News Release

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GLOBAL CONSORTIUM ANNOUNCES PLANS TO SEQUENCE BANANA GENOME

New Data Could Benefit Small-Scale Banana Farmers Worldwide And Reduce Reliance on Chemicals in Commercial Production

ARLINGTON, VIRGINIA, 19 July 2001 – Scientists from 11 countries today announced the founding of an international consortium to sequence the banana genome within five years. The scientists from governmental, university, and nonprofit organizations will use the new genetic data to enable developing-world farmers to grow bananas that are able to resist the fungus "Black Sigatoka," as well as other diseases and pests. Bananas are a staple food for nearly half a billion people worldwide, but their crops are increasingly lost to disease. The genome sequence will also benefit U.S. and European consumers of the popular dessert banana, one of the world's most chemically dependent crops.

"Ancient farmers selected banana strains that were seedless and thus sterile, and grew the fruit through vegetative sprouting," said Emile Frison, PhD, director of the Montpellier, France-based International Network for the Improvement of Banana and Plantain. "Cultivated bananas have, therefore, been at a near evolutionary standstill for thousands of years and lack the genetic diversity needed to fight off disease. A coordinated effort by scientists worldwide is needed to unlock the diversity found in bananas that still grow and reproduce in the wild."

The group sequencing effort is being launched at a meeting held 17-19 July at the U.S. National Science Foundation in Arlington, Virginia. The International Network for the Improvement of Banana and Plantain (INIBAP), a program of the Rome-based International Plant Genetic Resources Institute (IPGRI), is leading the effort, which brings together organizations from Australia, Belgium, Brazil, the Czech Republic, France, Germany, India, Mexico, the United Kingdom, and the United States. The newly founded "Global *Musa* (Banana) Genomics Consortium" includes the International Institute for Tropical Agriculture (IITA) based in Nigeria. IPGRI and IITA are Future Harvest Centers. The Consortium also includes the Institute for Genomic Research (TIGR), which previously collaborated in sequencing the genomes of rice and *Arabidopsis* (a plant in the mustard family), as well as sequencing the parasite that causes East Coast fever—a leading cause of death in African cattle. Scientists will map the banana genome using a sexually reproducing wild species of banana from Southeast Asia.

"Banana will be the first exclusively tropical crop to be sequenced," said Frison. "More than a popular snack, bananas are a staple food that many African families eat for every meal. This is our chance to develop a crop that won't fail for them and that may help lift them out of hunger and poverty."

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Cutting Back on Agricultural Chemicals

Farmers in 120 countries grow bananas and plantains. Plantains are long, green bananas—one of six major groups of cooking bananas—found mostly in West Africa and Latin America. Of the 95 million metric tons of bananas grown annually, approximately one-third is produced in each of Latin America, Africa, and Asia. Some 85 percent of the global crop is produced for home consumption and local trade, largely without the use of pesticides, leaving them highly susceptible to disease. The 15 percent of the global banana crop grown for export relies heavily on chemical inputs.

Bananas and plantains together are the developing world's fourth most important food crop, following rice, wheat, and corn. In parts of Africa, bananas provide more than one-quarter of all food calories. When ripe, most banana types are not sweet like the imported dessert Cavendish bananas eaten in Europe and North America, but starchy like a potato and eaten cooked. Banana varieties, all grouped under the scientific name of *Musa,* are rich in vitamins A, C, and B6 and contain high levels of calcium, potassium, and phosphorus, providing an essential source of nutrition in developing countries.

Bananas are threatened by the rapidly spreading fungus Black Sigatoka that has been undermining banana production for the past three decades. It has reached almost every banana-growing region in the world and typically reduces yield by 30 to 50 percent. Other diseases and pests that cripple yields include a soil fungus, parasitic worms, weevils, and viruses such as the Banana Streak Virus, which lurks inside the banana genome itself.

Commercial growers can afford and rely extensively on chemical fungicides, often spraying their crops 50 times per year—the equivalent of spraying nearly once per week, which is about 10 times the average for intensive agriculture in industrialized countries. Chemical inputs account for 27 percent of the production cost of export bananas. Agricultural chemicals used on bananas for diseases and pests have harmed the health of plantation workers and the environment.

