Improved Crop Yields & Nutrition

Group 2 focused on innovations to improve crop yields and nutrition, aiming to enhance food security and agricultural sustainability. The goal was to identify bottlenecks and interventions that could help scale crop improvements to better compete with traditional agricultural practices.

Objectives

1. Make agriculture more **climate-resilient** by engineering crops that can withstand a wider range of temperatures, drought, heat, and salinity
2. Reduce **agricultural inputs** by decreasing the need for chemical fertilizers and pesticides through the development of pest-resistant and nutrient-efficient crops
3. Increase **agricultural biodiversity** by expanding the number of plant species that comprise the majority of human-consumed calories
4. Generate **agricultural data sharing standards and norms**
5. Increase **crop yield efficiency** by improving overall crop yields, with a focus on sustainable production systems that reduce water usage

Bottlenecks

1. Difficulty of **neo-domesticating new crops**
2. Challenges in finding and sharing **useful, reusable data**
3. **Time required to validate yield-improving traits**
4. **Limited markets for climate-resilient crops**
5. **Need for farmer buy-in** (cultural, administrative, cost barriers)

Some interventions participants expressed interest in:

1. Onboard ethnocrops globally, maintaining national, regional, and tribal sovereignty of culturally important but agronomically neglected species
2. Consolidate all public databases on crop phenotype and genotype data, with significant curatorial efforts to standardize the data. Create a valuable resource and encourage others to share their data
3. Model and share yield-impacting trait data more deeply
4. Forecast the agriculture industry in the face of climate change, using multi-scenario modeling to allow for early investment driven by data, not investor hunches
5. Form farmer-biotech cooperatives, where farmers have an equity stake in the technology they are helping to develop and validate

Patterns:

1. **Rapid prototyping**: There was strong interest in investing in rapid plant models (e.g., algae, moss, duckweed) to accelerate research. Proposed interventions:

    a. Developing standardized greenhouse study methods with improved correlation to field conditions
    b. Creating AI models to test the impact of traits in-field, guiding the design of traits before field trials
    c. Investing in rapid plant models where photosynthesis traits can be tested much faster
2. **Diversification of crop species:** Ethnocrops and neo-domestication were suggested as a way to diversify the plant species used for human consumption. This was seen as a way to improve nutrition and climate resilience. Proposed interventions:
    a. Funding a “grand challenge” for neo-domesticating new crops
    b. Establishing a global decentralized effort to onboard ethnocrops (while maintaining national, regional, and tribal sovereignty)

    However, there was also significant skepticism about the feasibility of dramatically increasing the diversity of crops comprising the majority of human-consumed calories within a short timeframe. It was noted that existing NGOs have been working on similar goals for decades without achieving much.
3. **Field trials and yield improvements:** There was considerable discussion around the potential impact of dramatically increasing the number of field trials. Proposed interventions:
    a. A platform for farmers to perform experiments and record data in partnership with researchers and agriculture companies
    b. Establishing government-funded field trial zones in places with climates that reflect predicted future conditions (i.e. what we predict the climates of major agricultural areas will look like in 20-50 years).
4. **Regulatory and market challenges:** The group recognized the importance of addressing regulatory hurdles and market dynamics in bringing new crop technologies to scale. Some proposed interventions included:
    a. Developing a playbook to teach entrepreneurs about regulatory and incentive considerations that farmers contend with
    b. Identifying climate-resilient initiatives aligned with current government subsidies
5. **Climate resilience and sustainability:** Several objectives and potential interventions focused on developing crops that can withstand climate change and reduce the environmental impact of agriculture. However, these goals often faced challenges in terms of current market demand and the long-term nature of climate adaptation.

Key points of disagreement and uncertainty:

1. **Impact vs. Feasibility:** There was a recurring tension between the potential impact of interventions and their feasibility. Some participants prioritized high-impact, ambitious goals, while others favored more immediately achievable interventions. This was particularly evident in discussions about neo-domestication of crops and large-scale changes to agricultural practices.
2. **Scope and focus of interventions:** There seemed to be a preference for broad, systemic interventions over more targeted, specific research projects. This was reflected in the varying levels of support for different types of interventions, from

large-scale data sharing initiatives to specific technological improvements. One commenter thought this wasn't justified and constituted a bias.

3. **Role of technology vs. cultural/economic factors:** There were discussions about the relative importance of technological innovations compared to addressing cultural, economic, and regulatory barriers in achieving agricultural improvements. Some participants emphasized the need for farmer buy-in (noting their "razor-thin margins") and aligning innovations with existing agricultural practices and economic incentives.
4. **Data quality and utility:** There were differing opinions on the utility of large-scale democratic approaches to data collection. This was particularly evident in discussions about citizen science initiatives (concerns of low-qualita data) and the creation of large-scale agricultural databases (concerns of incompatible data). Some thought these problems were quite serious; others didn't. One participant suggested including standardized test-case samples to enable normalization of citizen-generated data.

Other Point:

1. While the group focused mainly on plant-specific interventions, there were brief mentions of soil health, marine farming, and fertilizer alternatives (due to, e.g., an estimate of phosphorus depletion in about 80 years).