

## LAUNCHING OF THE NEW PLANT SCIENCES CENTER

**St. Louis, Missouri**  
**July 30-31, 1998**

It is an honor to participate in the launching of the new Plant Sciences Center, which is being established by four founding partners—Monsanto, Washington University, the University of Missouri-Columbia, and the Missouri Botanical Garden—with help from the Danforth Foundation and the State of Missouri.

Washington University and the University of Missouri-Columbia are outstanding research and teaching institutions that have contributed greatly to the development of biotechnology applications in the plant sciences. The Missouri Botanical Gardens is a world leader in plant taxonomy as well as in teaching the general public about plants and the importance of biodiversity.

Hopefully, the new center will generate new breakthroughs in the plant sciences that will help assure more plentiful, reliable, and nutritious food crops, and also serve as a key transfer point for plant biotechnology research information and techniques to scientists from other nations in the world.

### **Food and Fiber for the 21<sup>st</sup> Century**

The task before humankind to meet the food and fiber crop requirements of the 21<sup>st</sup> Century is huge. In 1994 global food production of all types stood at 4.74 billion metric tons of gross tonnage and 2.45 billion tons of edible dry matter. Of this total, 98% was produced on the land—only about 2% came from the oceans and inland waters. Plant products constituted 93% of the human diet, with about 30 crop species providing most of the world's calories and protein. These included eight species of cereals, which collectively accounted for 66% of the world food supply. Animal products, constituting 7% of the world's diet, also come indirectly from plants.

Had the world's food supply been distributed evenly, it would have provided an adequate diet in 1994 (2,350 calories, principally from grain) for 6.4

billion people--about 800 million more than the actual population. However, had people in Third World countries attempted to obtain 30% of their calories from animal products--as in the USA, Canada, or EEC countries--a world population of only 2.6 billion people could have been sustained--less than half of the present world population.

These statistics point out two key problems of feeding the world's people. The first is the complex task of producing sufficient quantities of the desired foods to satisfy needs, and to accomplish this Herculean feat in environmentally and economically sustainable ways. The second task, perhaps more daunting than the first, is to distribute food equitably. Poverty is the main impediment to equitable food distribution, which, in turn, is made more severe by rapid population growth.

During the 1990s, world population will grow by nearly one billion people and then again by another one billion people during the first decade of the 21st Century. A medium projection is for world population to reach 6.2 billion by the year 2000 and about 8.3 billion by 2025, before hopefully stabilizing at about 11 billion toward the end of the 21st Century.

As in the past, humankind will rely largely on plants--and especially the cereals--to supply virtually all of our increased food demand. Even if current, and often inadequate, per capital food consumption stays constant, population growth would require that world food production increase by nearly 60% by 2030, as compared to 1990. However, if diets improve among the hungry poor—estimated to be at least one billion today—annual food demand could increase by nearly 100%.

It took us roughly 8-10,000 years to get agricultural production to the level it is now. Despite this Herculean achievement, over the next 50 years or so, the world's farmers will have to produce twice as much food and fiber as they do today.

The hallmark of 20<sup>th</sup> Century agriculture has been the adoption of yield-increasing, land-saving technology, which has permitted us to keep pace with the rapid population growth. Take the United States as an example. In 1940, the production of the 17 most important food, feed and fiber crops totaled 252 million tons from 129 million hectares. Compare these statistics with 1990, when American farmers harvested approximately 600 million tons from only 119 million ha—10 million less than 50 years previously. If

the United States attempted to produce the 1990 harvest with the technology that prevailed in 1940, it would have required an additional 188 million hectares of land of similar quality. This theoretically could have been achieved either by plowing up 73% of the nation's permanent pastures and rangelands, or by converting 61% of the forest and woodland area to cropland.

In actuality, since many of these lands are of much lower productive potential than the land now in crops, it really would have been necessary to convert a much larger percentage of the pasture and rangelands or forests and woodlands to cropland. Had this been done, imagine the additional havoc from wind and water erosion, the obliteration of forests and extinction of wildlife species through destruction of their natural habitats, and the enormous reduction of outdoor recreation opportunities.

Impressive savings in land use have also accrued to China and India through the application of modern technology to raise yields. Had the cereal yields of 1961 still prevailed in 1992, China would have needed to increase its cultivated cereal area by more than three fold and India by about two fold, to equal their 1992 harvests. Obviously, such a surplus of agricultural land is not available.

