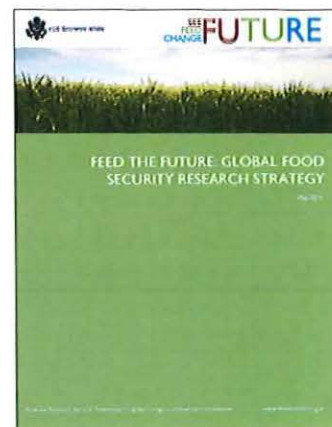


USAID Approach to Agricultural Research Under Feed the Future

Guided by the Feed the Future Research Strategy, USAID's agricultural research programs focus on sustainably transforming agricultural production systems and ensuring access to safe and nutritious foods, while addressing the emerging challenges of climate change and natural resource scarcity. USAID led the development of the Feed the Future Research Strategy in 2010-11, working closely with USDA and drawing on multiple consultations across the U.S. Government, the U.S. University community, the U.S. private sector, and other concerned domestic and international stakeholders. The Research Strategy identified the highest priority areas for research investment that will contribute to Feed the Future's overarching goals of reducing poverty and improving nutrition among the rural poor. Twelve of Feed the Future's nineteen focus countries are in sub-Saharan Africa and USAID's research activities have a strong emphasis on addressing African farming system challenges.



Released in May 2011, the [Feed the Future Research Strategy](#) lays out priority R&D areas for the USG to address poverty and malnutrition

USAID implements the Feed the Future Research Strategy through its Food Security Innovation Center (FSIC), which houses seven priority program areas in agricultural research, market and policy development and capacity building. The FSIC **Program Area for Sustainable Intensification** combines and applies "component" technologies (i.e. seed varieties, fertilizer technologies, pest management, improved fodder approaches) to smallholder cropping and livestock systems. Many of the component technologies being tested are generated through the different FSIC program areas, including **Climate-Resilient Cereals**, **Legume Productivity**, and **Advanced Approaches to Combat Pests & Diseases**. The cross-cutting programs on **Markets & Policy**, and **Nutritious & Safe Foods**, combined with foundational investments through the **Human & Institutional Capacity Development** program area ensure that agricultural productivity can be developed and sustained in multiple policy environments, that nutrition remains at the center of the Initiative's efforts, and that all of these efforts can be carried forward in the future by stronger national and regional institutions.

All seven program areas have a particular emphasis on Africa, as a result of the priority it has been given under the Feed the Future initiative, although our approach is global. Research activities to improve crop and livestock yields, including increasing resistance to pests and diseases, are concentrated in three program areas; Climate-Resilient Cereals, Legume Productivity, and Advanced Approaches to Combat Pests & Diseases.

Increasing African Farmers' Resilience through Crop and Animal Improvement

For African farmers to achieve food security and earn a profit from their farming activities as small businesses depends, in part, on their ability to optimize the amount and quality of food they produce on their land. However, African farmers often cannot access the improved inputs used by growers in the developed world. As a result, their productivity is consistently threatened on a yearly basis by many factors, including environmental stresses, such as drought and heat, and biological stresses, such as insects and diseases. For example, plant diseases of major food crops (including wheat, rice, maize, potato, soybean and cassava) account for up to 40% of pre-harvest losses and in some cases can reduce yields by 100%. Some of these plant diseases represent global threats: 90% of the world's wheat



Research to control the wheat disease known as stem rust during 1961-2009 has added 6.2 million tons annually to world wheat harvests, worth US \$1.12 billion per year

acreage is susceptible to new strains of dangerous wheat stem rust. In animals, on average one-quarter of smallholder farmers' livestock die due to preventable infectious diseases. Newcastle disease, for example, often leads to 100% poultry flock mortality.

