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Written Statement for the Record
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Chairman Carnahan and Chairman Payne, Ranking Member Rohrabacher and Ranking Member Smith and Committee Members thank you for the opportunity to testify today on such a vital topic---global hunger and food security. I am William Danforth, former chancellor of Washington University and now chair of the board of the Donald Danforth Plant Science Center both in St. Louis, Missouri. I have been involved in biomedical research for more than fifty years and in plant science for the last dozen years.

I got into plant science because I believed

- that plant science had been neglected and underfunded for decades,
- that it was important because the next generations of innovations in agriculture depended on science,
- that because of underfunding and old-fashioned research management at the national level there were few high-quality plant science programs, few, that is, compared with biomedical programs,
- that because of the depth and breadth in biomedical sciences including genetics, cell biology, molecular biology and so on, we in our region could build first rate programs,
- that success of our work in St. Louis and, in fact of all plant and agricultural research would require change from the traditional research management of the USDA and the adoption and funding of strong, well managed, research programs in which research grants were awarded to the most promising programs as judged by knowledgeable scientists in open competition.

The last Congress established the new National Institute for Food and Agriculture (NIFA). It is now up and running with Dr. Roger Beachy as its founding director. Its competitive grants program is called The Agricultural and Food Research Initiative Competitive Grants Program (AFRI). It was modeled after the stronger programs of the

NIH and the NSF. This new program is the opportunity to develop a first-class research program modeled after the best parts of the NIH, the NSF and the best of the USDA programs.

I believe that, there is enormous potential for modern agricultural research to address issues of hunger and food security and make our world a more livable planet for generations to come. Now in 2010 we have the federal agencies ARFI and the Agency for International Development (AID) poised to use the technologies and power of modern research to bring great boons to the fields under the jurisdiction of this sub-committee.

Now I will talk about the Donald Danforth Plant Science Center, because our goals are close to some of the concerns of this House Committee. I do so because it might give an example of how one can use plant science to address human problems.

The mission of the Danforth Plant Science Center is to improve the human condition through plant science. Each day Danforth Center scientists and staff pursue new discoveries with the potential to help feed the hungry and preserve and renew our environment. That may sound challenging, but, if we work together, these are noble and achievable goals that, when achieved, will benefit the United States and the world.

Consider three challenges: (Taken from **Blessings and Challenges Science Holds the Key By William H. Danforth M.D.]**

The first is that America must continue to lead the world in agriculture. That means innovating more rapidly than others, some with more favorable climates and cheaper labor and land. We need increased productivity with fewer inputs, lower costs and new value added. Science is a necessary component of innovation and success and many others chase this goal. Over the last twenty years China and India have doubled global agricultural research. Our nation starts with many assets and should not toss away our lead.

The second challenge is ancient: better nutrition. In many places, hunger and starvation plague humankind as they have since human life began. Still tonight, one billion people will go to bed hungry and about every six seconds one child dies of causes related to malnutrition.

The third challenge is preserving and enhancing the environment so our grandchildren inherit a livable earth. This challenge is essentially new, even though throughout human time on earth we humans have been changing the environment that sustains us, usually for the worse. But the environmental damage has been local; the rest of the world has gone on as before. What is new is that there are now so many of us and our tools are so powerful that we threaten the environment of the whole world all at once.

These challenges ancient and new can be summed up as one -- produce enough food, energy and other products in a way that is indefinitely sustainable.

Consider these additional facts:

- In order to avoid mass starvation global agricultural production must double by 2050.
- The reasons include continuing growth of world population and rising consumption of meat in developing countries.
- Seventy percent of the world's fresh water is used for agriculture. At the current consumption rate, by 2024 two of every three people will live in water stressed conditions.

The need for more production with less input of water, fertilizer, and energy of all types is obvious. There is little new land that can be put into production without causing further environmental damage. About 40% of the world's arable land is currently used. Most of the uncultivated land is marginal with poor soils and either too little rainfall or too much. Bringing such land into production would require costly irrigation systems or soil enhancement measures.

Biotechnology has to be one of the tools we use to meet the needs of a growing world population while preserving the environment.

Again, a few key facts:

Crops developed using tools of biotechnology have been approved by regulators in 25 countries and have a history of safe use and consumption.

- A record 14 million farmers in 25 countries are safely using products developed through biotechnology today to improve their livelihoods.
- Ninety percent of these are smallholder farmers living in 16 developing countries.
- No single incident has compromised human health or safety in the two decades biotech crops have been commercialized.
- No environmental damage has been found in numerous studies.

