

Feeding Our World

Subcommittee: Dr. Chris Skaggs, Dr. Clinton Allred, Dr. David Caldwell, Dr. Rhonda Miller,
Dr. Elsa Murano, Dr. Elena Castell-Perez, Dr. Wayne Smith

Introduction

Feeding our World is a grand challenge encompassing multiple facets of the College of Agriculture and Life Sciences at Texas A&M University. The challenge involves feeding nine billion people by the year 2050. The challenge to increase food production will rely on advances in technology. Funding for agricultural research is flat or trending downward in comparison to other industries and especially other countries such as Brazil and China. Research is critical to address the challenge and will require integration of soil, plants, poultry, fish, and animals. Challenges also exist in distribution channels, resulting in unnecessary excesses and deficiencies of agricultural products. Policy restrictions as well as transportation, storage and distribution issues currently exist. Post-harvest losses must be minimized as well. Food security will also be paramount to the initiative. While advancements in technology are adopted in the United States, barriers exist in other parts of the world. According to Dr. Robert Thompson in his Blue Bell lecture, the challenge to increase production by 2050 coincides with limited increases worldwide in productive land, reduction in land availability and a concomitant reduction in water usage. Water availability and quality will be of significant importance as well as climate change.

Texas is a geographically diverse state with Texas A&M AgriLife Research and Extension Centers and activities strategically located to focus research efforts to address diverse climatic, edaphic, geographic, and cultural conditions. Extension programming exists in 252 of our 254 counties providing an excellent infrastructure for technology transfer. Challenges

include populations that are metropolitan, urban, and rural with different needs that can be addressed by Texas A&M AgriLife. International outreach occurs through the College of Agriculture and Life Sciences educational programs and the Borlaug Institute.

Focus Areas

The subcommittee identified five areas of emphasis for the Feeding Our World grand challenge of the college including: (1) Breeding/Genetics of Plants and Animals, (2) Technology/Food Safety, (3) Resource Management-Water/Land, (4) Development of Nutritious Foods/Feeds and Education, and (5) International Development.

Breeding/Genetics of Plants/Animals

Genetic advancements in plant and food animal production have made significant contributions historically to the food and fiber supply chain through increased productivity. Enhanced disease resistance and environmental tolerance have boosted productivity and the need exists to continue development of plants and animals adaptable to environmental change. Adaptability to climatic change is paramount to provide adequate food for societies to thrive. Research initiatives will include development of plants adaptable to biotic and abiotic stressors. Enhancing the innate immunity of plants to respond rapidly to exotic pathogens is important. Likewise, factors impacting animal health will need to be continually addressed. The increasing global population and demand for food have intensified genomic research efforts to identify further improvements in productivity/yield, quality and efficiency while minimizing environmental impact. Phenomics and metagenomics research take advantage of the tremendous advances in genomics of the past decade within the multiple disciplines, both plant and animal, of the college. Educational efforts to enhance transparency from production to consumer and demystify genetically modified organisms to consumers will need to be addressed.

Technology/Food Safety

Improvements in technology have resulted in increased food production to meet global demand. Post-harvest machinery and production techniques have evolved to address food safety

concerns yet one third of food loss today occurs post-harvest. Efforts have been made to produce more and more product, yet losses exist through complications post-harvest. Research and development of preventative and diagnostic tools for early detection, monitoring and trace back of contaminants to improve food safety will be critical. Pre-harvest animal protocol greatly impacts post-harvest problems. Infrastructure is needed to deal with food waste. Extension programming provides training for producers and processors and educates consumers. Agricultural advancements in post-harvest technology are sometimes met with apprehension by consumers resulting in need for educational programs to address such concerns. Consequently, the role of extension is significant for consumer acceptance.

Resource Management and Conservation – Water/Land

Water availability and drought dominate rural and urban concerns in Texas. The College of Agriculture and Life Sciences must provide the educational, scientific and scholarly framework for the understanding, development, management and use of natural resources to benefit human and natural societies. Sustainable intensification is the objective to maximize the use of limited resources through precise methods in a manner that is considered sustainable. Drought impacts crop production which ultimately impacts the value of feed necessary for livestock enterprises. The recognition and importance of biofuels to decarbonize the energy sector through minimizing carbon dioxide emissions and ultimately reduce carbon footprint by mitigating climate change is one of college's research strengths. The college will concentrate on a systems approach to address water/land issues. Research initiatives address the framework for sustainable land production with reduced water, energy and fertilizer inputs. Several departments will provide expertise on water quality systems and training. Water is an expensive commodity with competition between urban and rural interests. Reclamation efforts to remove

pathogens from water for reuse will need to be addressed. Multidisciplinary or systems thinking will be required to address the complexities and intricacies of resource management.