Increasing climate variability is already affecting productivity, and significant yield declines are projected in future years as a result of shifting rain patterns and more prevalent drought conditions, emphasizing the need to focus efforts on developing animals and plants, especially cereals, legumes, small ruminants and poultry that can better tolerate these conditions. Better agricultural management practices, such as crop rotations and soil nutrient management, access to better quality feeds and grazing, and improved availability of water will partially improve the resilience to these threats. Over the long term, developing and deploying new seeds and livestock lines and breeds that can better tolerate environmental and biological stresses

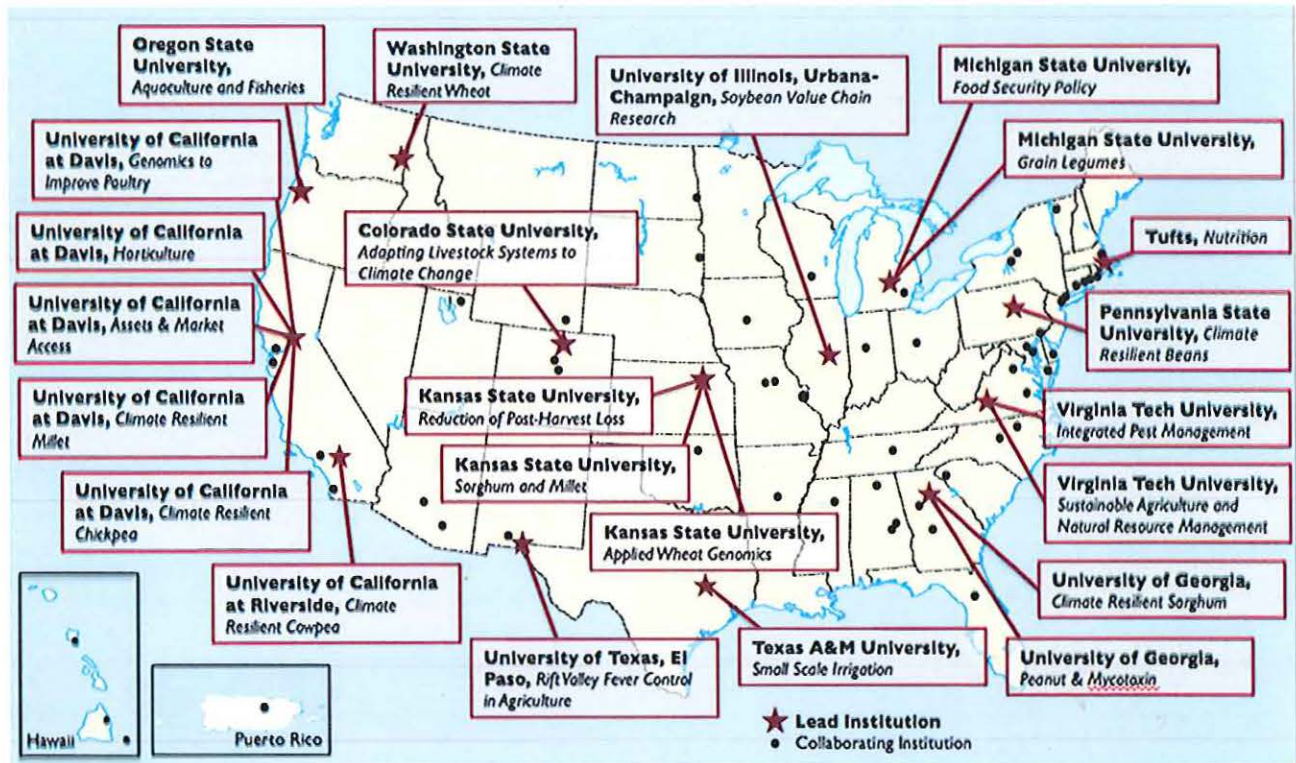
are required. A major focus of USAID's agricultural Research and Development (R&D) efforts under Feed the Future is on breeding and genetics of developing country staple crops and livestock to develop solutions to environmental constraints that pose significant threats to production. Research efforts concentrate on legumes, climate resilient cereals and advanced approaches to combat pests and diseases, using a mix of conventional plant and animal breeding approaches and more advanced breeding technologies, such as molecular marker assisted genetic selection and genetic engineering.

