

High-speed, Highly Sensitive On-site Testing Kits for Agriculture

Masaya Miyazaki

CEO & Founder

HaKaL inc.



About HaKaL inc.

- **Origin:** University-based startup (Kyushu University)
- **Founder & CEO:** Masaya Miyazaki, Ph.D.
 - Ph.D. (Saga University, 1995); Postdoc, Joslin Diabetes Center / Harvard Medical School (1995–1996)
 - Former PI & