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**Hearing of the U.S. Senate Committee on Agriculture, Nutrition, and Forestry
FARM BILL 2023: RESEARCH PROGRAMS
December 6, 2022**

Good morning, Chairwoman Stabenow, Ranking Member Boozman and Members of the Committee. I am Dr. Katy Martin Rainey, Associate Professor of Agronomy at Purdue University, where I conduct research on plant breeding and genetics. I am pleased to be here today to offer testimony on behalf of the American Seed Trade Association (ASTA), which represents nearly 700 member companies involved in seed production and distribution, plant breeding, seed treatment and related industries in North America.

Breeding and distributing the best seeds and other stocks is integral to U.S. farm productivity and food security, requiring substantial investments in R&D. Agriculture research through public-private partnerships, including seed companies, universities, and federal research entities, is foundational to crop improvement, and to U.S. farmers' access to the best varieties and hybrids. Many of ASTA's member companies work closely with public sector research programs like mine, for the public benefit.

Thank you for holding this hearing today to shine a light on the importance of agriculture research as the foundation of the Farm Bill, and ultimately of ensuring a safe and secure agricultural production and food system. Because of robust public and private investments in research over time, today's U.S. farmers produce increasingly more on the same acres using fewer resources, and U.S. farmers play an outsized role in global food security. Now, farmers and others engaged in agriculture strive to improve the sustainability of U.S. agricultural practices. But, now more than ever, U.S. agricultural production is faced with a complex array of emerging threats like extreme weather and new pests, combined with simultaneous needs to provide enhanced ecosystem services such as improving water quality. More is expected of the crops themselves, which increasingly provide not just food, but also renewable fuels and meat alternatives, while also sequestering carbon and using less fertilizer.

BENEFITS OF AG RESEARCH

U.S. seed companies, public and private scientists, and U.S. producers will continue to innovate to improve crops and production practices, thanks to ongoing and future cutting-edge research. Efficient and productive agriculture systems all start with seed. Strong investments in research from discovery through development lead to better seed, which means better outcomes for our farmers, our consumers, our land, and our environment, in the short and long-term.

These are not just platitudes, but are backed up with real data, including USDA based yield data per acre over many decades. The seed sector has a track record of return-on-investment to show for it.

I'd like to offer just a few examples highlighting the real and measurable value of public-led plant research:

- I leverage economically-valuable crop breeding research to also advance digital agriculture capacity for remote crop growth estimation, known as phenomics, and I launched a successful software company in this space. Because of my federally-funded training in entrepreneurship, I am currently seeking to extend my technology to facilitate effective on-farm research.
- My colleagues working on soybeans provide a perfect example of public-private cooperation on federally funded outputs to benefit consumers. A USDA geneticist at the Plant Genetics Research Unit in Columbia, MO discovered soybean mutants that produce healthier oil, and then collaborated with the University of Missouri soybean breeder to develop new varieties with funding from commodity organizations, the university, and the USDA. Today, the ag tech company Benson Hill has a vertically integrated program working with farmers to produce and sell the healthier oil, known as VERI oil, which is offsetting global deficits in the availability of sunflower oil due to the war in Ukraine.
- The Tasti-Lee tomato is the best-selling field round tomato in the U.S., and it is a hybrid produced by a private seed company from parents bred at the University of Florida with funding from growers.
- Lettuce is one of the most widely-consumed vegetables in the U.S., and is produced year-round in California and Arizona. Scientists at the University of California Davis (UC Davis) and the ARS Crop Improvement and Protection Research Unit are collaborating to develop and release varieties and breeding lines for the private sector, with critical resistance to diseases.
- Through a partnership with USDA, several leading academic institutions and Plant Sciences, Inc. (PSI), an agricultural research company, will study *Rubus*, or caneberry crops, and identify natural variation for future breeding and gene editing opportunities. Scientists and researchers from Pairwise, PSI, the University of Arkansas, the USDA Agricultural Research Service (ARS) in Corvallis, Oregon, Cornell University and North Carolina State University, will collaborate to identify and characterize the genetic diversity in blackberries, red raspberries and black raspberries as well as multiple wild caneberry species such as salmon and thimble berries.

CONGRESSIONAL SUPPORT

While there are many competing needs in the Farm Bill, we must prioritize a robust investment in ag research. Over the past decade, other countries have rapidly expanded investment in public agriculture research, threatening U.S. competitiveness. I want to thank the Committee for recognizing this through your historically strong support for research programs, including recent efforts to increase investment by:

- Strengthening and establishing authorities to bolster the role of the U.S. in agriculture research, including the Agriculture Advanced Research and Development Authority (AGARDA), and the Research Facilities Act in 2018;

- Preserving the baseline funding for key programs, including the Specialty Crop Research Initiative and Organic Research and Extension Initiative in 2018;
- The creation of the Foundation for Food and Agriculture Research in 2014.