USAID Partners in Agricultural R&D

Under Feed the Future, USAID works with a selection of partners best positioned to carry out R&D activities in cooperation with host country counterparts. The three most significant groups collaborating and receiving support from USAID are U.S. Universities, the Consultative Group on International Agricultural Research (CGIAR)¹ and multiple private sector partners. The U.S. University community, and

¹ The CGIAR is a global partnership of 15 Research Centers focusing on generating and disseminating knowledge, technologies, and policies for agricultural development. More info is available at www.cgiar.org.

in particular the land-grant university community, is one of USAID's longest standing partners. Historically, through the Collaborative Research Support Program, (CRSP), and now, through Feed the Future Innovation Labs, USAID partners with leading U.S. researchers to solve some of the most challenging problems constraining agricultural development in Feed the Future countries. Over the past two years, the number of U.S. university-led Feed the Future Innovation Labs has doubled, strengthening our ability to address these challenges. The 23 Feed the Future Innovation Labs are shown on the map below. Detailed information about each Feed the Future Innovation Lab is available at <http://feedthefuture.gov/article/feed-future-innovation-labs>.



The CGIAR (formerly the Consultative Group on International Agricultural Research) is the preeminent group of international research organizations focused on agricultural research for development, with an extensive network of R&D sites and host country collaborators around the world. CGIAR centers are important implementing partners for USAID-funded R&D programs. USAID is also a member of the CGIAR Fund Council, the governing body of the organization. Through its participation on the Fund Council, USAID helps to determine research priorities for funding (from all donors) and assesses the impact of those investments. As the largest donor to the system, the U.S. actively collaborates with other major CGIAR donors such as Department for International Development (DFID, UK), the World Bank and the Bill and Melinda Gates Foundation.

USAID and Feed the Future partner with the private sector in several different capacities, including specific partnerships to facilitate in-country investment and commercialize technologies under the New Alliance for Food Security, the Partnering for Innovation platform, and through the Feed the Future

Private Sector Engagement Hub. Through these public-private partnerships, private sector partners may contribute resources, design and management expertise, or donate intellectual property (e.g. genetic resources and proprietary genes.) Several representative private sector collaborative projects are outlined below.

Supporting Biotechnology

A number of USAID-funded R&D programs are using genetic engineering (GE or GMO) technology to help increase crop yield and resilience in specific areas. Genetic engineering in developing countries overcomes production challenges which have been difficult to solve through traditional breeding approaches. Thus GE can speed up the development of new resilient crop and animal varieties useful for farmers in developing countries. Genetically engineered crops have already helped to increase farmer incomes in countries like India, South Africa and the Philippines. GE crops there show higher yields and reduced crop losses due to insects and disease, while at the same time reducing the use of pesticides. USAID is one of the few international donors funding the development of critical GE technologies to solve agriculture challenges in developing countries. USAID and Feed the Future are playing an important role in broadening the impact of promising GE technologies by (1) expanding the range of crops and traits being developed through public investment and carefully crafted public-private partnerships; and (2) providing technical support and capacity building to help countries develop and implement sound science-based regulation policies. The latter is necessary to facilitate access to genetically engineered crops, including those found in U.S. food aid. By applying GE technology to the critical constraints facing poor farmers and helping countries build regulatory capacity, USAID and Feed the Future are helping to ensure that modern agricultural science contributes to the development of long-lasting improvements in yield and resilience.

Snapshots of Feed the Future's R&D Portfolio and Partners

Summarized below are a selection of current R&D activities focused on sub-Saharan Africa focused on the development of climate resilient cereals and higher-yielding legumes, as well as improving disease resistance in plants and animals. These examples feature a mix of activities utilizing genetically engineered and non-genetically engineered technologies. A complete list of research activities for each Food Security Innovation Center program area can be found at <http://feedthefuture.gov/article/feed-future-food-security-innovation-center>

Helping Bring Insect Resistance to Africa - The introduction of genetically engineered insect resistance into field crops in the U.S. has allowed farmers to significantly reduce insecticide use while maintaining robust yield levels, and has facilitated the introduction of low- or no-tillage agricultural systems that improve soil health. USAID is partnering with the Nairobi-based African Agricultural Technology Foundation (AATF), the Bill & Melinda Gates Foundation, and Monsanto to bring these insect resistance genes to two African staple foods, tropical corn and cowpea (or black-eyed pea). In the case of cowpea, the insect resistance gene has been shown to increase yields more than ten-fold when



