Science Societies

The big picture and the big questions in agricultural research

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Solving today's problems requires the expertise of CSSA, SSSA, and ASA members. Photo courtesy of Adobe Stock/metelevan.



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Agriculture is a complicated business, and so agricultural research must also consider the complex nature of the enterprise. At no time in modern history have off-farm business practices and the effects of globalization and supply-chain disruptions been as devastating to both research and production as today. Our traditional issues related to things like seed selection or fertilizer rates are now made more complex by climate change, degraded water quality, declining soil health, soil erosion, and land use pressures from development. In the background are pending extreme weather events and devastating phenomena such as forest and range fires that have the potential to reverse years of progress in crop yields and natural resource improvements made by the careful selection of improved cultivars and conservation practices.

To tangle the problem further, new state, regional, and federal government initiatives or regulations, often rapidly applied to address problems and opportunities listed here, may conflict with or exacerbate other problems. Many new technologies in agronomy, plant breeding and genetics, soil science, agricultural engineering, and the plant protection sciences can also have unintended and unforeseen consequences, causing more problems that must be addressed if we are to avoid accelerated soil and habitat degradation and food insecurity. Naturally, the devil is in the details, but are we addressing the details with a scientific approach leading to science-based policies?

Climate-Smart Agriculture

The latest technological and administrative item to come along is climate-smart agriculture, replete with new opportunities and complications. But is this really something different from soil health, soil quality, environmental quality, food security, air quality, water quality, and genetic/crop diversity? What is included in this latest bandwagon of potential solutions? Does climate-smart agriculture include human and rural economic health, support batteries or liquid fuel, or economic analysis? Are we still just as concerned about soil erosion or pest resistance to control mechanisms, all of which will be made worse by climate change? How will plant breeding and agricultural management be guided to keep up with changes? How does an aging workforce fit into this? How do new farmers learn all the moving parts of this increasingly complex juggernaut?

Soil, for example, is dynamic and has the ability to store carbon, store and filter water, store and retain nutrients, and safely retain pollutants all while providing habitat for micro- and macro-organisms. Plants are also dynamic and modify their behavior in response to abiotic and biotic stress. New technologies in data management, including process modeling, machine learning, digital mapping, and linkages with sustainability and ecosystem services assessments, can unlock these benefits. Likewise, crops can be improved to meet the challenges, using genetic diversity from global genebanks and new gene-editing techniques, to allow farmers to continue to increase yields with less external inputs, under increasingly difficult conditions, and without harming soil and water resources.

Starting the Hard Conversations

Who is responsible for seeing the global big picture and reviewing the entire agricultural production system for inconsistencies and adjustments that may work better? There are many questions that need to be addressed as we prepare for an

uncertain future. For example, how do we balance the need to meet food security and greenhouse gas emissions simultaneously, reduce food deserts, and maintain rural communities? We don't have answers; we are asking the big questions here and hope to start some of the really hard conversations.

These are hard conversations, but the members in our three Societies and related scientific societies are activity involved in addressing and reversing these problems. They publish research results on the unintended secondary effects, loopholes, and inefficiencies of new and old technologies; create educational materials such as those for our Carbon and Ecosystem Services Education Project website; train the current and next generation of soil scientists, crop scientists, and agronomists on how to integrate new technologies into agricultural production systems; and provide global leadership on sustainable management. We encourage you to become activity involved in these activities. We wonder if we need to create a platform for more dialog on these topics? Is it time for a forum on Interconnections in Agriculture Research? Send us your ideas—Send Message (David Clay), Send Message (Marilyn Warburton), and Send Message (Ron Turco).



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