Program for Research on Climate Resilient Cereals

The Feed the Future Food Security Innovation Center leads USAID's implementation of the Feed the Future Research Strategy through seven interlinked research, policy and capacity programs aimed at sustainably transforming agricultural production systems. Visit www.feedthefuture.gov/research to learn more.

Most of the world's poor depend on key staple crops like rice, wheat, maize, sorghum and millet, but climate change is already affecting crop productivity and significant yield declines are projected in future years.

The ***Program for Research on Climate Resilient Cereals*** invests in developing high-yielding, climate-resilient cereals along with complementary approaches to improve resource efficiency, enabling farmers to grow more cereals on less land, using fewer resources like fertilizer, water, labor and energy.

This approach will help build resilience and free up land and resources for farmers to invest in producing more nutritious and higher-value products.

DID YOU KNOW?

- **Cereals account for approximately two-thirds of all human energy intake and are grown on roughly half of the world's cropland.**
- **An estimated 1.2 billion poor people depend on wheat, a crop that is particularly vulnerable to climate change. In South Asia, wheat yields are projected to decline 20-30 percent by 2050.**
- **Tropical maize yields are projected to decline 7 percent for each 1C increase in temperature.**
- **Sorghum and millet are staple cereals for over 500 million people worldwide, often the poorest of the poor, providing subsistence for families and livestock in drier areas, particularly in Sub-Saharan Africa.**

RESEARCH IN ACTION

Scientists at the International Rice Research Institute, a research center supported by USAID and other donors, working together with national scientists, have identified and transferred a submergence tolerance trait from an indigenous rice variety into new, higher-yielding rice varieties.

By 2012, just three years after release, these new varieties had already been planted on 1.7 million hectares in South Asia. The new varieties can withstand up to 15 days of submergence in flooded fields, allowing farmers to harvest a substantial rice crop in years when flooding would have otherwise wiped out their rice seedlings and a whole season's investments.

RESEARCH AREAS

Crop Improvement – USAID invests in developing and disseminating improved cereal crop varieties and hybrids, harnessing the latest genomics, breeding and biotechnology tools to increase yields, fertilizer use efficiency, tolerance to heat, drought and salinity, and product quality through both public and private partners.

Agronomy – New varieties must be accompanied by improved management practices if farmers are to close the yield gap and build more resilient farming systems. Agronomic research in cereal systems is aimed at reducing resource use through, for example, zero-till wheat and improved fertilizer use; saving energy and labor through direct seeded rice; improving planting efficiency through small-scale mechanization; and diversifying systems through improved rotations.

Pest and Disease Management – Cereal diseases and pests, which could increase with climate change, have significant impacts on food security and farmer livelihoods. This program combines multiple approaches to combat major pests and diseases, including wheat stem rust, mycotoxins, maize lethal necrosis and corn borers through crop improvement, integrated pest management, and improved post-harvest storage and processing.

Post-Harvest, Marketing, Policy, Impact Assessment – Integrated breeding, agronomy and social science research has identified simple but successful approaches such as harvesting on tarps to keep grain clean, using community storage facilities to improve grain quality over time, and conducting market analysis research to optimize sale prices. Focused multi-disciplinary research explores how to sustainably scale such solutions to increase smallholder profits and income generated from cereals production.

RESEARCH IN ACTION

Higher temperatures related to climate change are emerging as a major threat to wheat and maize production, with potentially devastating impacts in South Asia and Sub-Saharan Africa. USAID recently launched several new partnerships to develop and disseminate heat-tolerant varieties of these crops.

Arcadia Biosciences and the International Center for Maize and Wheat Improvement (CIMMYT) have teamed up with partners in India to advance novel heat tolerance technologies in the best wheat lines screened in hotspots in South Asia and Mexico. Kansas State University and Washington State University are both leading major South Asian collaborations to bring new genomic tools to bear on these efforts. CIMMYT, Purdue University and Pioneer Hi-Bred are harnessing the latest genomic selection tools and partnering with public and private research institutions and seed companies in Pakistan, India, Nepal and Bangladesh to develop and disseminate heat-tolerant maize. This effort complements an ongoing effort to develop heat-tolerant maize for Africa in collaboration with the Bill and Melinda Gates Foundation.

PARTNERS

Universities – Through the Feed the Future Innovation Labs, USAID is connecting the best of U.S. science to developing country cereal scientists and providing important educational and training opportunities to students from these countries.

Private Sector – USAID is making major new investments in climate-resilient cereals through public-private partnerships, leveraging critical resources, upstream research investments and product development capabilities to expedite the release of new varieties. These new partnerships include large research and development companies as well as small- and medium-sized seed companies and are employing novel commercialization pathways to ensure that the new varieties under development will reach smallholder farmers.

International Institutions – Through support to the major cereal research programs of the CGIAR, USAID's global investments are linked to national research organizations and local partners. The CGIAR Research Programs integrate multiple streams of research, and through global breeding programs and long-established connections to national seed systems, provide a pathway for new technologies to reach farmers.

