October 25, 2021

Office of Science, Department of Energy
President's Council of Advisors on Science and Technology (PCAST)
ATTN: Dr. Sarah Domnitz, Designated Federal Officer, PCAST

Re: DOE-HQ-2021-0001
Via electronic submission to *PCAST@ostp.eop.gov*

To the President's Council of Advisors on Science and Technology,

Founded in 1883, ASTA's mission is to enhance the development and use of quality seed worldwide. Its membership consists of nearly 700 companies involved in seed production and distribution, plant breeding, and related industries in North America. ASTA members research, develop, produce, and distribute all varieties of seeds – including row crops, vegetables, flowers, grasses, forages, cereals and conservation seeds. ASTA member's seed-products support agricultural producers of food products and farm commodities in the U.S. and around the world. ASTA promotes the development of better seed to produce better crops for a better quality of life.

Today's food and agriculture system faces unprecedented challenges, from climate change to a growing population, and rapidly evolving pests and diseases. Continued innovation in plant breeding and seed variety development are crucial to ensuring long-term economic, social, and environmental sustainability. The seed industry is founded on innovation, and innovation is a part of everything we do – from plant breeding and seed treatments, to soil health and habitat restoration. Better seed means better life, for everyone.

ASTA is pleased to provide these comments to the President's Council of Advisors on Science and Technology (PCAST) ahead of their virtual meeting on combatting and adapting to climate change, including ongoing work within individual federal agencies, implications for national security, and achieving net zero emissions by 2050.

Combatting and Adapting to Climate Change

Plant Breeding Innovation

The development and commercialization of innovative plant varieties is already playing a significant role in assisting U.S. agriculture in reducing greenhouse gas emissions. Further crop improvements using new precision breeding methods, including gene editing, can hasten these positive trends. Seed companies are investing an average of 15% of sales income back into research and development annually, signaling a strong commitment to new innovation.

The robust intellectual property rights protection available in the U.S., whether patents, plant variety protection, or trade secrets, enables plant breeders to make these significant investments in new innovation with the assurance that their products and methods are protected.

ASTA members are committed to investing in research and development and depend on it to deliver products to farmers that address constantly evolving and interlocking threats from changing climate and evolving disease and pest pressures. An increasingly warming climate means an increase in disease intensity, mutation rates, and the evolution of pests and diseases in areas where they formerly didn't exist. In the face of these challenges, innovation in plant breeding and seed related treatments are necessary to protect productivity. New, improved plant varieties enable farmers to grow more food on less land, providing sustainable intensification and avoiding the expansion of land under agriculture.

Public funding for agriculture research is critical to innovation. An area of federal investment that is not well-known but critically important is the USDA Agricultural Research Service National Plant Germplasm System (NPGS), which collects, stores, and maintains unique plant germplasm from around the world. Plant breeders worldwide use these genetic materials to breed new plant varieties that can resist pests, diseases and environmental stresses. Modest additional investments in the NPGS would undoubtedly help researchers uncover new sources of climate solutions.

Investment in research, development, and deployment of innovative plant breeding methods will provide tools for plant breeders to develop new varieties in years instead of decades. We must prioritize the development of evolving plant breeding methods to address the critical environmental challenges facing today's food production system for the future of our planet, our health and our food. Cutting-edge plant breeding methods enhance the efficiency and effectives of plant breeders' ability to develop varieties of crops that have a significant positive environmental impact. According to the Food and Agriculture Organization of the United Nations, food produced for human consumption that is lost or wasted globally amounts to nearly 1.3 billion tons of food waste per year – about 8% of greenhouse gas emissions. Plant breeders are using gene editing to develop new crop varieties specifically designed to improve shelf life and cut the amount of food wasted. By making a small change to a potato's DNA, for instance, researchers are able to reduce bruising and browning. The new characteristic could eliminate 1.5 billion pounds of wasted potatoes, addressing food waste challenges as well as environmental impacts.

