USDA-NIFA Stakeholders Workshop for Plant and Pest Biology
ASA, CSSA, SSSA
Recommended Research Priorities

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Crop Science Society of America
Soil Science Society of America
Priority Areas for Research

✓ Global Food Security
✓ Climate Change
✓ Renewable Energy
Global Food Security
ASA 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.
Global Food Security

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Key Questions for Research

Global Food Security

American Society of Agronomy Grand Challenge

Key Questions

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

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

- 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?
Key Questions for Research

Global Food Security and Climate Change

American Society of Agronomy Grand Challenge Key Questions

- 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?
- Can new plants and fertilizers be engineered that maximize fertilizer and soil P and K resource utilization?
- What biogeochemical interactions limit plant-soil-air ecosystem cycling of renewable and non-renewable resources in order to limit leakages in agroecosystems?
- How can cropped systems, improved cultivars, and soil management practices be altered to increase crop yield per unit of available water?
Food Security, Climate Change, & Renewable Energy

CSSA Grand Challenges
CSSA Grand Challenges

- Genotype the major crop germplasm collections to facilitate identification of gene treasures for breeding and genetics research and deployment of superior genes into adapted germplasm around the globe.
- Increase the speed with which agriculture can adapt to climate change by using crop science to address abiotic stresses such as drought and heat.
- Develop sustainable biofuel feedstock cropping systems that require minimal land area, optimize production, and improve the environment.
- Increase durability of resistance to biotic stresses that threaten food security in major crops.
- Create novel crop varieties and management approaches designed for problem soils and low-input farming to increase economic prosperity for farmers and overcome world hunger.
- Create novel crop management systems that are resilient in the face of changes in climate and rural demographics.
Key Questions for Research
Food Security (Biotic Stresses)

- What are the molecular and physiological mechanisms by which various pathogens and pests interact with plants? How can these interactions provide novel and durable approaches for defense mechanisms?
- How do we efficiently identify novel resistance genes in our extensive germplasm collections?
- How do we incorporate resistance genes effectively without limiting progress for improving yield?
- How can genomic tools be used with germplasm to uncover the molecular basis for resistance to biotic stress?
- How best to develop and utilize gene-specific markers to combine and deploy resistance genes so that the risk of crop loss is minimized?
Key Questions for Research Climate Change (Abiotic Stresses)

- How can teams of breeders, geneticists, physiologists, and agronomists be created with sustained support to conduct research in abiotic stress tolerances through all phases of testing to produce economically viable tolerant varieties?
Key Questions for Research Climate Change (Abiotic Stresses)

- How can teams of breeders, geneticists, physiologists, and agronomists be created with sustained support to conduct research in abiotic stress tolerances through all phases of testing to produce economically viable tolerant varieties?
- Can we develop networks of abiotic stress-prone fields (laboratories/sites) and efficient screening methods to identify genotypes tolerant of stresses such as drought and heat?
- What economically important abiotic stress-tolerant genetic resources exist in germplasm collections and in applied breeding programs?
- What are the physiological mechanism(s) by which abiotic stress tolerance genes interact with each other and with the environment to impart abiotic stress tolerance?
- What are the physiological and genetic mechanisms by which temperature reduces pollen viability and seed-set, and can genetic tolerance to temperature stress be achieved?
- How can we exploit variation in the morphology, rooting depth, and/or functionality of roots, leaves, or stems to mitigate the effects of abiotic stress?
SSSA Grand Challenges

- To develop and extend information and technology needed to improve and maintain the productivity and sustainability of the global soil resource.

- To understand how species abundance and distribution and coupled hydrobiogeochemical processes in soil, the most dynamic portion of the critical zone, that control ecosystem services at the field and landscape scales.
To develop and extend information and technology needed to improve and maintain the productivity and sustainability of the global soil resource.

The Rhizosphere: A Frontier Cross-Cutting Research Area With Implications to Ecosystem Function, Climate Change, Sustainability, and Food, Energy, and Water Security

- What intrinsic (genetic) and extrinsic (e.g. temp., moisture, geochemistry) factors influence plant exudate profiles?
- What are the critical positive and negative feedback systems between plants and microorganisms in the rhizosphere?
The Rhizosphere: A Frontier Cross-Cutting Research Area With Implications to Ecosystem Function, Climate Change, Sustainability, and Food, Energy, and Water Security

- What triggers (e.g., nutrient and water stress, infection, etc.) alter the amount and chemical composition of exudates?
- Do plant exudates control the kinetics of nutrient and water acquisition by plants, and if so, what are the mechanisms for changing rates of nutrient and water acquisition by plants?
- How does plant breeding for desirable properties from the standpoint of food, feed, fiber, and biofuel feedstock production alter the exudate profiles and, thus, biogeochemical processes below ground?
- What questions can we ask that will lead to better resource use efficiency in local and global cropping systems?
- How can we overcome abiotic and biotic stressors on our cropping systems?
- What scientific questions can we ask that help us understand the rhizosphere?
- How do we build and effectively manage bigger and more diverse teams of researchers?
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Please email questions to:

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Thank you!