Cowpea production per plant of a non-GE variety (IT86D) and two GE varieties (709A and 252D) in Burkina Faso under insect pressure (Credit: TJ Higgins, CSIRO)

under heavy insect pressure in Burkina Faso and Nigeria. In corn, field tests in Kenya and Uganda have achieved significant yield increases by controlling corn pests. Insect resistance bred into local crop varieties will be very beneficial to smallholder farmers who often lack access to insecticides. Monsanto is making both of these insect-resistance technologies available to smallholder farmers at no additional cost. The application for regulatory approval for corn will likely be submitted this year in Kenya, followed by Uganda and Tanzania. Regulatory approval of cowpea in Nigeria and Burkina Faso will be sought within the next three years after the completion of requisite regulatory safety assessments, which are now underway.

Curing Poultry Diseases - Livestock provides an important source of high quality protein and micronutrients, as well as extra income, to smallholder farmers in developing countries. To increase



Poultry is a critical and neglected source of protein in Africa that USAID is improving via genomics tools (Credit: David Bunn)

livestock productivity, USAID and Feed the Future invest in the development of genomic tools to select for characteristics related to disease resistance, climate resilience, and productivity in global livestock breeding programs. The recently awarded Feed the Future Innovation Lab for Genomics to Improve Poultry, led by the University of California at Davis, is identifying regions in the chicken genome that enhance poultry resistance to heat stress and Newcastle disease. Newcastle

disease is the top constraint to village poultry production in Africa. Newcastle strains endemic in Africa can cause up to 80% mortality in flocks. In the United States, mild strains of the virus also reduce productivity in flocks. Heat stress also affects productivity globally as temperatures exceeding 95°F can result in reduced egg production and increased bird mortality. Outputs of this research will yield insights into the genetic mechanisms of poultry resistance to heat stress and Newcastle disease and will benefit both African and U.S. poultry producers.

Improving the resilience of the “camel of cereals” - Sorghum is a critical food security crop across the Sahel and in the Horn of Africa. Known as the “camel of cereals,” sorghum can be grown in hot, dry environments, providing grain for human sustenance and forage for livestock. USAID has a thirty-year history of investing in sorghum research, first through the International Sorghum and Millet (INTSORMIL) program at the University of Nebraska-Lincoln, and more recently through USAID’s brand-new Feed the Future Sorghum & Millet Innovation Lab based at Kansas State University. INTSORMIL collaborators developed many higher-yielding varieties of sorghum combined with crop management approaches to reduce pests and diseases. A breakthrough developed by Purdue University faculty members participating in INTSORMIL, including World Food Prize Laureate Dr. Gebisa Ejeta, effectively controlled Striga, a parasitic weed that can decimate sorghum fields, particularly in Ethiopia. The Feed the Future Sorghum & Millet Innovation Lab is building on



For 30 years, the University of Nebraska, Lincoln led USAID’s efforts to marshal the best US sorghum researchers to contribute to food security for the world’s most vulnerable (Credit: INTSORMIL)

INTSORMIL's previous research results to advance sorghum production and profitability for resource-poor farmers across East and West Africa. The new Innovation Lab also works closely with U.S. stakeholders, including the National Sorghum Producers and Sorghum Checkoff Board, whose members participate on the program's technical advisory committee. This cooperation ensures that the program yields benefits for sorghum producers in the U.S. and globally.

Finding Resilient Rice for Africa - While rice production is most commonly associated with Asia, it is also a very important food crop in Africa, where it is primarily rain-fed and thus highly susceptible to environmental variability. To address these challenges, USAID supports a public-private partnership with Arcadia Biosciences, a California-based biotechnology company, and a consortium of national and international research institutions. Members of the partnership are evaluating the performance of African rice varieties which have been genetically engineered with several of Arcadia's genes to improve their climate resilience. The Arcadia genes improve the nitrogen use efficiency, salt tolerance, and water use efficiency of locally-preferred rice varieties. A major milestone was reached in spring 2013 when research partners in Ghana and Uganda planted Africa's first-ever confined field trials of genetically engineered rice under this cooperation. The project recently reported that the new variety out-yielded conventional rice by 22-30 percent under low-fertilizer conditions in field trials. The researchers are now working to validate these promising results over additional seasons before potentially moving forward with a commercial product.

