Using on-farm experimentation to transform agronomic research

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Brief self-Introduction: Takashi S. T. Tanaka

- Gifu University, Faculty of Applied Biological Sciences / Center for Artificial Intelligence Research Promotion
- Associate Professor (33 years old)
- Saguri Co., Ltd. Director and CTO (Selected as a J-Startup company)
- Specialization: Crop Science, soil and plant chemical analysis, analysis of sensing data, spatial statistics and machine learning
- Three years in Yunnan Province, China - able to speak Chinese / Visiting researcher at Wageningen University & Research
- Gifu Prefecture Smart Agriculture Promotion Committee Member

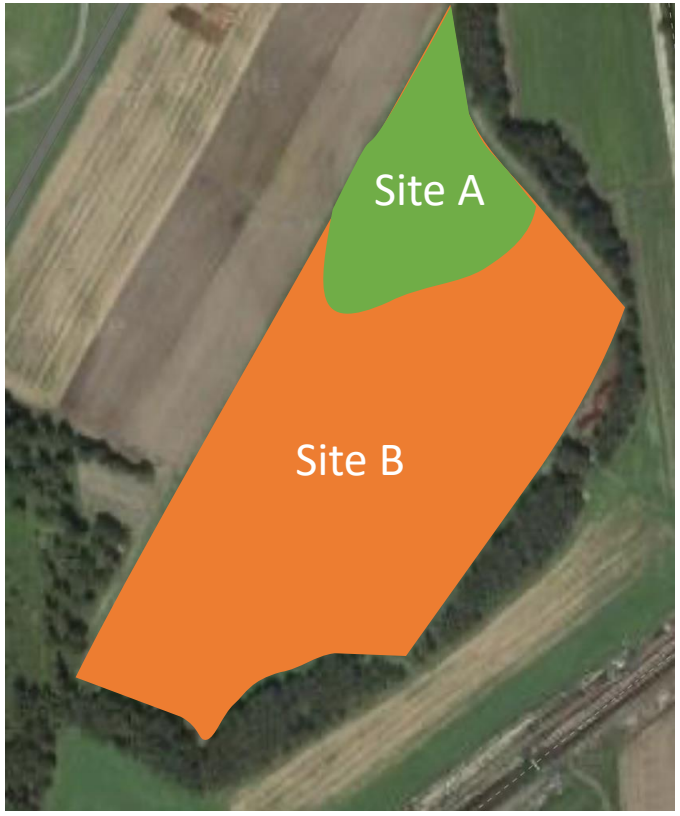
Research scale

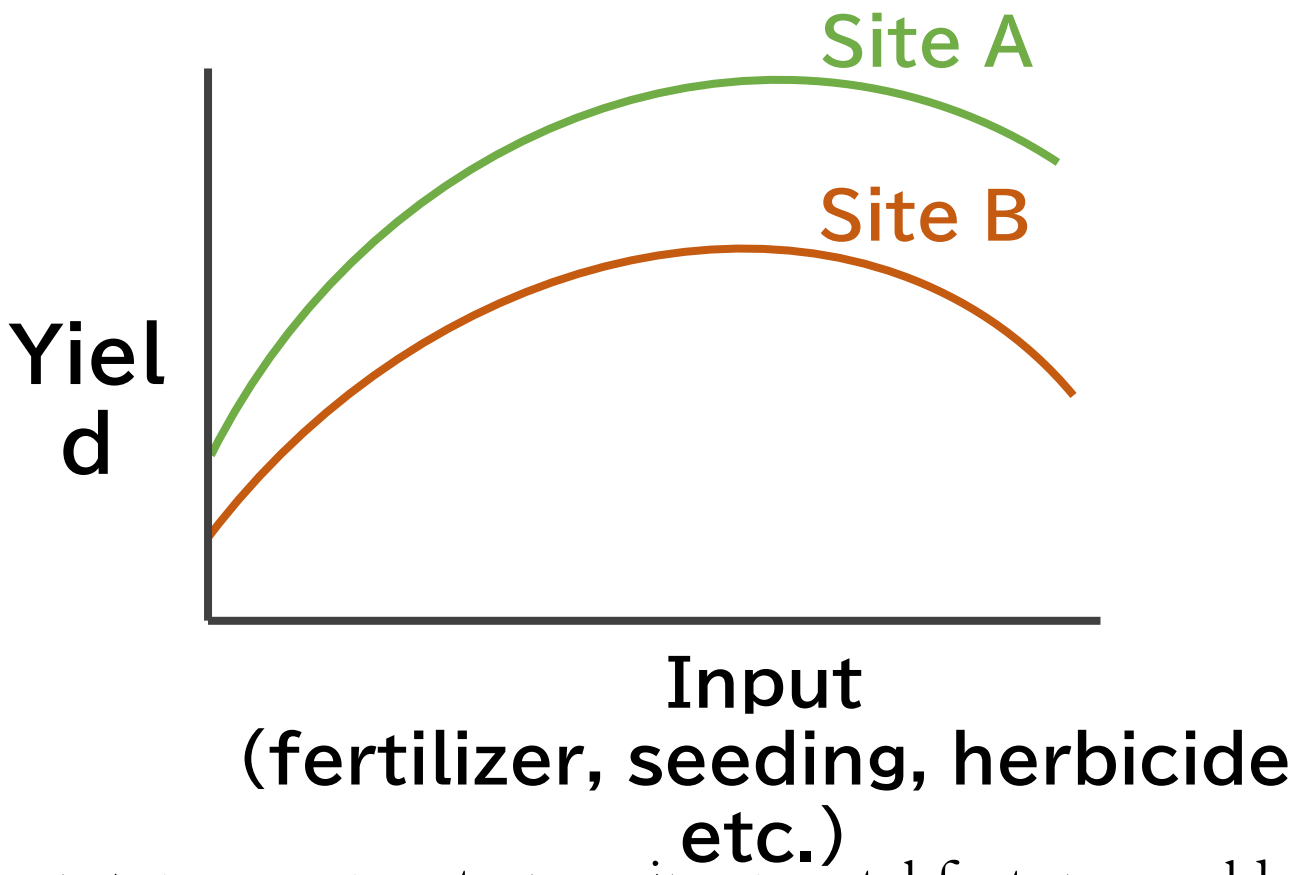
Pot experiment

Experimental field

On farm

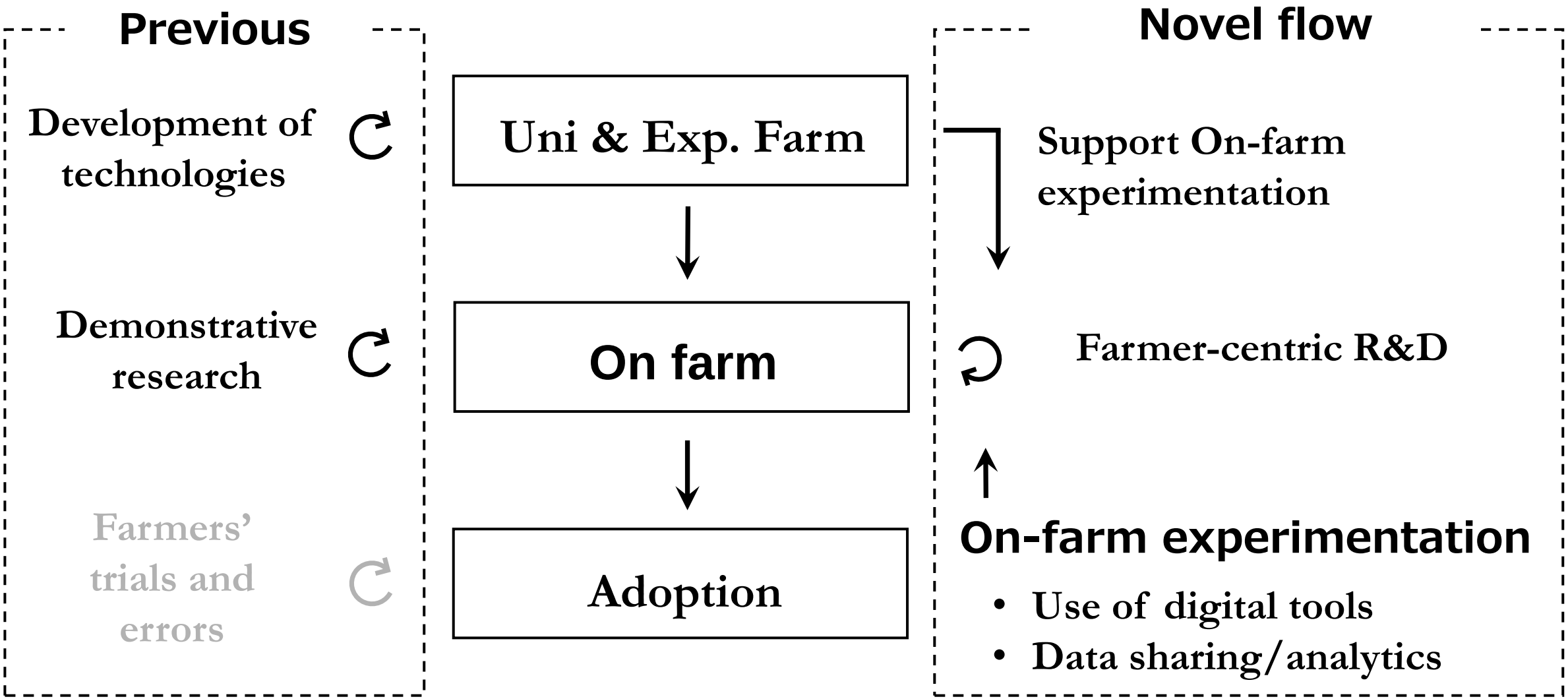
Site-specific crop yield response modelling

