Alternative View of 'Food, Society, Plant Pathology'

All of us are aware of the primary challenge: to increase the production of food and fiber through decreased plant disease loss in order to feed growing populations.... Given our track record, I am confident—even optimistic—that if our success depended solely upon technology, we would meet the challenge even under the constraint of time.

James F. Tammen, PLANT DISEASE
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As society grows geometrically, its requirements grow geometrically. To meet the geometrically increasing requirements for its bare survival, society trusts providence or the agricultural sciences, failing to accept that the essential resources are at once finite yet infinitely renewable. One wonders if society will constrain itself voluntarily or will grow unconstrained to dinosaur proportions, with mammoth appetite exceeding resources one day before oblivion.

James Tammen reminded us of the challenge that society is issuing to the agricultural sciences and noted that the challenge is too urgent to be ignored. The nature of the challenge seemingly precludes refusal, and thus I suspect that few scientists or scientific societies have critically weighed the consequences of our acceptance. Yet that very acceptance implies our ability to collectively contribute the technology with which the challenge may be met. Can the science of plant pathology realistically meet the stated challenge? If our stated goals (and implied future contributions) are unrealistic, what are the effects of such optimistic delusions on people outside our profession?

To examine these issues objectively, the challenge from society must be revealed in concrete form. What is the size of the population we are trying to feed? The Global 2000 report to the President, *assuming extensive policy changes and developments to reduce human fertility rates*, projects an increase from 4.5 billion people in 1980 to 6.35 billion by 2000. Food production must then be increased by 41% in two decades. What is our track record in plant disease control? In the 1953 *U.S. Yearbook of Agriculture*, Jessie Wood estimated crop losses due to plant disease as 10% of potential total production. George Agrios, in his 1978 text, *Plant Pathology* (2nd ed., Academic Press, New York), provided an estimate of 11% loss in potential crop production. If these estimates are correct, we did not achieve any reduction in the percentage crop loss due to diseases in that 25-year interval.

If we could totally eliminate losses due to plant disease in the next two decades, plant pathology would contribute only one-fourth of the required increase in productivity. If all crop losses (preharvest and postharvest) caused by weeds, pests, and diseases were eliminated in 20 years, crop protection would just provide the necessary food increase. This means extinction of *all* crop pests—and at present not one appears on the endangered species list. Which of you believes we can achieve this goal? Of course we cannot. The prospects for zero disease loss are remote or nonexistent. Our real contribution has been to prevent disease losses escalating to 100% despite adoption of agricultural practices that favor epiphytotic disease (C. E. Yarwood, *Science* 168:218). That contribution will be no less imperative in the future nor is it likely to be less difficult, given the dynamic persistence of the plant pathogens that challenge our disease control technology.

I have tried to show that the goal of feeding growing populations through decreased plant disease loss and the contribution it implies are unrealistic. Some will reason that while plant pathology alone cannot meet society's challenge, we may be confident of the combined ability of the agricultural sciences to deliver the required technology. With its short-term validity, this reasoning baits a streamlined and scaled-up version of the very trap it seeks to avoid. The Global 2000 report projects adequate food production for the world population up to the year 2000, *assuming that agricultural technology will continue to increase crop yields at a rate equal to or above the record rates of the past three decades, including the Green Revolution.* In the process, the real price of food will double, the world's forest area will decrease 20%, desert area will increase 20%, and at least 500,000 living species will become extinct—but the number of human beings per year added to the world will be even higher than it is now. At the growth rate projected for 2000, the world's population will reach 10 billion by 2030, assuming that massive crop failures or wars do not intervene. The U.S. National Academy of Sciences previously estimated that an *intensively managed* world could not support a world population above 10 billion with any degree of comfort and individual choice. This is a staggering conclusion; anyone with a present life expectancy of 50 years can expect to see world population reach—and exceed—maximum sustainable levels.

The earth's finite capacity to support life and absorb environmental impact sets the upper limit for technological response to society's challenge. The nature of the challenge will make this response inadequate within 50 years. Yet confident predictions of technological capability abound in the literature because they impart a desirable positive aura to scientific reviews, grant proposals, and popular articles.

Those who regard such pervasive optimism as harmless miss an insidious consequence. People with the misguided faith that technology will provide the solutions to world problems are not motivated to work for real solutions. Scientists who provide false bases for such faith perform a great disservice to society. Until people appreciate the magnitude and severity of the impending world crisis, as well as the urgency and difficulty of the solutions, they cannot be expected to support the painful economic, social, and political transition to a sustainable global community.

I urge thinkers among plant pathologists to critically reconsider the goals of our science and profession in relation to current and projected global problems. There are challenges our science can and must meet and corresponding goals we ought to state. I suggest four tentative objectives:

1. Continue to control plant disease losses in high-yielding agricultural systems that necessarily favor epiphytotic disease development.
2. Continue to adapt existing technology to assist developing countries formulating integrated programs for food self-sufficiency.
3. Join other sciences to authoritatively advise policymakers and the public of the inability of technology to solve major global problems, *before* other opportunities for workable solutions are lost.
4. Evaluate social and technological changes to which our science contributes in terms of global ethics, seeking alternatives to practices that cannot be sustained for the benefit of all, now and in the future.

Some of these objectives may seem dangerously like "getting involved" in economic, social, or political issues. In defense, I hold that plant pathologists must be responsible for informing society of the limitations and dangers as well as the benefits of the technology we contribute. As scientists, we are responsible for the philosophy as well as the skills of our profession.

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