Like many parts of society, agriculture has become highly dependent on computers in recent years. Even small farmers who till their fields with ox-drawn ploughs probably rely on supplies produced in high-tech factories and transported thousands of kilometres over computer-controlled transportation networks. Their seeds and fertilizer, their irrigation water and electricity, their credit and marketing facilities may all be vulnerable to Year 2000 computer problems. At least in the near term, the Millennium Bug could prove to be one of the most dangerous pests threatening farmers, along with the locusts and brown planthoppers they have battled with throughout the centuries.

The most severe problems for agriculture are likely to occur not in the fields themselves but in upstream and downstream activities – in the production and delivery of essential inputs and services and in the processing, distribution and marketing of farm produce. These problems could have severe consequences both for agricultural production and for national and household food security.

In one way or another, Year 2000 computer problems threaten almost all of the supplies and services essential for agricultural production. These include:

- **fertilizers and pesticides** – the productivity of many high-yielding crop varieties depends on regular applications of petrochemical fertilizers and pesticides. The production of these chemicals could be interrupted by breakdowns in their factories due to embedded chip malfunctions. And the transportation and financing of shipments to developing countries could also be disrupted, putting agricultural production in many of the intensively farmed “Green Revolution” areas at risk.

- **seeds** – many farmers in developing countries depend on purchase and delivery of highly commercialized seeds. Disruptions to inventory, shipping and transportation systems at a critical time of year for seed deliveries could jeopardize crop seasons for some farmers.

- **transport** – these essential inputs reach the fields at the end of a long journey by ship, rail and truck. Although most Year 2000 transportation worries have focused on the risk to air traffic control systems and air safety, the shipping, rail and trucking systems also rely heavily on computers for scheduling. One recent report noted that “the maritime industry is just waking up to the fact that navigation and shipboard systems are in jeopardy of failing or malfunctioning”. This could pose problems for food shipments and also for the productivity of some fisheries.

- **irrigation systems** – many large-scale irrigation systems depend on computers to regulate the flow of water. The World Bank warns that “the Year 2000 problem may have serious implications for developing countries where large investments have been made in building dams and
energy – agriculture is energy-intensive. Irrigation pumps, tractors, milking equipment and many other pieces of farm machinery need electricity, gasoline or diesel fuel to run. Electrical generating plants and transmission grids, oil and gas refineries, fuel pipelines and transport systems are all highly computerized and highly vulnerable. If and where they fail, agricultural production will suffer.

banks and financial systems – farmers large and small frequently need credit to purchase seeds, fertilizer and other inputs. This leaves them vulnerable to the threat of Y2K problems in the highly computerized and interconnected banking and financial systems, where local failures could trigger national, or even global, chain reactions and temporarily dry up flows of credit.

Year 2000-related computer problems could also bring disruptions in almost any aspect of food processing, marketing and distribution. The risks are greater in developed countries with highly integrated industrial systems. But Y2K problems could also affect developing countries through their impact on:

transportation – just as farmers depend on transport to receive necessary inputs, they rely on trucks, trains, ships and planes to deliver their perishable produce to processing plants and markets, at home and around the world. Most experts pinpoint transportation as the weakest link in the food chain. In testimony before the United States Senate, the chief economist of Deutsche Bank Securities asked pointedly, "Will the railroads be able to operate at full capacity to transport grains, livestock and finished-food products? Will ships move freely in and out of ports to deliver the imported and exported foods that are so important to global trade?"

processing plants – like other industrial activities, food storage and processing plants rely heavily on equipment that may be vulnerable to failure of either computer control systems or embedded processors. Even if the food processing activity itself is not disrupted, flaws in computer systems responsible for managing inventory and shipments could create production and delivery bottlenecks.

telecommunications – farmers, traders in agricultural commodities and government ministries rely on national and international telecommunications links to deliver a steady flow of information on weather, prices and shipping. "If the phones don't work," one Year 2000 expert asked, "what might be the impact on food production, distribution and exports?" In many countries, the computerized telephone switching systems are considered among the most likely to fail.

marketing systems – trade in agricultural commodities depends on massive computer systems, high-speed exchanges of vast quantities of data and transport of produce across countries, continents and oceans. Food marketing and distribution systems are highly vulnerable to breakdowns in telecommunications, financial systems and transport. "If you don't know who needs grain," asks biologist Geri Guidetti, who moderates an Internet forum on Y2K and agriculture, "if you don't know what global prices are ... what's going to happen to the normal grain commerce?"
To prevent or mitigate Year 2000-related problems in agriculture and food availability, farmers, food supplies for families and essential foreign exchange resources needed by governments to finance imports of food and agricultural inputs. Both food security and future agricultural production could be affected.