Biotech crops contribute to increased food availability and affordability, increasing world production by 141 million metric tons from 1996 to 2007

- Growers of biotech crops numbered 13.3 million in 2008 compared with 12 million in 2007, the vast majority farm less than 10 acres of land.
- In agriculture-based developing economies, biotech crops are an engine of rural economic growth, which in turn can contribute substantially to national economic growth.

In addition to improving yields, biotech crops preserve our environment.

- Biotech crops reduced the amount of insecticide used in agriculture by more than 350 million pounds.
- Biotech crops have increased no-till farming by 35% since 1996 preserving thousands of tons of topsoil.

- Research in the United Kingdom indicates that energy savings created by the use of no till with GM crops is equivalent to removing five million cars from the road.

It is worth noting that in the past there have been only minimal efforts to improve food security crops like cassava, sorghum and cowpea. Unlike maize and soybean there are no commercial drivers for the improvement of these crops despite the enormous numbers of people who depend on them for sustenance. It is not possible to grow maize or soybean in many parts of Africa due to the dry climate. All of the technologies developed for commercial crops have been proven applicable to food security crops.

I'd like to share with you information about two projects underway at the Danforth Plant Science Center that are intended to address hunger in the developing world. Both are focused on the root crop cassava which is the 6th largest source of calories worldwide and 3rd largest in the developing world. 250 million people living in sub Saharan Africa and 700 million people worldwide rely on it daily as a major source of calories.

Cassava has the ability to grow on marginal land where cereals and other crops do not grow well because it can tolerate drought and can grow in low-nutrient soils. Roots are processed into a wide variety of granules, pastes, flours, etc., or consumed freshly boiled. Additionally, tubers can be left in the ground up to three years so if drought or disease kills off other crops, farmer's families can still fend off starvation by eating cassava.

Although Cassava has many properties that make it an important food across 105 countries in the world, it also has many limitations. Cassava lacks protein, vitamins A and E, iron and zinc and is susceptible to many pathogens, particularly in Africa, where one third of the continental harvest is lost each year to viral diseases.

Twenty-five percent of the research at the Danforth Center is aimed at helping developing countries in Africa and other parts of the world. The Danforth Plant Science Center has been the lead on two major projects to address two of the most important constraints to cassava production and utilization – poor nutritional content of the root and susceptibility to virus disease.

BIOCASSAVA PLUS

Danforth Center scientists have joined researchers at nine world-class institutions from around the globe in an effort to develop improved nutritional solutions for African farmers. In Nigeria, researchers at the National Root Crops Research Institute are leading the way. This project is called BioCassava Plus and is funded by the Bill & Melinda Gates Foundation's Global Challenges for Global Health Program. Its primary objective is to develop and deliver improved African cassava varieties that help meet certain minimum daily nutrient requirements.

Research at the Danforth Center is primarily focused on increasing cassava's Vitamin A protein, zinc and iron content, lowering the levels of naturally occurring cyanide releasing chemicals and reducing spoilage. Beta-carotene is the precursor to Vitamin A

and is contained in various foods today, but those foods are not readily available to many people living in the developing world.

Vitamin A deficiency is perhaps most serious. The World Health Organization (WHO) estimates that more than 250 million school children are deficient in vitamin A. Vitamin A deficiency leads to lower immune function and people with the deficiency often have a higher risk of dying from infections. Vitamin A deficiency destroys eyesight and is a leading cause of childhood blindness. In Nigeria and Kenya alone, it is estimated that 1.1 million productive years are lost annually due to vitamin A deficiencies.

Another way of looking at the importance of these nutrients comes from a recent economic study conducted by John Fiedler of Harvest Plus on behalf of the Bill & Melinda Gates Foundation that supports the benefits of nutritional enhancement. This study looked at the efficiency of uptake of various micronutrients including vitamin A, iron and zinc and then used a formula to assess the annual impact of life years lost due to death and disease also known as Disability Adjusted Life Years (DALY).

In Nigeria alone, the study predicted that increasing the level of Vitamin A to the target we have set would decrease the loss of nearly one million life years annually. Add zinc and iron and the total increases to more than two million years saved.

Furthermore the study predicted that in the first ten year time period our improved cassava varieties have the potential to provide longer healthier lives to more than 9 million people living in Nigeria and Kenya. Should these technologies also be adopted in other developing countries the potential is enormous. For example, the more than 900,000 DALYs in Nigeria resulting from a deficiency in vitamin A include the deaths of more than 35,000 children.

To date, Danforth Center researchers and our partners in Africa have met or exceeded all targets:

- The levels of beta-carotene (Vitamin A) have been increased 30X, from 1 µg/g to 37 µg dry weight.
- The levels of iron have been increased 4X, from 11 µg/g to 42 µg /g dry weight.
- The level of proteins have been increased 4X, from 3% to 12% dry weight.