Additionally, public/private collaborations are critical in advancing climate-smart agricultural and forestry practices. Appropriate policies can incentivize investments in plant breeding innovation, such as gene editing, while creating new jobs and market opportunities, and boosting sustainability along the entire agriculture and food value chain. We have seen evidence of this through several research efforts at land-grant universities and research institutes. For example:

> UC Davis: Researchers have discovered a wild lettuce variety that is capable of germinating at dry, high temperatures, which holds significant value given warming

global temperatures. Using gene editing, it's been shown possible to develop varieties capable of thriving in warmer global temperatures.

University of Florida: Researchers conducted a survey to observe the effects of citrus greening disease on citrus production. The Florida citrus industry and its position in the global citrus market is being jeopardized by a bacterial disease known as Huanglongbing (HLB) or citrus greening. The disease reduces yield, fruit size and quality, and increases tree mortality and cost of production. Since HLB was first found in 2005, researchers have reported that orange acreage and yield in Florida have decreased by 26% and 42%, respectively. Citrus growers need long-term, sustainable solutions. There is no question that plant breeding innovation holds the key. Using gene editing, researchers are working on developing citrus trees that are resistant, if not immune, to citrus greening, the bacteria that causes it, and the insect that spreads it. Innovation is enabling us to potentially do in years what would previously only have been possible in decades, or longer.

The Salk Institute in San Diego: Researchers are engineering crops to have more prominent roots made of a natural waxy substance called suberin—found in cork and cantaloupe rinds—which effectively captures carbon and is resistant to decomposition. The roots would store CO2, and when farmers harvest their crops in the fall, the deep-buried roots and the carbon they have sequestered would stay in the soil for years.

New York University: A $4 million grant through the Plane Genome Research Project has allowed NYU to address drought tolerance in rice. With decreasing land and water resources available to meet the future needs of humanity, gene editing has been used to develop rice lines that can be grown using saline water, with no changes to any other genes and no deleterious changes on any other aspects of planet yield and performance. These advancements, achieved in large part through plant breeding innovation, are necessary to meet the needs of our nation and the world.

Better seed allows farmers to grow more, using less land and fewer resources; and in turn, provides consumers with access to wider varieties of safe, affordable, and nutritious foods. Plant breeding holds the key to addressing many of our collective global challenges – from health and nutrition to hunger and climate change. The public and private sectors have an important role to play. It's critical that we continue moving forward, through a robust investment in research, development and education, to drive forward the next generation of innovative solutions to meet the emerging challenges of tomorrow.

Environmental and Conservation Seed

The seed industry plays an important role in providing quality seed for land restoration, rehabilitation, reclamation and conservation. Environmental and conservation seed helps to restore lands devastated by wildfires, natural disasters, and invasive weeds. It serves as the foundation of healthy landscapes, contributing to stable ecosystems and economies, while providing critical erosion-control and biodiversity benefits.

Cover Crops

Cover crops are an important means of increasing soil health, retention, and resiliency, improving farmer productivity, and enhancing carbon sequestration. ASTA members are working to develop new varieties of cover crops that address a range of issues including improving water infiltration to address excessive moisture, nitrogen fixation to reduce run-off, weed suppression to reduce herbicide use and soil health. ASTA has prioritized communication with its members surrounding cover crop adoption, focusing on training needs and education. There is a widespread concern surrounding practical impediments that are preventing cover crops from becoming more widely adopted. Farmers may not be aware of the benefits of cover crops or may lack the technical know-how to incorporate them into their operations. Several entities are conducting education and training for farmers on the use of cover crops, but additional funding is needed to heighten these initiatives. Minimizing bureaucratic hurdles for enrolling in the U.S. Department of Agriculture (USDA) programs and multi-year contracts will further encourage producers to use beneficial conservation practices. Lastly, additional funding is needed to make sure that farmers have access to the programs that offset cover crop expenses.

