Grand Challenge

American Society of Agronomy

Agronomy Feeds the World

Agronomy is the science of crop and soil management to sustainably produce food, fiber, feed, and fuel.

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The American Society of Agronomy (ASA) is a scientific society helping its 8,000+ members advance the disciplines and practices of agronomy by supporting professional growth and science policy initiatives, and by providing quality, research-based publications and a variety of member services.

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Grand Challenge

Double global food, feed, fiber, and fuel production on existing farmland within the 21st century with production systems that:

- enable food security;
- use resources more efficiently;
- enhance soil, water, and air quality, biodiversity, and ecosystem health; and
- are economically viable and socially responsible.

American Society of Agronomy Key Questions

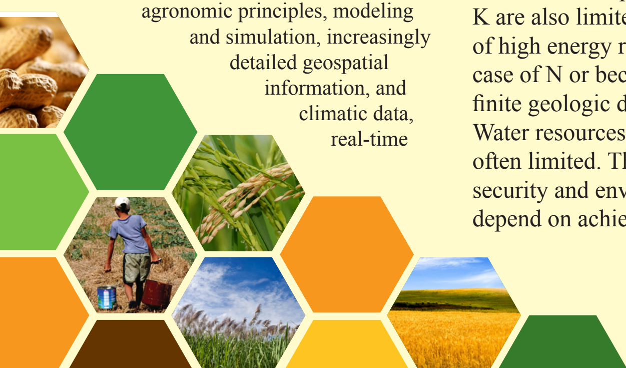
Food Security

Food security is critical to overcome poverty and achieve peace among nations. Future populations need access to adequate, safe, and nutritious food. Yet, population growth and rising incomes will require doubling of crop yields on existing farmland. Putting even greater pressure on agriculture will be a requirement that agriculture mitigate climate change and promote good land, air, and water stewardship. In order to achieve global and regional food security, solutions must be found to the following key questions.

Question: How can yield potential and yield stability of crop production systems be maximized in the face of a decreasing water supply, changing climate, and multiplying abiotic and biotic stresses?

Outcome: An integration of ecology, physiology, and genetics to develop new technologies, crop cultivars, and cropping systems that can achieve the required productivity and stability.

Question: How can mechanistic agronomic principles, modeling and simulation, increasingly detailed geospatial information, and climatic data, real-time weather information and forecasting be used to improve on-farm agronomic decision-making processes?



Outcome: Sustainably narrow the gap between attainable and actual crop yields through improved management decisions.

Question: What crops and cropping systems can be identified and/or designed to achieve significant improvements in human health and nutrition?

Outcome: Ability to diversify our cropping systems to create a more nutritious and resilient food supply.

Resource Use Efficiency

Agricultural crops which convert air, sunlight, water, and available plant nutrients into food, feed, fiber, and fuel, remove nutrients such as nitrogen (N), phosphorus (P), and potassium (K) and water from soil. These same nutrients, if not applied according to agronomic principles can negatively impact the environment, affecting air, soil and water quality. Nitrogen, P, and K are also limited in supply because of high energy requirements in the case of N or because they come from finite geologic deposits (e.g. K and P). Water resources for irrigation are also often limited. Therefore, future food security and environmental quality will depend on achieving a large increase in nutrient- and water-use efficiency, while also enabling a continuation of rapid increases in crop yields on land currently in production.

Question: Can N needs of agronomic crops be met while limiting N losses to levels that do not cause environmental damage or contribute to greenhouse gas emissions?

Outcome: Greatly reduced use of N fertilizer for every calorie produced, resulting in lower energy requirements and improved air, soil, and water quality, enabling greater global food security.

Question: How can biological N fixation by soil microbes, improved plant varieties, and more water- and nutrient-efficient crop rotations be harnessed to increase per acre crop yield and nutritional quality?

Outcome: Significantly enhanced agroecosystem nutrient use efficiency through improved nutrient cycling.

Question: Can new plants and fertilizers be engineered that maximize fertilizer and soil P and K resource utilization?

Outcome: Enhanced agroecosystem P and K use efficiency, improved soil fertility, and increased crop yield.

Question: What biogeochemical interactions limit plant-soil-air ecosystem cycling of renewable and non-renewable resources in order to limit leakages in agroecosystems?

Outcome: Increased allocation of research efforts toward significant improvements in managed nutrient cycles. Addressing this key question will generate knowledge needed to design production systems with substantially improved resource use efficiency.

Question: How can cropped systems, improved cultivars, and soil management practices be altered to increase crop yields per unit of available water?

Outcome: Increased crops yields with reduced water use per unit of production.

Enhancement of Ecosystem Services Provided by Agriculture

Agriculture is multifunctional; it is both dependent on and can be complementary to ecosystem functions that produce goods. The study of natural and managed ecosystems, including agroecosystems, has shown that these systems provide services that generate goods essential to life. Ecosystem goods include clean air, water, soil, diverse plant and animal species, and wildlife habitat. Through agricultural and plant production, soil can provide multiple services that include not only food, feed, fiber, and fuel production, but also carbon storage, erosion control, plant growth, nutrient cycling, and water filtration and storage. Improving and maintaining soil quality through proper management and care of soil is critical for the production of these goods. While ecosystem services are difficult to value monetarily, they have intrinsic value because they produce goods that support our health and economy. As society realizes the value of these services and goods, new ecosystem service markets are developing. To ensure that these markets are based on sound science, it is critical to understand the multifunctional relationships occurring in major agroecosystems. In this way, the services provided can be enhanced.

Question: How can food, feed, fiber, and fuel production be more efficiently integrated with other ecosystem services in both large acre and smallholder agricultural systems to create a more sustainable use of the landscape?

Outcome: Ecosystem services, e.g. clean water, provided by agroecosystems will be increased on millions of hectares of agricultural lands.

Question: What tools and practices can be provided to enable producers to adopt cropping systems and management practices that improve soil, air, and water quality without compromising aggregate food, feed, fiber, and fuel production?

Outcome: Profitable and productive cropping systems that increase soil, air, and water quality.

Question: How can agroecosystems enhance wildlife habitat and biodiversity, while doubling food, feed, fiber, and fuel production?

Outcome: Increased wildlife habitat and biodiversity coupled with increased food security.

Agriculture as an Economically Viable and Socially Responsible Sector

Agricultural systems are the foundation of human health, economic development and political stability. Productive and sustainable agricultural systems will be achieved through high-quality, interdisciplinary, and integrated research, education, and extension.

Question: How can we implement integrated research, education, and extension programs that deliver the optimum crop production knowledge appropriate for implementation of changes that aid in overcoming regional challenges?

Outcome: Increased crop productivity and nutritional quality, opportunities for economic development, and greater political stability.