Agriculture:
Wrap-up and Expectation

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(e-Asia JRP Workshop: Jan. 16, 2024)

Possible research topics

1. Innovative sensing, data processing
2. Design pest and disease warning system
3. Novel ICT technologies for field and post-harvest management
4. Educational materials on ICT for farmers
5. Development of integrated agriculture data platform
6. Social economic analysis on climate-smart food production

Major issues to be addressed

1. High-throughput phenotyping
2. Innovative data collection and creation of data base for its utilization

・・・ Key technologies for ICT-aided agriculture.

1. Phenotyping

We need super innovation to achieve sustainable and productive agriculture

Phenomics takes important roles in all of them

- Acceleration of breeding for super cultivars
  - Identification of new genes for crossing & genome editing
  - New trait definition with high heritability linked to final target trait
  - High fertilizer use efficiency
  - Biotic and abiotic stress resistance & resilience
  - high performance for yield, high nutrition & profitability
  - Design breeding based on G X E models
- Powerful crop monitoring tool in smart farming
  - Supporting super-precision farming
- Strong support for new discoveries in plant science
  - Understanding microbiome and crop interactions
  - Understanding environment and genome interactions

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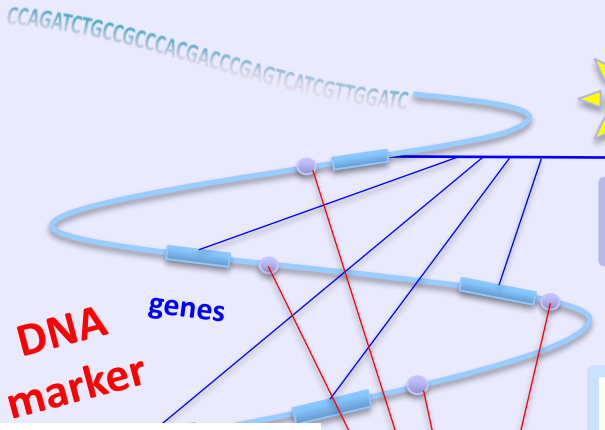
Acceleration of breeding by modeling P = G X E

- To understand the relationship between phenotype, genes, and environment
- One application is genomics selection



Field tests

Watanabe et al. (2005)
Ann Bot. 95:1131

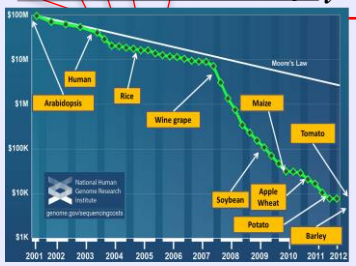
Selection by field observations

Prediction by DNA marker information

$$y_i = f(x_{i1}, x_{i2}, \ldots, x_{iN})$$?

Selection by predictions without cultivation

Next Generation Sequencer （NGS）



- Genotyping is not a bottleneck anymore
- Phenotyping is still very low-throughput in general

Courtesy of Prof. Ninomiya

Smart Farming helps improvement of productivity and sustainability

High-throughput phenotyping is a key basis for field crop management in smart farming