RESEARCH PRIORITIES

We rely on the support of Farm Bill funding and programs to ensure continued U.S. leadership as the provider of the best seed to the world. ASTA worked closely with Congress to mandate that the USDA Agricultural Research Service (ARS) develop and implement a national strategic germplasm and cultivar collections assessment and utilization plan for the **National Plant Germplasm System**. As a key priority for ASTA, we look forward to the publication of this plan, which will be instrumental in establishing a roadmap for the sustainability of NPGS for years to come, allowing scientists access to critical plant germplasm, and enabling the development of new varieties and hybrids that resist pests, diseases, and environmental stresses. A strong and healthy national germplasm collection is valuable to the public and private sectors, especially with new technologies, such as genomic prediction, that enable us to fully utilize these collections.

USDA's Agricultural Research Service (ARS) leverages long-term investments for high- impact payoffs. Its management and utilization of vast collections of genetic resources is the type of research that can't be done by an individual university or company. A great example of utilization of the National Plant Germplasm System (NPGS) is the **Germplasm Enhancement of Maize (GEM)** project at ARS, which focuses on identifying useful genetic diversity in exotic germplasm for commercial use in developing new hybrids in the U.S. Over 300 lines have been released by GEM and made available to commercial breeders. The continued success of American agriculture is intimately linked to corn production, with USDA estimating 14.2 billion bushels were harvested in 2020. It's important to note, however, that U.S. corn production is still based predominantly on just two races of maize, when over 250 exist to be exploited. ASTA is encouraged by Congress' continued investment in ARS; however, additional funding is necessary to address the broad range of long- and short-term research needs of the entire agriculture sector.

Another key initiative, and one I'm passionate about given my role with Purdue University, is land-grant capacity funds, and funding for non-land grant colleges of agriculture. Capacity funds through the Farm Bill allow land-grant universities, like Purdue, to invest in infrastructure and people for cutting-edge research that has a direct impact on farmers in our states and beyond, and these capacity funds allow us to respond quickly to emerging issues. Consider tar spot in corn: Purdue uses Hatch Act funding to fund an Extension Plant Pathology scientist and the Purdue Plant and Pest Diagnostic Lab. Both were critical in 2018 when the lab identified the first instance of tar spot in Indiana. With resources already in place when tar spot hit Indiana fields, Purdue researchers and Extension specialists could quickly identify the new disease and start working on management options.

Consider as well that land grants are critical to agriculture research through our role in STEM education, indeed agricultural technology is a critical application of the STEM disciplines. Purdue estimates that approximately 59,000 new U.S. graduates with agricultural expertise are needed per year, and land grant universities educate this workforce. Nonetheless, the land-grant system is facing unprecedented infrastructure challenges. U.S. scientists and educators are asked to perform

21st century science in facilities constructed in the 1950s and 1960s, and this situation negatively impacts recruitment of the best and most diverse talent to study critical topics in food security. According to the Association of Public and Land-grant Universities (APLU), more than 69% of research and education facilities at land-grant universities colleges of agriculture are at the end of their life cycles. To remedy this, robust support is needed via the Research Facilities Act in the 2023 Farm Bill.

The National Institute of Food and Agriculture (NIFA) leads and funds extramural research, education, and extension programs in partnership with leading scientists and educators around the country. As you know, under its flagship competitive grants program, the **Agriculture and Food Research Initiative (AFRI)**, the agency funds research in several priority areas, including plant health and production and plant products. We are encouraged that AFRI has received critical increases in recent congressional appropriations cycles, but it continues to be funded significantly below its authorized level of \$700 million. We thank the Committee for its continued support in the authorization of AFRI, and we strongly support its full funding through congressional appropriations. Similarly, as the primary entity funding public-private partnerships for food and agriculture research, the Foundation for Food & Agriculture Research, or FFAR, leverages federal funding to bring private-sector investments and knowledge to public scientists. To date, FFAR has awarded over 290 grants with more than 550 funding partners, and spanning 45 states and 17 countries. With an average matching rate of \$1.40 FFAR is on track to invest nearly a billion dollars in food and agriculture research.

The Economic Research Service (ERS) and the National Agricultural Statistics Service (NASS) provide foundational research and data in socioeconomics, and statistical insights that are critical for all agricultural stakeholders. The tools and services provided through these agencies inform the decisions of seed companies and the rest of the private sector, as well as scientists, producers, and policy makers.

For instance, producers across the country have been seeking to adopt conservation practices, such as using cover crops to improve soil health. Data related to acres and types of cover crops planted would help producers and the seed industry plan ahead to ensure the availability of high-quality cover crop varieties at the right place and the right time. As Members of this Committee seek to assess programs and policies that support conservation, the work of ERS and NASS will continue to grow in importance as the agriculture industry continues to work to overcome challenges and meet food security needs with a reduced carbon footprint.

The **Agriculture Advanced Research and Development Authority (AGARDA)** was established in the last Farm Bill to allow USDA to drive high-risk and long-term research to address challenges that threaten the stability and economic viability of agriculture in the U.S. Modeled from the success of other advanced research and development authorities such as the Defense Advanced Research Projects Agency (DARPA), and the Advanced Research Projects Agency – Energy (ARPA-E), AGARDA was established to support transformative advances that industry by itself is not likely to undertake because of technological or financial uncertainty.

