Breakout Day 1: Production Priorities

How do we increase crop yield, resource efficiency and economic return?

1. Identify impactful decision
2. Outline the data required
3. Define and prioritize technical white space (e.g. accuracy, frequency, resolution)
4. Estimate potential impact of success

Format

1. Introductions (5 min)
2. Subgroup discussions (20 min)
3. Subgroup readouts, group discussion (1 hour)
4. Closing thoughts (5 min)

What are the greatest yield-impacting decisions?

Plan	Prepare	Plant	Produce
Crop Rotation	Tillage	Seed Depth	Insect Control
Row Spacing	Burn-Down	Planting Speed	Weed Control
Genetics Selection	Fertility Program	Population Dynamics	Disease Control
Seed Treatment	pH Management	Fertilizer	Irrigation
Soil Protection	Irrigation Program	Herbicide	Macronutrients
	Other Pre-Treatments	Insecticide	Micronutrients
		Fungicide	Harvest Timing
			Storage

Breakout Day 1: Abiotic Sensors and Platforms

What are the technical priorities in terms of node and network development?

Format

1. Introductions (5 min)
2. Group discussion
3. Closing thoughts (5 min)

What are the technical priorities for node and network development?

Abiotic Parameters (non-exhaustive)	
Carbon Monoxide	Iron
Humidity	Macroaggregate stability
Methane	Manganese
N2O	Molybdenum
Temperature	Nitrogen
Acidity	Permeability
Boron	pH
Buffering	Porosity
Bulk density	Redox potential
Carbon (organic/inorganic)	Salinity
Chlorine	Sulfur
Copper	Toxic substances (Cd, Pb)
Extractable K	Water
Extractable P	Zinc
Humification	

Sensors – what are the best methods for sensing the phenotype parameters of interest?

- Where are the greatest deficiencies?
- Is the challenge one of accuracy, deployment, or durability?
- How might an in-field network interact with remote sensors? With farming equipment?
- How do we ensure sensor accuracy and durability in outdoor environments?

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Power – where is the cutting edge with respect to:

- Energy efficiency, especially during data transmission
- Power sources that can tolerate the environment while ensuring operation throughout the year
- Energy harvesting mechanisms

Processors – to what degree can analytics be pushed to the edge?

- What does this mean for power consumption?
- What are the requirements for memory, on-site security?
- What are the benefits?

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Communication – how do we improve data transfer rates and volumes?

- What are the most promising methods of reducing the cost of data transmission? What are the trade-offs?
- What are the most promising methods of node coordination? How do we ensure that node failure does not result in system failure?

What are the environmental considerations and/or opportunities related to leaving these devices in the field over the course of a season?

How does node size impact:

- Power strategies
- Transmission strategies
- Deployment strategies

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2. Group discussion
3. Closing thoughts (5 min)

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Biotic Parameters (non-exhaustive)	
Above ground yield (dry, wet)	Respiration
Composition (carbs, lignin)	Stage of development
Emergence rate	Stem diameter
Flowering date	Stress response
Hormones	VOCs
Disease, Insects, Weeds	Water potential
Leaf angle distribution	Yield
Leaf area	Biological activity
Leaf senescence	Microbiome
Lodging	Pathogens
Photosynthetic activity	Respiration
Plant height	

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Breakout Day 1: Decision Support

What are the critical elements of an integrated data pipeline for decision support, from in-field sensors to satellites?

Format

1. Introductions (5 min)
2. Group discussion
3. Closing thoughts (5 min)

What are the technical priorities for node and network development?

- What datasets are required to solve for crop performance prediction algorithms?
- How do today's crop production models and life-cycle analysis methods feed into state of the art machine learning capabilities?
  - How do we link phenotype, genetics, environment, and management?

What are the technical priorities for node and network development?

- How might these datasets enable machine learning, multi-sensor data fusion and neural network development?
  - What constitutes a quality machine learning dataset?
  - What are the most promising methods of incorporating disparate data sources?
  - At what stage are the data combined?
  - What is the role/impact of standardization?

What are the technical priorities for node and network development?

- How might improved processing at the node level impact overall performance?
- What are the primary metrics for measuring progress in this space?
- What are the data management implications for high data volumes generated over the course of a growing season/multiple years?
  - What are the most promising methods of archiving key datasets?
- What are potential strategies for preserving privacy and security while enabling and/or incentivizing data sharing?