Sharing US expertise in soybean production - Improving legume productivity is a key element of the Feed the Future research strategy. Legumes play an important role in improving human nutrition, as well as contributing to farming system sustainability and soil health through their capacity to fix



Legumes have a unique ability to increase soil fertility by converting atmospheric nitrogen to soil nitrogen through the use of "nodules" on the root system. (Credit - BBSRC)

nitrogen. Through focused research programs in beans, cowpeas, chickpeas and soy, legume research is poised to deliver solutions that will improve agricultural sustainability and nutrition across the African continent. USAID's primary investment in soy, a rapidly emerging crop with significant potential for human and animal nutrition in Africa, is being led by the University of Illinois at Urbana-Champaign, in close collaboration with researchers at the University of Missouri and Mississippi State University. The new Feed the Future Innovation Lab for Soy Value Chain Research will be instrumental in developing a suite of technologies and approaches to

enhance soy production and utilization in Mozambique, Ghana and other African countries. With strong support from the World Initiative for Soy in Human Health (WISHH), a U.S. soy industry-supported humanitarian organization, this program contributes to advances in the use of soy in human and animal nutrition.

Uncommon focus on common beans - In recognition of the common bean's critical role in improving poor farmers' income and nutrition, USAID recently made two complementary investments in bean research. The first continued the work of the Feed the Future Innovation Lab for Collaborative Research

on Grain Legumes, led by Michigan State University, and the second launched the new Feed the Future Innovation Lab for Climate-Resilient Bean, led by Pennsylvania State University, with collaboration from the University of Missouri. These two programs are coordinating closely with USDA's Agricultural Research Service to identify new sources of disease resistance, climate resilience, and nutritional quality harbored by indigenous bean varieties. As the researchers introduce these novel traits into breeding programs in the U.S. and across sub-Saharan Africa, improved bean varieties will enhance the productivity of both domestic and developing-country farmers, as well as improve nutrition for consumers around the globe.

Collaboration with other Donors and Philanthropic Foundations

USAID and Feed the Future take a proactive approach to collaboration, strategy development, joint funding, and harmonized reporting with other international donors investing in complementary areas. On strategy development, USAID field missions often work with other donors to collaboratively develop implementation plans anchored in host country agricultural plans. In many cases, USAID has leveraged other donor funding and contributed to multi-donor activities to amplify potential research impacts. One example of effective collaboration includes a multi-year joint USAID and Gates Foundation support for the Cereal Systems Initiative for South Asia, an integrated R&D and technology deployment program that has already reached hundreds of thousands of farmers with improved seed technology. A second example is a funding partnership between USAID and the UK's Biotechnology and Biological Services Research Council (BBSRC) and other organizations to establish the International Wheat Yield Partnership (IWYP). The goal of IWYP is to increase wheat yields by 50% over the next 20 years through collaboration among international funders and public and private research organizations around the world, including wheat experts at USDA-ARS. Lastly, and increasingly importantly, USAID staff actively engages with counterparts at other donor organizations to ensure complementarity, discuss progress, identify collective gaps, and share best practices, ultimately resulting in better programming.

Opportunities to Amplify Impact

While the technological progress made in the first several years of Feed the Future is strong, the success of these programs will ultimately be judged on their availability and adoption by farmers. For this reason, USAID has redoubled its efforts to scale "shelf ready" technologies to greater numbers through new scaling focused programs and more explicit and targeted linkages of R&D programs to in-country development programs. One such activity which we believe will amplify the impact of our investments is the *Scaling Seeds and Technologies Partnership*, a new collaboration between USAID and the Alliance for a Green Revolution in Africa (AGRA) in six countries that aims to increase production of high-quality seeds by 45 percent and ensure that 40 percent more farmers gain access to innovative agricultural technologies. AGRA has focused on the seed and farm input sectors in Africa and in ensuring that these systems are nurtured in a way that African farmers can turn technologies into measurable economic progress. A second such activity is the *Feed the Future Partnering for Innovation Program*, which focuses on finding and commercializing agricultural technology that can help smallholder farmers at scale. The program works to overcome the risks of investing in emerging markets so that the products of agricultural research can more effectively be put into action to make agriculture more productive, efficient and cost-effective.