Education and Development of Nutritious Foods and Feeds

The college will serve a leadership role in discovery and dissemination of new knowledge in nutrition and food science to promote public health and well-being. Educational outreach to nutritionally at risk populations in Texas and beyond is necessary to promote healthy lifestyles and prevention of diet-related diseases. Communication is critical to prevent misinformation concerning nutrition. Development of new foods or food products or new varieties of existing crops to provide nutritional, high quality foods will continue to be prioritized. Discovery of dietary mechanisms and factors impacting obesity, cardiovascular disease, carcinogenesis, diabetes, and other chronic diseases will be addressed. The need to educate physicians on diet and nutrition issues is critical. Population-specific research is also needed in nutrition. The college will continue involvement in policy development as related to agricultural production, imports and exports, with goal of enhancing competitiveness of Texas and U.S. Agriculture.

International Development

The College of Agriculture and Life Sciences has a strong presence around the world impacting global food production. The Borlaug Institute serves as a hub for international activities. The institute helps small scale farmers around the globe to prosper through improved crop varieties, animal genetics, product handling, transport, food safety, nutrition and food policy marketing. The mission revolves around helping countries to produce their own food in a sustainable manner to decrease dependence on imports. The Borlaug Institute focuses on providing modern technology to help farmers efficiently produce crops and livestock for a profit.

The Borlaug Institute also works to enhance education in colleges of agriculture in foreign countries. Recommendations are made from planting to harvest to enhance production efficiency. International outreach and consulting opportunities exist for faculty involvement. Longer sabbaticals of up to 6 months may provide a crucial time threshold to accomplish progress. Short courses of 1 to 2 week duration may also play a role in reaching the continuum from production to consumption. Training and educational programs will help address gender equity in the global farming enterprise. The approach of hosting veterinarians, faculty and graduate students from other countries and place them in laboratories of faculty at TAMU expands international collaborative and research impact. Distance and continuing education programs in plant and animal breeding and genetics will provide opportunities for Texas A&M and the College to impart knowledge and skill sets worldwide. Distance delivery of information in other disciplines will expand the sphere of influence and help alleviate hungry and poverty through transfer of information. Novel programs such as reciprocal exchange and sandwich programs to bring graduate students from foreign institutions to Texas A&M for 6 to 12 months and send U.S. students to foreign university or agricultural research organizations will expand the influence and exchange of knowledge of the college. Dedicated funding to establish these kinds of activities in developing nations could pay dividends in alleviating hunger and poverty.

Challenges

The technology and scientific discovery exist but a mechanism of dissemination may need refinement. The college does outstanding work but how do we go about sharing with world? Technical assistance may be required to assist with integration of efforts. Continual breakdown of barriers is essential to encourage collaborative approach. Connecting people by removing barriers can sometimes be achieved through centers or institutes, or through

incentivizing faculty and unit heads to pursue collaboration. Increased incentives, increased services and a reduction in structural and procedural barriers will promote collaboration. Professional grant writers working on college level with familiarity of research agendas of AgriLife Research and the 14 departments might assist with leading some collaborative efforts. Encouragement of interdisciplinary, intra-departmental research/extension efforts is necessary. The college is highly leveraged with significant grant performance and industry ties which leads to less flexibility to move to current issues. The re-organization of Texas A&M AgriLife Research and Extension Centers into innovation laboratories may serve as model to better promote collaborative research. The change of focus from commodity-based to issues-based orientation at centers should foster integration of efforts. Funding for agricultural research will continue to be a challenge with current downward trend in support in the United States as compared to Brazil and China. The diversification of research portfolios to increase funding opportunities and competitiveness is a priority. Funding opportunities at the federal level beyond USDA and through private entities are essential. Increased urbanization and sprawl will impact land availability for agriculture and hasten exploration of novel concepts such as large hydroponics facilities to raise crops. Extension must continue outreach efforts to small-scale producers of plants (gardens) and animals (small acreage cattle operations).

Strategic needs

The grand challenges provide framework for future priorities of the College of Agriculture and Life Sciences. The land-grant mission of providing consistent flow of information to reach clientele in their homes could occur via satellite and internet television programming. Strategic needs include continued emphasis on educational and extension programs both inside and outside of the United States, problem-based sabbaticals for faculty in

international venues, sandwich/2x2/reciprocal exchange programs through agreements with international universities and distance education to reach the public. Positioning of the College of Agriculture and Life Sciences to anticipate research initiatives and future direction of granting entities will impact future research support. Enhanced communication between federal relations and development officers to find donors for research initiatives is essential. Technical assistance is a concern with need for more technicians to enhance discovery efforts. Graduate student support should be prioritized to attract the highest quality students. Support to maintain infrastructure or existing facilities is needed. First-class facilities are also essential to attract new faculty. Development of more endowed chair positions to elevate notoriety of faculty and attract the highest quality faculty is significant. The development of college-professorships to recognize excellence similar to the model used for Distinguished Professors at the university-level is one possibility. Feeding the world is a grand challenge with global implications and achievable through scientific and technological innovations, information transfer and political awareness of need for sustainability.