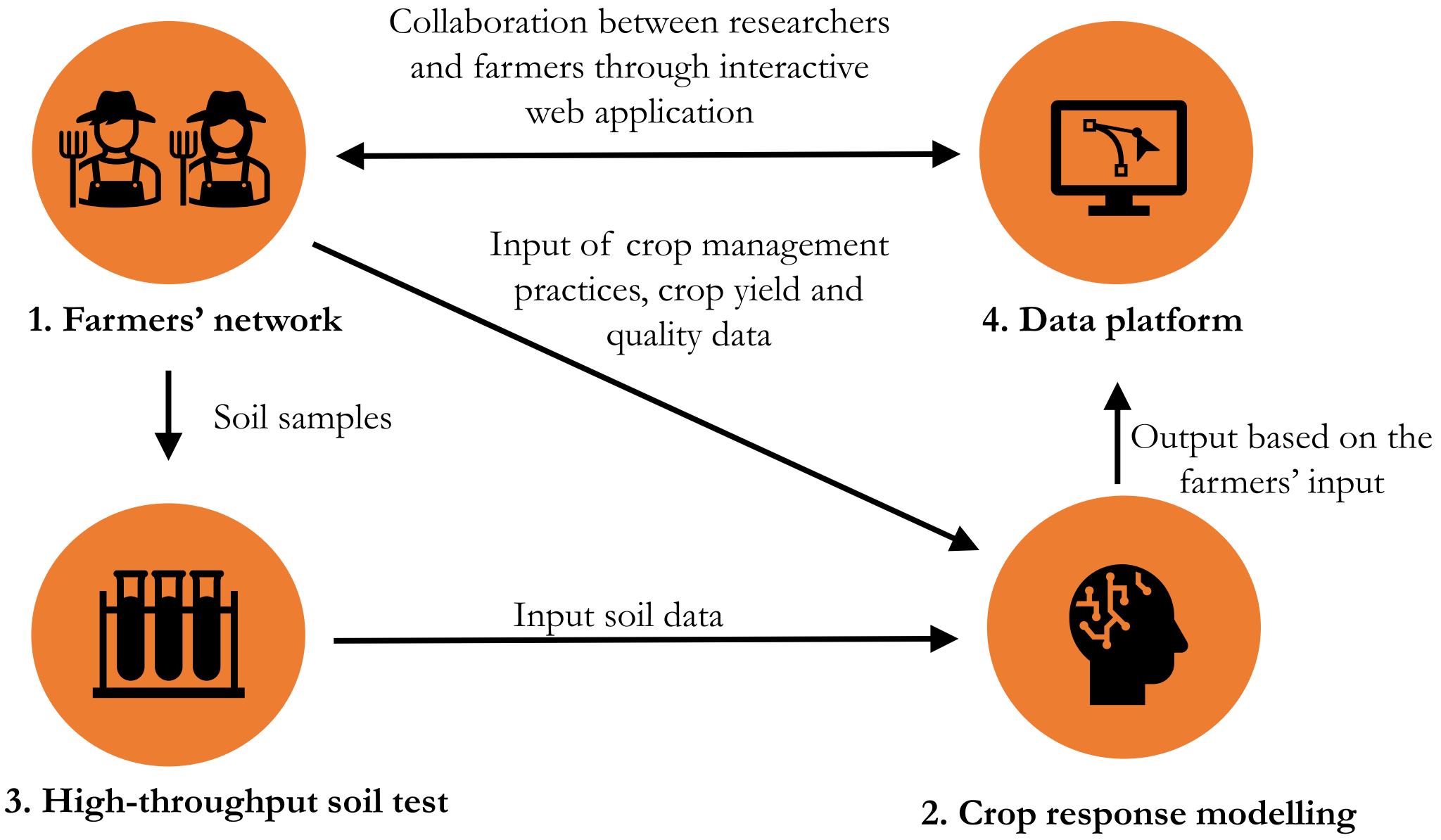




Understanding of crop yield response to crop management or environmental factors would contribute to better decision making, which can enhance profits while reducing environmental loads

How to transform agronomic research?



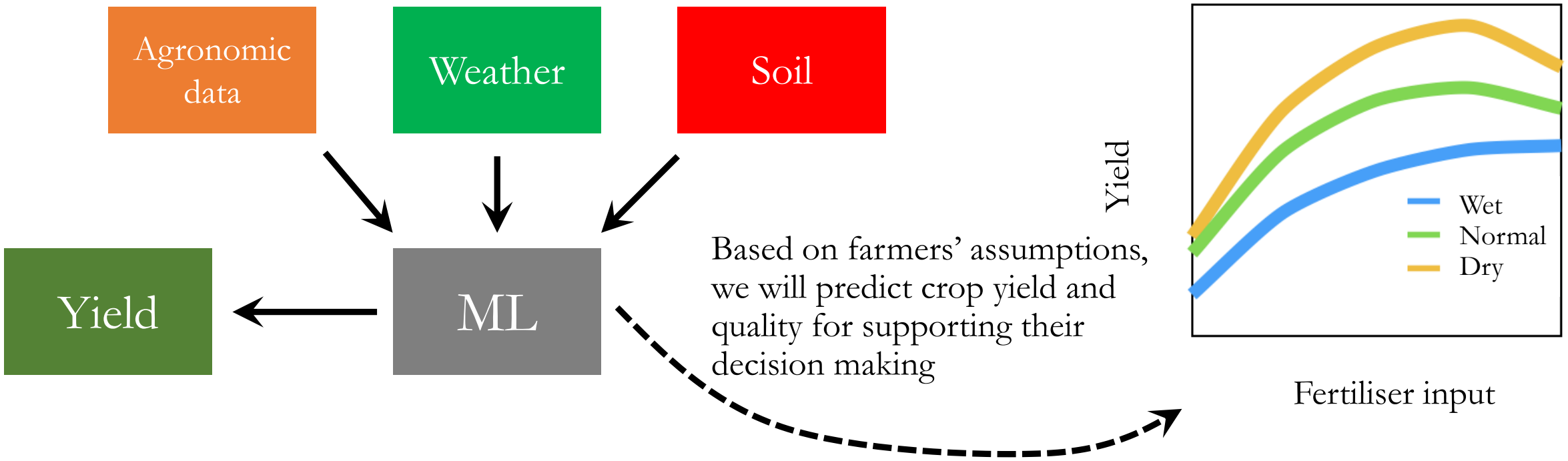

Collaboration between researchers and farmers through interactive web application
Input of crop management practices, crop yield and quality data
1. Farmers' network
4. Data platform
Soil samples
Output based on the farmers' input
