

Visualizing the Future of Agricultural G2P



Agricultural Genome to Phenome Initiative

Timeline: Gathering community perspectives

September 9-10, 2022: AG2PI organized the “Thinking Big: Visualizing the Future of AG2PI” workshop held, in Ames, Iowa, co-hosted with the United State Department of Agriculture’s National Institute of Food and Agriculture (USDA NIFA).

During the meeting: attendees were asked to use their experience and curiosity to review the current status of agricultural genome-to-phenome (AG2P) work and envision the future of the AG2P field, based on community input from surveys and AG2PI advisory boards (see pink box).

Subsequent to the conference: additional writing, idea exchanges, and e-mails were shared among participants. Challenges and solutions were identified across multiple topics (see green box) and two areas of innovation are recommended: 1) innovate in genetic improvement methods development and evaluation and 2) innovate in agricultural research processes to solve societal problems.

Now-Future: To address these needs, we provide six specific goals that should be implemented immediately in support of advancing AG2P research (see blue box).

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David Ertl, Iowa Corn Growers Association
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Common Challenges to Address

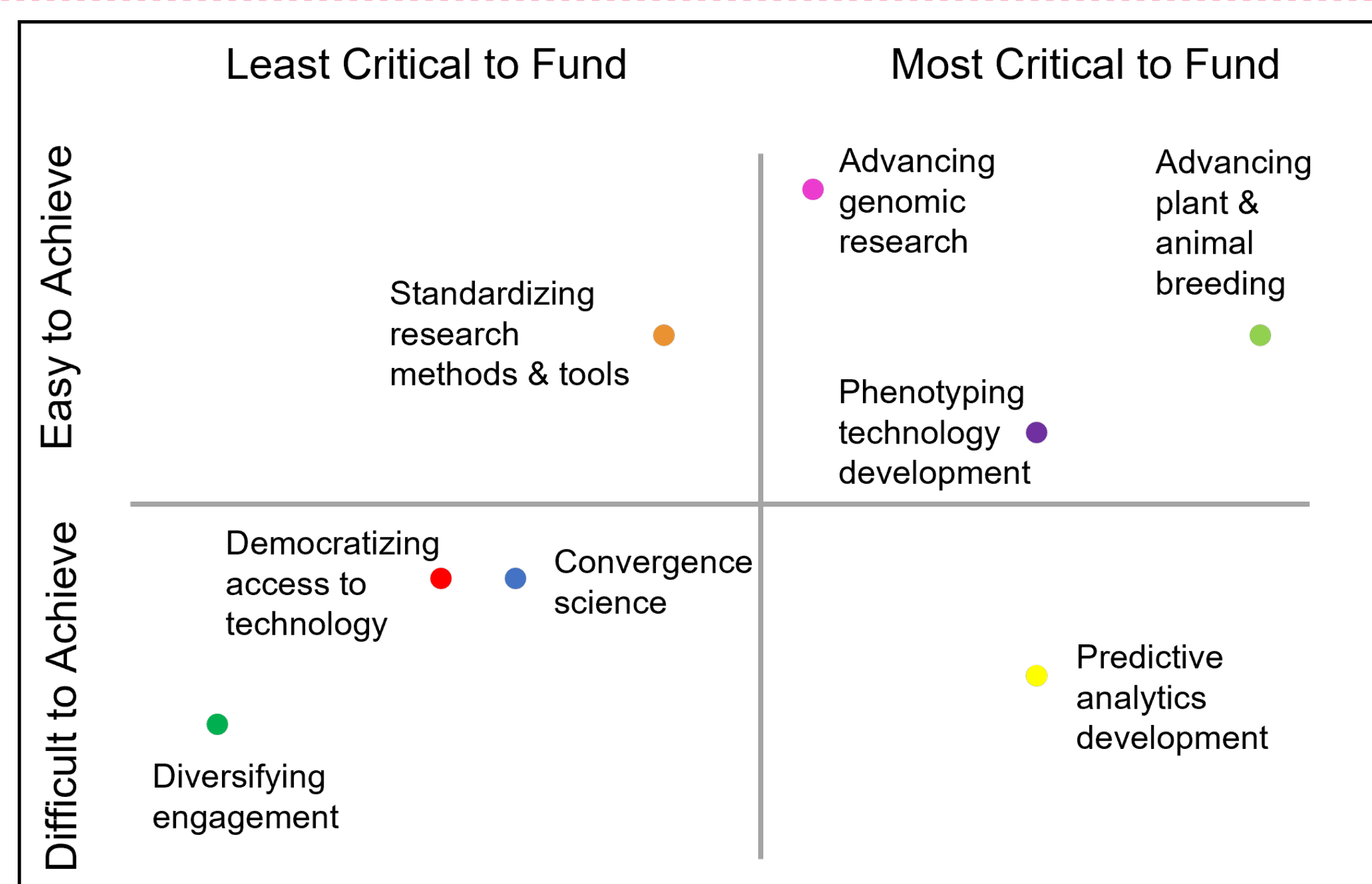
Topic Area	Galting public trust or support	Shortage of trained personnel	Disrupting cultural norms in disciplines	Reinventing the wheel / not publishing failures	Cost effectiveness	Intellectual Property	Targets / parameters still unknown
Phenotyping technology development	☑				☑		☑
Advancing genomic research	☑	☑		☑			
Convergence science	☑		☑			☑	
Advancing crop / livestock breeding	☑					☑	
Predictive analytics		☑	☑	☑			☑
Diversifying engagement	☑			☑	☑		
Standardizing methods / tools			☑	☑	☑		☑
Democratizing access					☑	☑	