I have been working for the past 12 years in Sub-Saharan Africa, known as Sasakawa-Global 2000 (SG 2000), and which is a partnership of two NGOs—the Sasakawa Africa Association, of which I am President, and the Global 2000 program of the Carter Center, which is chaired by former U.S. President Jimmy Carter. The SG 2000 projects were conceived by the late Ryoichi Sasakawa and have been funded since their inception by the Sasakawa Foundation, recently renamed as the Nippon Foundation. Projects are currently in operation in 12 sub-Saharan countries.

Working with national extension services, we have been involved with more than one million farmers who have grown demonstration plots (0.5 to 1 acre) to evaluate improved technology. Most of these plots (known by different acronyms depending on the country) have been concerned with demonstrating improved technologies, mainly in maize, wheat, sorghum, cassava, grain legumes, and potatoes.

The improved technological packages include: (1) the use of the best available commercial varieties or hybrids, (2) proper application at moderate

levels of appropriate fertilizers to restore plant nutrients in the soil, (3) improved agronomic practices that assure proper rates, dates and methods of planting, timely weed control, efficient use of available soil moisture, and when needed, crop protection chemicals, and (4) improvement of on-farm storage structures and methods for harvested grain, both to reduce postharvest losses and to extend the marketing season by safely holding stocks until prices are more favorable.

In virtually all of the SG 2000 project countries, demonstration plots yields have been two-to-three times higher than those obtained in the control plots or in traditional farmers' fields.

SG 2000 and national research and extension organizations have been working with Monsanto for three years to introduce conservation tillage technology to small-scale farmers in Ghana. In Ghana, a typical farm family of eight cultivates 3 to 4 acres, which is about all you can work by hand, using a machete and a hand-hoe.

Small-scale Ghanaian farmers who are using conservation tillage list many benefits. The mulch left on the surface helps to preserve moisture and reduce erosion—factors that increase yields. Since the land isn't plowed under conservation tillage, farmers have time to plant more land. Women farm members—who provide much of the labor on food crops—especially appreciate the reduced weeding required with conservation tillage, estimating that it added up to "weeks" of time that normally were spent in the hot sun, bent over, pulling weeds. The increased income made possible through conservation tillage helps assure family food security, shoes and school books for the children, and medicine in times of sickness.

Africa's resource-poor farmers eagerly want access to yield-increasing, labor-saving, cost reducing technologies like conservation tillage as well. The challenge is for governments, donors, and NGOs to really support resource-poor farmers in their struggle to access these production tools to improve their economic well being.

### **A Tribute to Monsanto**

I would like to pay tribute to the Monsanto company and staff for their vision, tenacity to push forward the frontiers of science and technology, and strong sense of social responsibility. Most people are pretty comfortable

with the "status quo" and prefer to play it safe. In the agricultural sciences, Monsanto has sought to overcome this inertia with bold new ventures.

About five years ago, Monsanto had recently completed a corporate visioning exercise in which the staff had said that they wanted the company to do something "extra" for agricultural development in the developing world, which probably would be "revenue neutral," at least for the intermediate term. The Monsanto leadership incorporated this "developing world" objective into their business plan.

With less experience in working with small-scale farmers, Monsanto invited several non-governmental organizations (NGOs) to discuss possible partnerships with them in the delivery of improved agricultural technology, in which Monsanto had expertise. My organization, the Sasakawa-Global 2000 program, was one of those that agree to collaborate with Monsanto in several countries of Africa to introduce conservation tillage technology to small-scale farmers. We are well satisfied with the results.

Monsanto was a major financial supporter of the World Summit on Microcredit, held last year in Washington D.C. Thousands attended this meeting, including a number of Heads of State. It was an influential meeting and much activity is under way today to provide additional microcredit services to the world's poor.

Monsanto the world leader today in agricultural biotechnology. It went through all of the regulatory hurdles to bring BST to the marketplace, where it has now become an accepted component in modern milk production. Monsanto has introduced into the marketplace genetically-modified varieties that have a built-in defense against certain pests. In the research pipeline, no doubt, are crop varieties with new resistances to various diseases, and tolerance to climatic extremes and soil toxicities. Monsanto scientists are also working to improve nutritional quality in our foods and to increase the maximum genetic yield potential of our main crop species.

