June 24, 2021

Produce Marketing Association, United Fresh Produce Association and Western Growers provide stakeholder input in response to the USDA NIFA request for input (NIFA Listens). Collectively, our associations represent almost the entire fresh produce and mass market floral supply chain in the US.

As NIFA prepares its RFAs for competitive programs, it is critical to highlight the importance of horticulture (including floriculture) in the US economy. We applaud NIFA's efforts to foster the culture of agricultural innovation, and see continued support for SBIR programs as integral to the success and competitiveness of the horticulture industry. There is a critical need to translate laboratory discoveries funding into commercialized tools for the industry. American horticulture faces unique challenges that can only be addressed by a sustained federal investment into R&D, and focusing on systems solutions for addressing these problems. Specifically,

1. **Labor and automation**. The pandemic exposed vulnerabilities in the labor supply. Modern agriculture is increasingly dependent on the collection and sophisticated analyses of big data and operation of next-gen technologies. An investment into R&D for robotics and automation technologies that will reduce labor needs in the most labor-intensive segments of the supply chain while maintaining the quality and safety of the product, is paramount.

2. **Biotech tools and resources**. Biotechnology is an important tool for solving problems of feeding a growing global population with fewer inputs. Key priorities for biotechnology research and adoption include:

- Identification and release of genotypes and tools to develop varieties that can be grown in new environments (including indoors), and have superior taste, sensory and nutritional properties
- Understanding consumer perception and overcoming barriers to consumer acceptance of genetic traits that make specialty crop production more efficient and sustainable.

There does not appear to be a consensus on how most efficiently address perceived consumer hesitancy toward biotech crops, however, anticipating these uncertainties will be critical to advancing sustainable horticulture.

3. **Sustainable packaging**. Distribution and sale of fresh produce requires packing and packaging that is low cost, biodegradable, stackable, yet sturdy enough so that it can withstand temperatures and conditions under which fresh produce and floral are shipped and stored. There is also a critical need to develop home compostable/biodegradable stickers for fresh produce to replace existing plastic PLU stickers and to develop home compostable/biodegradable adhesives for produce labels.

4. **Technologies to reduce food waste and food loss**. Produce and floral are perishable commodities. Therefore, there is a need to develop tools and technologies that extend shelf life and quality of fresh fruits, vegetables and florals. Such tools and technologies cannot rely on single-use packaging/packing or have a significant requirement for energy.

5. **Systems "One Health" approach to food safety**. Unfortunately, some fresh foods have been linked to outbreaks of human illness. It is becoming clear that addressing safety of fresh and minimally processed foods would require a different paradigm. FDA has been clear that *Salmonella* and STEC found in the produce production environment can be traced to animal and poultry operations. It is therefore important to develop effective and cost-efficient tools (vaccines, probiotics, phages, other microbiome manipulations) for animals and poultry to minimize carriage and shedding of these human pathogens. Key priorities include:

- Developing effective and cost-efficient tools (vaccines, probiotics, phages, other microbiome manipulations) for animals and poultry to minimize carriage and shedding of zoonotic pathogens associated with produce consumption.
- Efficient and scalable tools for manure management to quickly and reliably remove human pathogens, both to promote food safety and address soil health.
- Understanding ecology, sources and carriage of emerging pathogens such as *Cyclospora cayetanesis*. This should begin with developing tools to propagate the organism, or identify an appropriate surrogate, given that researchers are limited in their ability to conduct research due to the shortage of oocyts. *Cyclospora* research should also seek to uncover the life cycle of the parasite, triggers for infectivity, and opportunities to disrupt the life cycle, limiting the public health impact (estimated between 125,000-190,000 cases of illness in the US annually).

6. **Climate-smart agriculture and smart energy**. Our industry plays a unique role in a responsible stewardship of our Nation's limited natural resources. We see a need to:

- Develop technologies that will lead to the intensification of production under the conditions that lend themselves to intensification practices, and in parallel provide incentives for taking marginal lands out of crop production.
- Develop renewable and affordable energy solutions, and evaluate research and outreach efforts that incentivize small businesses to develop microgrids for renewable energy.
- Understand basic science behind crop-specific conservation practices that sequester atmospheric carbon.
- Research is critically needed to develop valuation metrics for carbon-sequestration in specialty crops in order to provide a robust foundation for incentivizing adoption of the production practices that promote soil health, sequester carbon and also allow for profitable operations
- Conduct research to assess economic viability and sustainability of regenerative agriculture
- It is now clear that soil carbon stocks and soil-sequestered carbon are negatively impacted by tillage. However, current production practices for most economically-important vegetables (including vine-stalk vegetables) require tillage, forming beds, etc. Therefore, there is a need to develop and validate production practices for vegetables that involve minimal soil disturbance. Assessment of economic viability, labor, equipment and varietal needs required for these production practices must be a component of this work.

7. **Health benefits of consumption of fresh produce and floral**. We urge NIFA to invest into understanding multi-dimensional impacts of fresh flowers, fruits and vegetables on human health. The data on specific nutritional benefits have been difficult to reproduce. It is critical to understand the basis of this variability, as it can be derived from the impacts of production practices, crop genotypes and their interactions with human genetics and microbiomes. We will not be able to fully capitalize on the health-promoting benefits of fresh produce until these interactions are understood. Further, more studies are needed to investigate the importance of florals in promoting mental and emotional health.

8. **Integrated Pest Management (IPM)**. It is critical to continue to invest into optimizing IPM. Food production is not without trade-offs, and the smart use of the entire tool set of technologies and inputs is critical to feeding the exploding human population, while protecting the planet. With pollinator health continuing to be a global concern, it is critical to invest into identifying novel technologies for controlling pests that will not harm off-target organisms. NIFA has invested significantly into various environmental surveys: it is time to move beyond cataloguing issues, and toward identifying and validating pro-active, systems-based solutions for integrated pest-management.

9. **Water: safety and use efficiency**. Issues in water use efficiency are inseparable from the critical need to ensure microbiological safety of water for use along the fresh produce and floral production chain. There is a critical need to develop new technologies to assure microbiological safety by improving microbiological water quality and water conveyance systems for specialty crops. Education and outreach efforts should focus on continuing water access for specialty crops and floral, and research should focus on incentivizing scale-up of technologies for smart water use. Identifying crop genotypes, soil amendments or microbial formulations that can significantly increase plant resilience to environmental stressors (including droughts) appear to be promising directions for research on increasing water use efficiency. Research on green roofs, capture of rainwater can be also promising as long as it focuses on scaling up these technologies to make them economically viable for operations of size that represent modern crop production.

10. **Soil health**. Despite decades of research, the term "soil health" continues to be vaguely defined, lacking robust metrics. If we are to make progress in promoting soil health, there need to be clear, actionable and science-based metrics for assessing soil health. Validation of the role of crop production practices (beyond conservation tillage, cover cropping and fallow) in promoting soil health is also critical.

11. **NIFA Fellowship programs**. Preparing a globally competitive labor force has to continue to be a goal of land grant university partners through education and extension efforts. We support continued investment in programs such as the National Needs Fellowship program and Multicultural Scholars program, and suggest that the United States would benefit from increased numbers of individuals with expertise in specialty crop production, produce safety, the intersection of climate change and sustainability with specialty crop production, and related disciplines.

It is critical that any review panel includes senior decision makers from the industry or trade associations that represent the industry. Furthermore, it is imperative that any funded project includes a consultative body/advisory board that consists of industry scientists and decision makers to ensure that research, extension and education efforts funded through this project aim to address needs that directly impact the industry and consumers.

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