Method: The challenges and solutions delineated are distilled from two 1.5-hour small group discussions that included 6-8 participants, each representing a mix of crop researchers and livestock researchers, data scientists, social scientists, engineers, and other diverse stakeholders. Tables include only those items that were mentioned across multiple topics.

Common Solutions

Topic Area	Recruit / train workforce	Share widely / open access	Public-Private Partnerships	Effective multi-disciplinary team building	Characterize / discover more variants	Include more voices
Phenotyping technology development	☑	☑	☑	☑	☑	
Advancing genomic research						☑
Convergence science	☑		☑	☑		☑
Advancing crop / livestock breeding	☑	☑	☑			
Predictive analytics	☑	☑		☑		
Diversifying engagement	☑		☑			☑
Standardizing methods / tools	☑					☑
Democratizing access	☑	☑				☑

Method: In the spring of 2022, AG2PI asked members of its scientific advisory board and steering committee to list what they “view as the most critical opportunities and challenges in the area of agricultural genome to phenome (AG2P) research.” This input was categorized and eight emerging themes, or “topics”, were included in a subsequent community survey in which participants (n = 148) were asked to mark the three topics 1) most critical for future R&D funding and 2) the most difficult to achieve. They were also asked what was least critical to fund as well as easiest to achieve.



We recommend that future AG2PI funding be used to address the following critical goals:

1. Provide resources to address identified needs for G2P research, including generation of benchmark testing datasets to identify success or failure and parameters to effectively advance from first- to second-generation AG2P predictive tools.
2. Remove current public-private barriers for collaborating with commercial entities that maintain large and relevant phenotypic datasets that are critical for development and testing of predictive algorithms for agricultural G2P.
3. Establish comprehensive public genome/phenome knowledge bases that enable FAIR data sharing as a foundation for building on Federal investments for exploration of biological function and creation of new and improved agricultural products.
4. Increase progress toward developing and evaluating data analytics training programs and accelerate the training of scientists required for AG2P research and implementation, using curricula identified in AG2PI activities (e.g., field days, training workshops and funded grants).
5. Expand the diversity of researchers, students and producers engaged in agricultural G2P activities through a sustained effort to bring G2P science and opportunities to underrepresented communities.



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