"If we can devise resistant banana varieties, we could possibly do away with fungicides and pesticides all together," said Frison. "In addition, resistant strains are essential for small-holder farmers, who cannot afford the expensive chemicals to begin with. When Black Sigatoka strikes, farmers can do little more than watch their plants die. Increased hunger can swiftly follow."

Banana Genome to Reveal Secrets of Plant Evolution

Following rice and *Arabidopsis*, the banana will be only the third plant sequenced. Comprised of just 11 chromosomes with a total of 500,000,000 to 600,000,000 base pairs, the banana genome is among the smallest of all plants and researchers expect quick results.

"If we've learned anything from genomics, it is how little we know about biology," said Claire Fraser, PhD, president of TIGR in Rockville, Maryland. "We expect that the banana genome sequencing will reveal surprising insights into the evolution of plants." J. Craig Venter, PhD, head of the human-genome sequencing company Celera, is chair of the TIGR board.

"Bananas have unique characteristics that will provide researchers with a powerful model, capable of investigating fundamental questions with potentially widespread applications to agriculture," Frison said. He notes several areas of scientific interest:

- Scientists will ultimately be able to compare the genome of wild bananas that reproduce sexually with those of asexual crop bananas. This should provide important insights in to how, and how quickly, plant genomes evolve.

- Bananas originated in Asia, but several thousand years ago, humans introduced them to Africa. The wild bananas that remained in Asia continued to co-evolve with their pests, while the African arrivals left most of their pests behind. Comparing the genomes of wild Asian varieties with those of African cultivars will provide an uncommon look at the effects of disease agents on genome evolution.

- The majority of cells of most organisms have two sets of chromosomes (one inherited from the female, the other from the male). In the laboratory, bananas can be grown with anywhere from one to six sets of chromosomes. Once the banana genome is known, scientists will be able to probe the effects of multiple chromosome sets on basic plant functions, such as how plants use and store carbon.

- Bananas are the only known plant in which a virus (the Banana Streak Virus) imbeds pieces of itself into the banana's own DNA, only to pop out during times of stress, reassemble itself, and cause disease. The banana genome sequence should reveal just how this virus is able to strike when the plant is most vulnerable. It may provide a powerful new tool for targeted genetic transformation.

North-South Collaboration Key to Success

During this week's meeting at the National Science Foundation, Consortium members from developed as well as developing countries are discussing how to divide up the banana genome, which sequencing methods to use, and how to fund the project. (See list of Consortium members on next page).

"We have ensured North-South collaboration right from the beginning," Frison said. "And we have the opportunity to benefit from all the players agreeing on how to proceed from the outset."

Prior to the founding of the Consortium, individual members, including the governments of Australia, Belgium, France, India, Mexico, and the United States were already investing an estimated US$1.2 million in banana genomics research. Following the July meeting, this financing will increase to at least US$2 million, with an additional 10 full-time researchers. However, in order to achieve their goals, the Consortium will require US$4 to $5 million annually. The Consortium expects some of this additional support to come from the U.S. National Science Foundation and the European Union.

"By building a strong public and non-profit consortium that unites experts in genomics and plant biology, we hope to be able to approach the private sector later from a position of strength," Frison said. "We want to guarantee that any results, such as disease-resistant banana strains, will be made available to small-holder farmers on a royalty-free basis, even if they have commercial applications."

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The International Network for the Improvement of Banana and Plantain (INIBAP) (www.inibap.org) is a program of the Rome-based International Plant Genetic Resources Institute (IPGRI) (www.cgiar.org/ipgri), a Future Harvest Center. INIBAP was established in 1985 as an international organization with a mission to sustainably increase the productivity of banana and plantain grown on smallholdings for domestic consumption and for local and export markets. Using networking as its modus operandi, INIBAP has a small headquarters staff in Montpellier, France and regional offices in the four major banana-growing areas of the world.

Future Harvest (www.futureharvest.org) is a nonprofit organization that builds awareness and support for food and environmental research for a world with less poverty, a healthier human family, well-nourished children, and a better environment. Future Harvest supports research, promotes partnerships, and sponsors projects that bring the results of research to rural communities, farmers, and families in Africa, Latin America, and Asia. Future Harvest is an initiative of 16 food and environmental research centers that receive funding from the Consultative Group on International Agricultural Research (www.cgiar.org).

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Consortium Members

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