USG partners – Under Feed the Future's whole-of-government approach, USAID partners with the USDA's Agricultural Research Service, building on their advanced strengths in areas such as genomics and diseases that threaten cereal production in the United States and overseas.

Current Research Projects	Lead Institutions	Countries
CGIAR Research Program 3.2 - MAIZE	International Center for Maize and Wheat Improvement	Global
Water Efficient and *Bt* Maize for Africa	African Agricultural Technology Foundation	Kenya, Uganda, Tanzania, Mozambique, South Africa
Drought Tolerant Maize for Africa	International Center for Maize and Wheat Improvement	Angola, Benin, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Tanzania, Uganda, Zambia and Zimbabwe
Improved Maize for African Soils	International Center for Maize and Wheat Improvement	South Africa, Kenya, Zimbabwe
Heat Stress Resilient Maize for South Asia	International Center for Maize and Wheat Improvement	Bangladesh, Indonesia, Nepal, Pakistan
CGIAR Research Program 3.3 – Global Rice Science Partnership	International Rice Research Institute	Global
NEWEST Rice – Nitrogen Efficient, Water Efficient, Salt Tolerant Rice	African Agricultural Technology Foundation	Ghana, Uganda, Nigeria
Abiotic Stress Tolerant Rice	Ceres, Inc.	India
Abiotic Stress Tolerant Bioengineered Cereals	Australian Center for Plant Functional Genomics	India
Cereal Systems Initiative for South Asia – Breeding for Heat and Drought Tolerance in Rice and Wheat	International Center for Maize and Wheat Improvement and International Rice Research Institute	Bangladesh, India, Nepal, Pakistan
Abiotic Stress Tolerant Rice and Wheat	Arcadia Biosciences	Bangladesh, Indonesia
CGIAR Research Program 3.1 - WHEAT	International Center for Maize and Wheat Improvement	Global
Heat Tolerant Wheat for South Asia	Arcadia Biosciences	India
Wheat Yield Network	International Center for Maize and Wheat Improvement	Global
Feed the Future Innovation Lab for Climate Resilient Wheat	Washington State University	India
Feed the Future Innovation Lab for Applied Wheat Genomics	Kansas State University	India, Pakistan
CGIAR Research Program 3.6 - Dryland Cereals	International Center for Research on the Semi-Arid Tropics	Global
Feed the Future Innovation Lab for Collaborative Research on Sorghum & Millet	Kansas State University	Ethiopia, Niger, Senegal
Feed the Future Innovation Lab for Climate Resilient Millet	University of California, Davis	India, sub-Saharan Africa
Feed the Future Innovation Lab for Climate Resilient Sorghum	University of Georgia	Ethiopia, Ghana, India

Feed the Future Food Security Innovation Center

The Program for Research on Climate Resilient Cereals helps smallholder farmers adapt to climate change and build resilience by developing new cereal varieties with enhanced yield and tolerance to drought, heat, salinity and low soil fertility, and delivering these varieties in diversified, sustainable farming systems.

The Feed the Future Food Security Innovation Center leads USAID's implementation of the Feed the Future Research Strategy through seven interlinked research, policy and capacity programs aimed at sustainably transforming agricultural production systems. It is housed within the Bureau for Food Security and is a strategically aligned and integral component of USAID's science and technology programs. The seven programs of the Food Security Innovation Center are:

- **Research on Legume Productivity** – This program increases the production and consumption of critical, protein-rich legumes by developing disease- and stress-tolerant, high-yielding varieties, improving market linkages and post-harvest processing, and integrating legumes into major farming systems to improve household nutrition and incomes, especially for women.

- **Advanced Approaches to Combat Pests and Diseases** – This program harnesses U.S. scientific expertise and emerging molecular tools to develop new animal vaccines and crops and animals resistant to pests and diseases that cause significant production losses in tropical systems.

- **Research on Nutritious and Safe Foods** – This program links research on the production and processing of safe, nutritious agricultural products to a learning agenda on household nutrition, including the utilization of and access to fruits, vegetables, meat, fish, dairy and legumes with the goals of preventing undernutrition (especially in women and children), improving child survival and securing family investments in agriculture.

- **Markets and Policy Research and Support** – This program works to achieve inclusive agricultural growth and improved nutrition through research on enabling policies, socioeconomics and technology targeting, and by building the capacity of partner governments to effect sustainable change in areas such as land tenure, financial instruments, input policies and regulatory regimes.

- **Sustainable Intensification** – This program works with smallholder farmers to incorporate sustainable, productivity-enhancing technologies and farming practices into major production systems where the poor and undernourished are concentrated and, through intensification and diversification of these systems, to enhance resilience, nutrition and agricultural growth.

- **Human and Institutional Capacity Development** – This program strengthens individuals – scientists, entrepreneurs, educators – and institutions, ensuring that food and agriculture systems in developing countries are capable of meeting the food security challenge and that women in particular are poised to take advantage of new opportunities and provide critical leadership in agricultural research, private sector growth, policy development, higher education and extension services.

Questions? Contact FTFinnovation@usaid.gov