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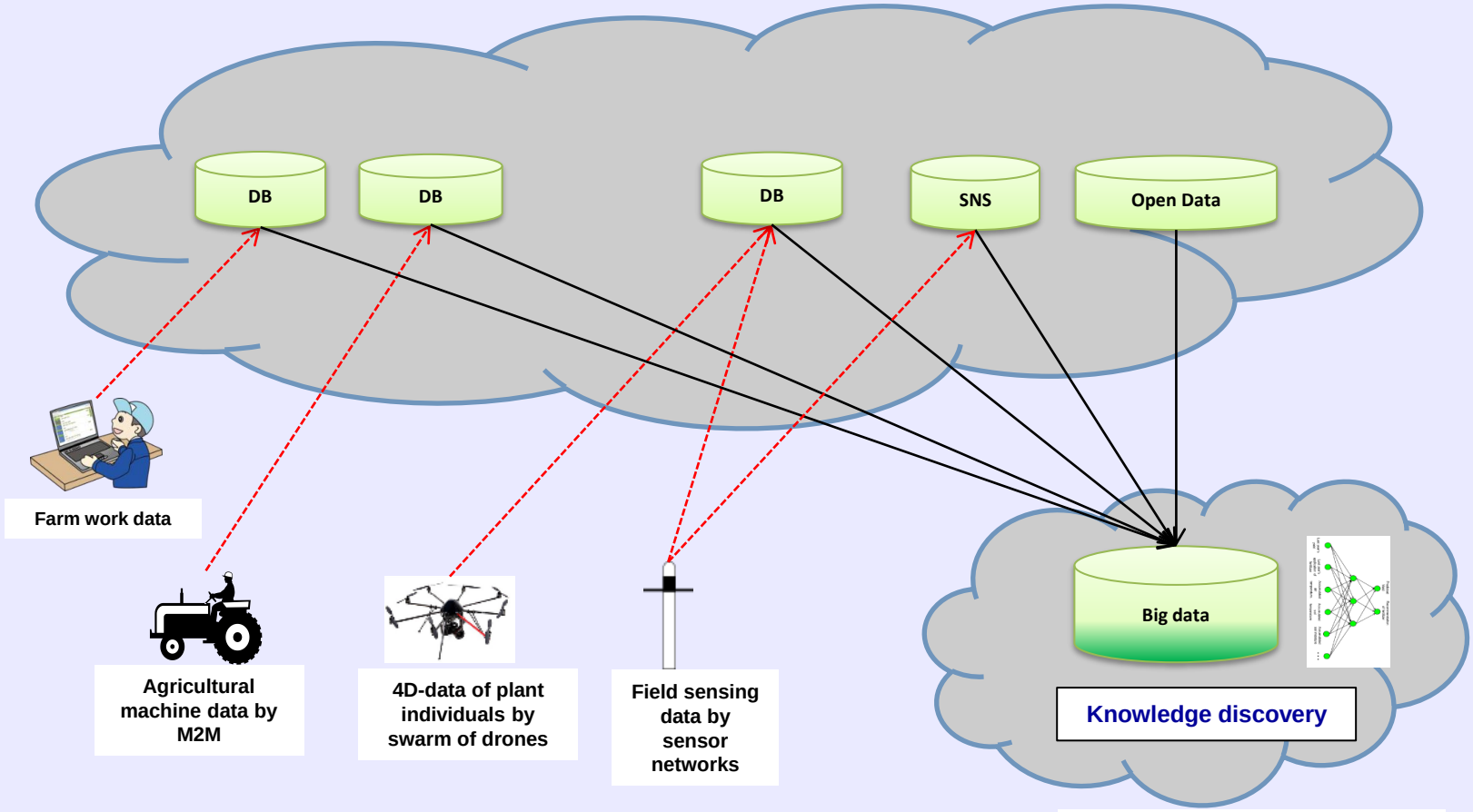
Courtesy of Prof. Ninomiya