Seed Treatments

The USDA and the US EPA should continue to ensure that producers have the tools needed to promote resiliency, including seed treatments. Seed treatments help protect the developing seed genetics during its most vulnerable times – at planting and germination. The treatment's highly targeted, precise approach means less impact on the surrounding environment. This is one of the many valuable and innovative tools that enable America's farmers to be more productive, while using less land – that's a win for farmer's bottom line and a win for the environment. Continued innovations in seed treatments will allow farmers to meet new and emerging challenges while realizing healthy yields – all while protecting our land and natural resources for the future.

Public/Private Sector Collaborations

A long-standing example of public/private sector collaboration is the Germplasm Enhancement of Maize (GEM) project which is a cooperative effort of the USDA's Agricultural Research Service (ARS), land-grant universities, and the seed industry. GEM's objective is to widen the germplasm base of commercial hybrid corn in the U.S. through the introduction and incorporation of novel and useful germplasm gathered from around the globe.

Another example of successful public/private collaboration is the National Turfgrass Evaluation Program (NTEP). Similar collaborations should be established to increase awareness of opportunities and breeding needs in the cover crop sector.

The public and private breeding sectors and the agricultural producers of our food, feed, fiber and fuel supply could benefit from increased collaboration opportunities. Potential examples of collaborations that could begin and endure over the 2021-2050 timeframe are:

- Devising new crop rotation systems that introduce new crops into existing rotation patterns

- Identifying cover crop systems that fit into the growing season of the more northern latitudes that struggle to establish cover crops prior to the first freeze
- Modeling cropping systems and predicting durability of a range of pest solutions
- Identifying species that have substantial genetic vulnerabilities to pests due to the lack of genetic diversity and determining solutions to address those vulnerabilities
- Initiating collaborations, similar to the GEM, for other crop species, where the private sector enables collaboration with the germplasm, as well as in-kind support, and the public sector leads the "pre-breeding" efforts to diversify the species
- Increasing the strategic education of future public/private sector planbt breeding/agriculture employees with forward looking goals of developing skill sets needed for the next generation
- Increasing the number of employees that shift from the public to the private sector ,and vice versa, through revised sabbatical systems or planned employment shifts, including private sector sabbaticals where scientists visit universities and USDA facilities

Ongoing Work Within Individual Federal Agencies

Consistent and Transparent Communication

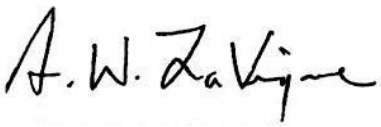
In order to maximize the benefits of innovations in plant breeding, there needs to be a rational and clear path to commercialization for new plant varieties that does not include unnecessary duplicative requirements or processes among the three U.S. regulatory agencies: the USDA, Food and Drug Administration (FDA), and Environmental Protection Agency (EPA). Historically, under the Coordinated Framework for Regulation of Biotechnology, USDA, FDA and EPA have each served a specific function in ensuring the health of our food and the environment. ASTA encourages the U.S. government to ensure alignment in risk-based policies around plant products of newer breeding methods across these three federal agencies. Lack of consistency and science-based regulation among the agencies will stifle research investments and activity, create uncertainty on commercialization of new varieties, and prohibit widespread access for public sector scientists to these evolving tools and the array of critical benefits they hold for society now and in the future.

One of the key barriers to application of innovative plant breeding methods is gaining the trust of consumers in accepting these innovative solutions. Therefore, communication across the value chain – public and private – about the value and benefits of these solutions continues to be critical. Regulatory burdens that are not justified by risk and science will also hinder the realization of plant breeding innovations. Potential regulatory burden includes policies that inhibit the flow of and the ability to access germplasm from accessions in other countries.

The Federal agencies and the private sector should collaboratively identify challenges and solutions to minimize duplicative regulatory burdens hindering commercial product development and marketing through innovative technologies such as genome editing. Joint efforts should be made to educate policy agencies in the U.S. and globally regarding the safety of enabling technologies that increase plant performance.

Again, ASTA appreciates the opportunity to provide a response to PCAST, and looks forward to continued collaboration on these critically important issues.

Sincerely,



Andrew W. LaVigne
President and CEO