. Since 1960, the arable area has remained virtually constant (around 1.3 or 1.4 billion hectares), while global average cereal yields have increased in close proportion to population size (at a steady ratio of one metric tonne per hectare for each two billion people).

The population of three billion was a turning-point in another decisive respect: 'if the world population were only three billion, a largely self-sufficient traditional agriculture would be possible, e.g. with two billion hectares under cultivation, half of it in cereals yielding one tonne of grain per hectare. But the population is already twice that and intensification is unavoidable.'

Some scholars, such as Ester Boserup, have held that population growth presses agricultural production forward, whereas others, such as Malthus in 1798, held that the limits of agricultural production constrain population growth. Using abundant concrete examples, Evans integrates those partial truths, as Ronald D. Lee's elegant theoretical models had done previously: '...people, prices and production, both agricultural and industrial, are indissolubly linked, and the question of prime mover becomes a philosophical one.' Evans points out that Malthus himself came to just this balanced view by his fifth edition (1817), although some of his followers have still not done so. And today, 'Malthus stalks through much of Africa while Boserup is at work in China.'

Following this impressive historical achievement, Evans devotes the last 35 pages of text to the future. To encourage modesty about human capacity to know the future, Evans quotes the 'rash declaration of the 1974 World Food Conference "that within a decade no child will go to bed hungry, that no family will fear for its next day's bread and that no human being's future and capacities will be stunted by malnutrition."' On the side of unexpected success, Evans asks 'who in 1960 would have foreseen that the combination of dwarf cereals, cheap nitrogenous fertilizers, new herbicides and investment in irrigation would have such prolonged and synergistic effects on food production? And who, now that the impact of that combination is dwindling, can know what rate of improvement in crop yields to assign to various regions over the next 20–50 years? Yet small differences in these assumptions can lead to projections with very different consequences over such time intervals.'

Evans sees a triple challenge in the next half century: rapid population growth (increasing numbers to feed in poor countries), rapid urbanization (converting the best arable land to nonagricultural uses) and climatic change (stretching the limits of agronomic adaptation, especially in poor tropical countries). 'Trade-offs have been

the inevitable companion of growing populations': trade-offs against 'the long-term sustainability of agriculture and the environment,' Evans writes, and, I would add, trade-offs against many other cultural and social values.

Can the triple challenges be met without forcing people to make tragic choices¹ among dearly held values? Evans describes himself as a 'despairing optimist', in the words of René Dubos. 'The further raising of crop yields to match further population growth without compromising the ability of future generations to meet their own needs will require all the understanding, inventiveness and interaction of farmers, industrialists, agricultural scientists, educators, environmentalists, health care workers and policymakers'. I would add economists to this list and (heaven help us!) lawyers (to help design systems of incentives that will promote the desired innovations), politicians (not merely as policymakers, but as the antennae and larynx of the inarticulate poor – think of Lincoln, Gandhi or Mandela), and theologians, poets and philosophers (to help us see more clearly and render our deepest human values more coherent). It is a worthy challenge. For the factual background to this challenge, beautifully presented, I know of no better account than this book.

Having expressed my deep admiration for Evans's book, let me explain one reservation. Evans argues that increasing global food production can be separated from alleviating poverty. 'The world must develop the capacity to feed the ten billion within the next 40–50 years, predominantly within Asia and Africa. In this context, it is important to distinguish two quite separate but often conflated problems. The first is that of developing the global capacity to produce enough food for ten billion people, i.e. for 67% more than at present, the main focus of this book. The second is that of eliminating the chronic undernutrition that still afflicts so many of us in a world that produces enough food for all. Agricultural research is the key to the first problem but cannot be expected to solve the second, more complex, task of eliminating poverty and providing the work, health and education which should allow the poor to obtain food.'

These two problems are separable conceptually, but I do not think they are separable practically. Separating these two problems might even retard or prevent the solution of both of them.

Evans and many others affirm, and I agree, that most of the world's food will continue to have to be grown at home, however important international transfers of food by trade or aid may be for small economies or in time of crisis. 'The nutritional fate of our fellow human beings varies by

region, by country, by district, by year, by tradition, by gender and by income. It can be ameliorated to a small extent by aid and trade, but for most of our additional billions it will depend primarily on local production.' Given the diversity of local soils, water availability, climatic conditions and biotic environments, it seems unlikely that the future of local production lies mainly with the farming by foreign experts of cultivars developed by foreign experts.

It seems more likely that the future lies in the direction pointed by Peter Kenmore. 'The FAO [Food and Agriculture Organization of the United Nations] "Inter-Country Program for integrated pest control in rice in south and south-east Asia", begun in 1986 under the leadership of Peter Kenmore, has shown that the small farmers of Indonesia can be effectively taught how to look at the rice paddy as an ecosystem and to manage it with smaller inputs of pesticides and fertilizer and with less variation in yield. ...Kenmore insists that "IPM [integrated pest management] is not a technology; it is a problem-solving process" through which "National IPM programs replace investment in chemicals and their associated pest-surveillance systems by investment in people.'" Evans himself argues that 'as inputs and interactions multiply, farm management expertise becomes an ever more crucial element in crop production.'

Following Amartya Sen, Evans writes that 'the problem of food insecurity is less one of insufficient production than of lack of "entitlement", i.e. of the means to command food. ...On a world scale, such lack of entitlement by the poor results in the demand for food being less than the need. Thus, while many of those with low incomes have benefited from the fall in cereal prices in recent years, the absolutely poor may not have.'

Putting the need to increase local food production together with the need to entitle poor local people to purchase food suggests that educational investments in rural poor farmers (including, but not limited to, an understanding of local agricultural ecology, and in combination with other prerequisites of agricultural development) could be key to solving both problems. A broader vision of agricultural research would help bring the two problems together. In a broader vision, biotechnology, agricultural experiment stations, and all the traditional biological and chemical research, public and private, in support of agriculture would remain crucially important. Such research would become increasingly carried out by local people with respect for local environments, and increasingly sensitive to local cultural priorities for the timing and mode of food production, as well as for the preparation and taste of food. Added to these traditional elements of agricultural

research would be a greatly expanded place for operations research on the development of farmers. As most of the world's farmers are reported to be women, such research would inevitably have to develop an understanding of gender roles in different cultures.

Evans would probably be sympathetic to this broader vision of agricultural research. He wrote: 'Even when food availability increases and hunger decreases, malnutrition may not do so because of poor access to sanitation, clean water, health care and education. Women and children are frequently disadvantaged in these ways, particularly through lack of elementary education, despite the high rates of social return on public investment in rural education.'

Two logs burning side by side generate a far hotter fire than two logs burning separately. Addressing food production and farmer development simultaneously in poor countries may release the energy required to solve both problems.

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