2. Data collection and creation of data base

AgriBigData and Knowledge Discovery



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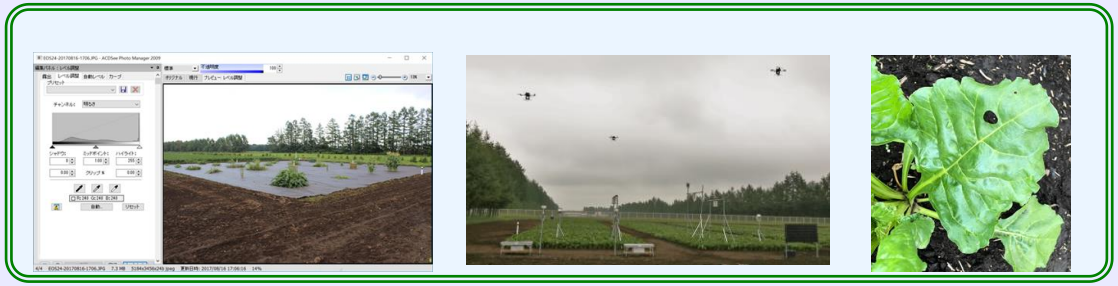
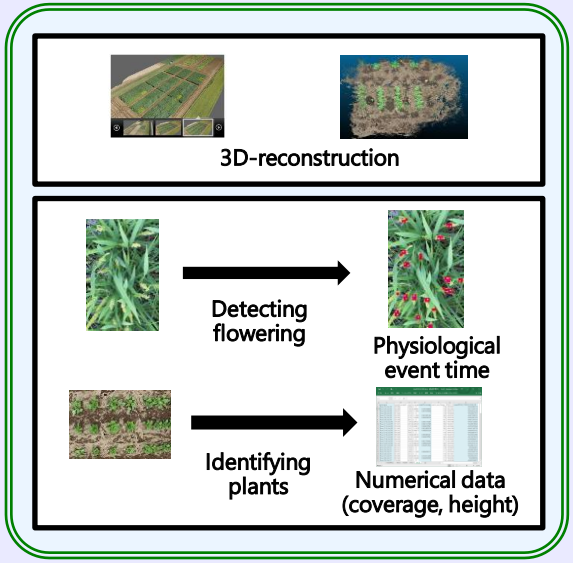
Data collection and application to practical uses

1. Collect data in fields (UTokyo, UTsukuba, NARO)

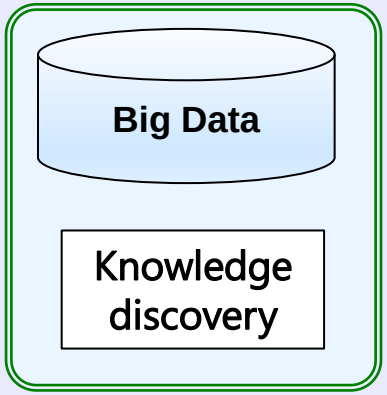


Improve breeding & farming

2. Get numerical data (Utokyo, NES)



3. Discover knowledge (UTokyo, NARO)



Social implementation

1. Collaboration with local governments
2. Establish companies

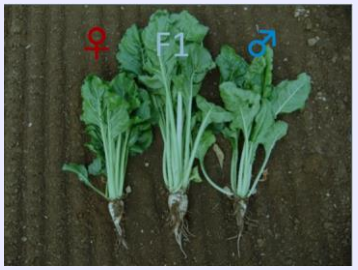
Courtesy of Prof. Hirafuji

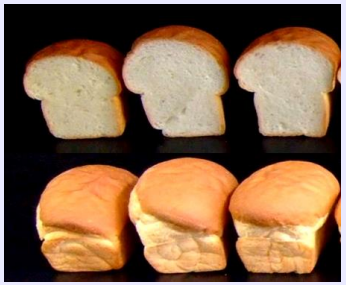
Selected 3 targets for knowledge discovery

1. Breeding & Agronomy
   - Easy field phenotyping methods
   - Findings about Heterosis (hybrid vigor)

2. Phytobiome dynamics to understand mysterious effects to plant growth
   - New data collection methods
   - Findings about symbiotic microbiome

3. Prediction to produce high-quality foods
   - New sensing methods
   - Findings about protein prediction





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Looking forward to proposals

Deadline for submission:

29 March 2024

Acknowledgements

The figures shown here were kindly provided by;

- **Seishi NINOMIYA, The University of Tokyo**
- **Masayuki HIRAFUJI, The University of Tokyo**
- **Kohki HOMMA, Tohoku University**
- **Takehiko HOSHI, Kinki University**