One area of great potential within AGARDA is to support the role of data in agricultural resiliency. The AGARDA authority provides the ability to facilitate the sharing of publicly-funded ag research

data. A reauthorized and robustly funded AGARDA would position USDA to lead a partnership of agricultural data stakeholders in the development and implementation of badly-needed data infrastructure that is currently lacking in public agriculture research.

In the seed sector, we are challenged to respond quickly to new production challenges with new seed of hybrids and varieties. The **Ag Genome to Phenome Initiative (AG2PI)**, enhanced in the last Farm Bill, is generating knowledge that bridges genomics, phenotype, and the environment to support more responsive, and predictive plant and animal breeding programs. This initiative strengthens interdisciplinary collaboration among public and private research communities, which will enhance U.S. producers' access to improved crops and livestock in future scenarios. ASTA supports full funding of the AG2PI through congressional appropriation.

As we deal with ever-increasing challenges facing the future of our planet, all of these programs play unique and important roles in driving the solutions for a more secure and sustainable future, while keeping the U.S. competitive at the global level. It's important that these solutions are founded on measurable, data-driven metrics, emphasizing the critical role of research arms like USDA's Research, Education, and Economics (REE) in supporting NRCS, FSA and other agencies as they work to achieve large-scale conservation outcomes.

CONSERVATION PROGRAMS

In the area of conservation, as we look to increase conservation and cover crops practices, advancements in breeding will bolster their vast benefits – for climate adaptation and mitigation, soil health and habitat restoration – while at the same time boosting farmer productivity. In fact, the significant use of cover crops in production agriculture is one of the most promising practices to address the stewardship of our soils and nutrient reduction in our environment. A report from the Farm Bill-supported **Sustainable Agriculture Research and Education (SARE)** program showed that cover crops have the potential to sequester approximately 60 million metric tons of CO₂ equivalent per year when planted across 20 million acres. **SARE** also qualifies the benefits of the use of cover crops to include:

- On average, cover crops reduced sediment losses from erosion by 20.8 tons per acre on conventional-till fields, 6.5 tons per acre on reduced-till fields and 1.2 tons per acre on no-till fields.
- Cover crops have been shown to reduce nitrogen losses by an average of 48% and as much as 89%.
- Cover crops have the ability to reduce average total phosphorus loads to waterways by 15% to 92%, but additional research is still needed

Additionally, 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, all while providing critical erosion-control and biodiversity. Whether it's farmers enrolling acres in the Conservation Reserve Program, signing up for the Environmental Quality Incentives Program to promote wildlife habitat or other environmental benefits, or strengthening efforts on working lands by implementing management activities through the Conservation Stewardship Program, farmers and landowners need high-quality, innovative seed. And that innovation starts with research in plant breeding.

PLANT BREEDING INNOVATION

One especially exciting focus of breeding as of late is the exploration of new and emerging tools like gene editing. These innovative methods have the potential to unlock new capabilities in plants thanks to robust private and public sector R&D investments over time. Gene editing is being used to help drive potential solutions to climate change, food and nutritional security, and sustainability. Here are just a few examples:

- Non-browning varieties of fruits and vegetable like potatoes, avocados, lettuce, and apples could significantly cut down on food waste – a problem that has serious consequences for people and for the planet. FAO estimates that worldwide, the amount of food wasted is enough to feed 2 billion people — more than double the number of people struggling with hunger. And food waste contributes to climate change, causing about seven percent of all greenhouse gas emissions.
- Drought tolerant and water-efficient varieties of crops, from lettuce to wheat and rice can reduce agriculture use of water for irrigation and help crops withstand a changing climate.
- Wheat with higher protein and fiber content; and berries that are more flavorful and higher in key nutrients can lead to healthier diets
- Multiple plant disease resistance genes can be leveraged for maintaining production levels despite the emergence of new diseases threatening crop production.

In order for the tremendous benefits of these innovations and others like them to become widely available, the U.S. must create an innovation-enabling environment that includes sustained and substantial investment in public-sector agriculture research; fair, strong, and enforceable protection for intellectual property rights to incentivize private investment and business development; and science-based, predictable and transparent regulatory policy in the U.S. and influencing regulatory policy alignment around the world. While the Farm Bill and the Research title are key, the industry will be limited without effective regulatory systems in place to allow for and foster continuing innovations such as these.

CONCLUSION

Before I close, I want to dispel the notion that commodity organizations, private companies, and a few other investors have the basic and applied research needs for row crops covered. While considering competitive granting programs, private sector investments in row crops deserve corresponding investment of public funds, because these crops, such as soybean, are so economically valuable, and critical to national security.

In summary, a strong federal investment in agriculture research—leveraged through strong public-private partnerships-- is vital to ensuring the success of U.S. farmers and a sustainable and secure global food production system. It begins with seed, which is founded on innovation. Thank you for allowing me the opportunity to provide remarks today on behalf of ASTA and their many partners in the public and private research community, and thank for your continued support for critical agriculture research programs. I am happy to answer any questions.

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