The possible impact of Year 2000 problems on agricultural production, trade and transport poses a particular threat to:
- countries that depend heavily on exports of agricultural commodities as a major source of income; and
- countries that rely on food imports and food aid to meet the needs of their populations.

The key to minimizing the impact of the Year 2000 problem, whether at the level of a smallholding farmer, a large food industry enterprise or a national government ministry, lies in giving priority attention to a three-part strategy that includes:
- assessment of areas of risk and vulnerability
- remedial and preventive action to address the most severe threats
- contingency planning and preparation to adapt to problems for which solutions may be impossible or unaffordable.

In some cases, fear of the Millennium Bug may pose a greater danger than the computer problems themselves. Panic-buying and hoarding of agricultural inputs and food could create severe, artificial shortages and price distortions.

As K. Poulsen warned in an article in Wired magazine, “The dissemination of misleading, partial, erroneous or speculative information about Y2K risks may cause social distress. The public may stockpile food or withdraw savings from banks. The potential effects of a ‘new millennium’ paranoia can be crippling and endanger the public order.”

The best antidote to panic and paranoia is information. Providing accurate, timely and sensible analysis of potential problems will allow farmers and other key participants in food production and distribution to protect against—rather than create—short-term problems of prices and supplies.

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At the national level, urgent action must be taken to mobilize awareness within governments, as well as among farmers and the food industry, of possible threats to agriculture and food security. Priority must be given to identifying:

1. locally controlled equipment and processes essential to food production and distribution that may be affected by the Millennium Bug. These might include national transportation, electricity, banking and telecommunication systems.
2. external sources of essential supplies and services that may suffer from Year 2000 problems, including sources of agricultural inputs, financial services and food imports.

Once vulnerable points have been identified, research and analysis will be required to determine the degree of risk, the potential impact of Y2K-related system failures, and the costs and time required for replacement or repair. On the basis of that analysis, plans and priorities can be developed to minimize both the risk and the impact of Year 2000 problems.

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In the case of locally controlled equipment and systems, research and analysis may be required to determine both the levels of existing Y2K compliance and the costs of improving it. Problems in banking systems, for example, might not only disrupt flows of short-term credit but could have an impact that would be felt over a much longer period.

At the same time, external sources of essential supplies and services should be required to provide full reports on Y2K compliance. Steps should be taken to make external parties aware of their responsibilities to provide full compliance information and continuity of services. Contracts and procurement rules should be modified to include assurances of Y2K compliance and insurers should be pressed to clarify their responsibilities in the event of Y2K-related failures.

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The best antidote to panic and paranoia is information. Providing accurate, timely and sensible analysis of potential problems will allow farmers and other key participants in food production and distribution to protect against—rather than create—short-term problems of prices and supplies.
In the case of relatively small computer systems and applications, the simplest and most effective way of eliminating Year 2000 problems may often prove to be the replacement of non-compliant equipment. Certainly, the costs of software revision, which can be considerable, should be weighed carefully against the costs of purchasing new systems that may offer significant performance advantages as well as being certified Y2K compliant.

But this approach clearly cannot be applied in the case of systems that are either externally controlled or prohibitively expensive. Similarly, modifying existing systems and software to make them Y2K compliant may not represent a viable option because of the very limited time remaining before 1 January 2000. Modifying systems can be extremely expensive and time-consuming. Many large corporations started work years ago to achieve Y2K compliance, contributing to a total expenditure of some US $600 billion, as estimated by the Gartner Group. In the process, qualified Y2K experts have become increasingly scarce and extremely expensive.

Under these circumstances, farmers and governments in developing countries may not be able to remedy or avoid some Year 2000 problems, particularly those that may erupt in international financial, production and transportation systems. In many cases, their most realistic approach may be to concentrate the limited time and resources available on developing and implementing contingency plans to cope with failures that they do not have the means to prevent. Even these approaches may entail significant costs and therefore require careful analysis and planning.

Key elements in such plans may include diversifying sources of supplies and services in order to reduce the impact of failure by any individual supplier. Other steps may include adopting procedures to ensure that failures are identified promptly and that alternative channels for delivery of essential goods and services are in place and ready to be activated if and when computerized systems fail.

In some cases, without exacerbating the “Fear 2000 problem” of hoarding and panic-buying, farmers and governments may decide to review the level of their food security stocks and inventories of essential agricultural inputs.

“Should farmers be encouraged to stockpile the basic inputs they need to produce food in 2000?* economist Ed Yardeni asked pointedly in testimony before the United States Senate. "Should we be ready to provide food assistance to nations overseas that have major Y2K-related problems with their food supplies?"*

Those same questions need to be asked and answered at all levels, from the farm to the government ministry.

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