These increased levels reflect what is needed to furnish the minimum daily requirements for a child.

BioCassava Plus has won the confidence of national partners and regulators in Nigeria on its effort to combat nutritional deficiency. In March 2008, it became the first entity ever to be granted a permit to conduct a confined field trial (CFT) of a transgenic crop in Nigeria. BioCassava Plus currently has a field trial of pro-vitamin A enriched events in Nigeria.

VIRUS RESISTANT CASSAVA FOR AFRICA (VIRCA)

Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD) represent the most serious threats to cassava production in sub-Saharan Africa. Each year, CMD is responsible for a minimum of 30% losses of the harvest and cassava brown streak disease has become an increasing threat in recent years. Currently brown streak is ravaging cassava crops along the East African coast and around Lake Victoria, threatening millions of east Africans who rely on cassava for food. The virus has been present on coastal farms for several decades but in 2004 a new virus emerged in Africa's interior (spread by the white fly) and there has been an explosive pandemic-style spread since then. Farmers are desperate.

The Virus Resistant Cassava for Africa (VIRCA) project represents a collaboration between the Danforth Center, the National Crops Resources Research Institute (NaCRRI) in Uganda and the Kenyan Agricultural Research Institute in Kenya to develop farmer-preferred cassava cultivars that are resistant to cassava virus diseases for delivery to African smallholder farmers thereby increasing root yields and food and economic security. Its second goal is to increase research ownership and capacity in the target countries. VIRCA is supported by funds contributed by USAID and the Monsanto Fund.

Danforth center scientists have experienced significant progress on several fronts on both of these projects. Most importantly, in establishing multiple confined field trials of our transgenic cassava in Puerto Rico, Uganda and Nigeria. We gathered encouraging data from the field further corroborating findings in the greenhouse. Eventually we hope to stack multiple beneficial traits in the same cassava plant through transgenic technologies.

Although much of the Center's biofortification efforts have been focused on cassava, there is also significant research underway to improve virus resistance in sweet potato, and to develop more nutritious, protein-enhanced peanut. Each of the programs has engaged research partners in Africa and active collaborations are ongoing.

CAPACITY BUILDING

Training scientists from the world's tropical regions in technologies of value to their agricultural systems is a central component of our mission. Through enhancing the physical infrastructure and increasing human capacity in country, our goal is to establish functional cassava biotechnology laboratories in Uganda, Kenya and Nigeria. Researchers from each of these countries continue to receive training at our facilities on the transgenic technologies required to improve cassava.

DELIVERING FOOD PRODUCTS TO SECURE LIFE AND PEACE

The Danforth Center is committed not only to developing the science and technology to come up with improved food products but has put together a professional team of experts from the private sector to deliver these products in a timely manner. Experts in property rights, biosafety, communication, field trials, and product management have been recruited in the recent years. In recognition of this commitment, in 2008 the Danforth Center was awarded a $5.4 million grant from the Bill & Melinda Gates Foundation as part of the Grand Challenges in Global Health initiative which seeks to identify and direct funds to the most critical scientific challenges in global health.

Funds were used to create and manage a BioSafety Resource Network (BRN) to support four project teams conducting research under Grand Challenge #9 (GC9) which focuses on the use of appropriate technologies to increase nutrients in local crops in a socially and culturally acceptable way. The goal of the BRN is to ensure that research projects address quality assurance, biosafety science and regulatory science requirements. The BRN is conducting a thorough, preliminary biosafety assessment of all traits intended to be expressed in the crops, formulating a regulatory strategy and work plan for each trait-crop combination, and providing support in the planning and implementation of confined field trials. The BRN is also overseeing the systematic transfer of experience and services through the GC9 projects to scientific personnel and institutions thus building local and regional regulatory infrastructure.

The Danforth Center will continue to play a pivotal role in developing and applying the most modern scientific and business thinking to the age-old problem of providing food, plant, fiber and energy products to the people of the world in ways that can be sustained for generations to come.

The impact of global food security will have implications for foreign and trade policies as well as peace. In the past several years it is estimated that more than 76 nations have experienced food riots.

Therefore, Mr. Chairman, we strongly recommend increased Congressional investment in basic agricultural research through the Agriculture and Food Research Initiative (AFRI) at the USDA's National Institute of Food and Agriculture (NIFA) and for USAID programs that enable biotechnology applications for food security crops as well as USAID home country missions that provide support for biosafety regulation.

Thank you.