Input soil data
3. High-throughput soil test
2. Crop response modelling

Topic 1: Establishing farmers' network

Data sharing

Focusing on farmers who are using yield monitoring system and cloud-based crop management tool.

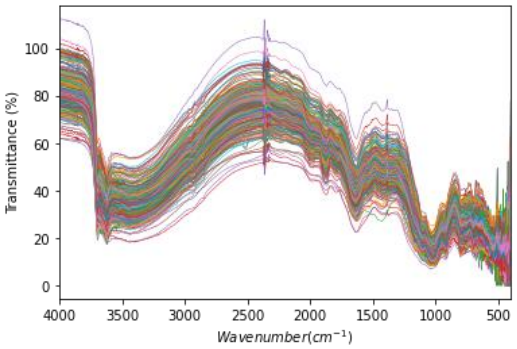
Topic 2: Crop yield response modelling



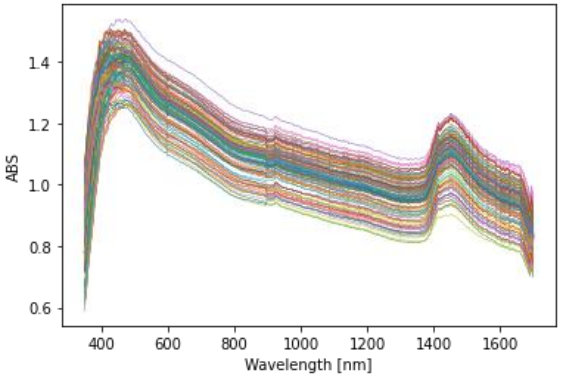
ML models
- Time-series deep learning models: LSTM or Transformers
- Causal inference: Causal machine learning
- Uncertainty analysis based on Bayesian optimisation