With their powerful new genetic knowledge, scientists have the capability to pack large amounts of technology into a single seed, which becomes a very simple and effective delivery mechanism. Despite current campaigns by extremist groups, the products of agricultural biotechnology will no doubt spread rapidly among farmers in developed countries during the coming decades.

But will these breakthroughs also reach small-scale farmers in the developing world? This issue goes far beyond economics; it is also a matter for deep ethical consideration. While appropriate safeguards should obviously be put into place, it is critical to develop mechanisms to ensure that these new agri-biotech products reach the small-scale farmers of Africa. Public and private cooperation will be especially important in achieving these objectives. I believe we must give this matter serious thought.

Perhaps this new Center for Plant Sciences will take as one of its objectives, the study on how best to assure that the world's small-scale farmers also will enjoy the benefits of the new plant science and technology.

### **Standing Up For Science, Fact, and Reason**

In closing, let me say that a very important question facing agricultural scientists and professional foresters today is "will they be permitted to use the science and technology essential to producing the food and fiber needed by future generations?"

Science and technology are under growing attack in some affluent nations where special interest groups—although lacking research evidence or food production experience—raise hypothetical and often irresponsible issues about food, food safety and environmental impacts.

There is the danger that a few media-savvy, well-financed, highly-effective lobbying groups, headed by utopian environmentalists with narrow special interests, may influence and convince policy makers to prohibit or restrict the use of technology essential to attaining the food and fiber production goals dictated by the rising population

Of course scientists and researchers must pay attention to public values and legitimate concerns, and must explore all legitimate and reasonable questions about the potential impacts of its activities. However, too many opponents of biotechnology too easily dismiss the many safety and regulatory checks that govern whether a new agricultural product is brought to the marketplace as worthless. Unfortunately, they willfully choose to emphasize highly unlikely potential risks rather than recognize the years of experience, research, and regulatory oversight that govern the safe use of these new technologies."

The more irresponsible of these groups claim that the consumer health is being harmed by the current high-yielding systems of agricultural production and recommend that we revert back to the lower-yielding technologies of an earlier age. And yet those of us in the developed world live longer, more productive lives than ever before. Indeed, if there is any food problem in the USA and other industrialized countries, its obesity not food safety.

Some contend that small-scale food producers can be lifted out of poverty without the use of modern agricultural inputs, such as improved seed, fertilizer, and agricultural chemicals. How wrong they are! We must face up to the fact that we cannot turn back the clock to the "good old days" of the early 1930s, when world population stood at two billion people and little chemical fertilizer and few agricultural chemicals were used.

The common misconception that fertilizers and pesticides are similar types of compounds especially disturbs me. Fertilizers (whether organic or inorganic) are plant nutrients, in the same way that food are nutrients for people. Properly used, fertilizers have no toxic effects. In contrast, pesticides are chemicals selected for their toxicity to kill insects, disease organisms, rodents, and weeds.

The world's farmers use about 100 million nutrient tons of nitrogen, with most of this coming from inorganic fertilizers. Without the use of inorganic fertilizers, we would probably need 4 billion cattle—three times the number in existence today—to produce the equivalent nitrogen from the manure. Similarly, we would need hundreds of billions of poultry, or tens of billions of sheep or goats. Such animal populations aren't even remotely available around the world, even if all of their excrements could be collected and returned to the soil as plant nutrients.

So far, agricultural research and production advances—and the efforts of the world's farmers—have kept gains in food production ahead of global population changes. However, there can be no lasting solution to the world food-hunger-poverty problem until a more reasonable balance is struck between food production/distribution and human population growth. Unless Third World poverty is ameliorated, the masses of displaced hungry miserable migrants will increase, and with it will come more social and political instability. Pressure for people to migrate elsewhere—ideally an industrialized country—is increasing. This will cause much international

tension and despair for individuals and families. Time is late and this enormously large and complex problem must not be ignored!

Agriculturalists and environmentalists have a professional and moral obligation to warn the political, educational, and religious leaders of the world about the magnitude and difficulties of producing ever-greater quantities of foods to feed the unrelenting "population monster." If we fail to act now, any possible solution in the future will inevitably be more difficult and costly to achieve.