Topic 3: High-throughput soil analysis

Mid-infrared



Near-infrared



ML

Soil properties

- EC
- pH
- Sand, silt, clay
- Mineralizable N
- Available P
- Exchangeable K,Mg,Ca
- CEC
- TN, TC

- 3000 soil samples were collected and accumulating 1000 to 2000 points annually.
- Utilizing near/mid-infrared spectral data as explanatory variables, conducting ensemble learning

Topic 4: Data analytical platform

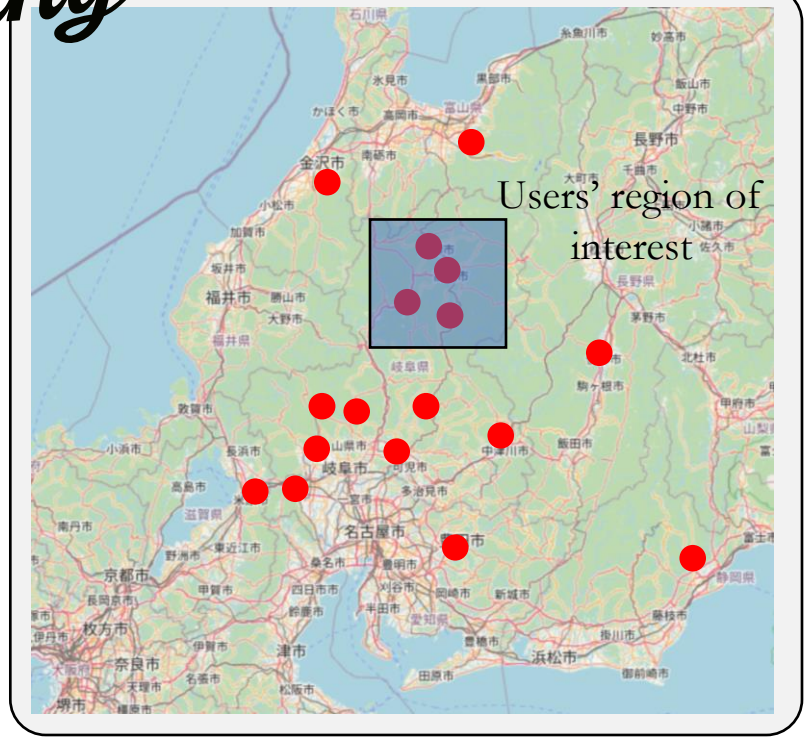
Shiny

Cultitvar

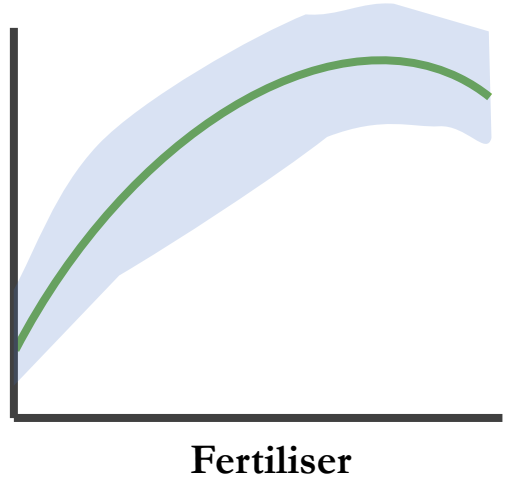
Transplanting

Fertiliser price （yen/20kg

Grain price （yen/60kg）



Model (Topic 2)



Presenting the economically optimal fertiliser rate tailored to each region and individual farmers!

EONR: **6** kg/10a

- Instead of unilaterally distributing researchers' analytical results in print media, we are developing an interactive web application that reflects analysis results based on the conditions users want to know.
- This application will assess not only economic feasibility but also, in the future, evaluate carbon sequestration and nitrogen leaching.

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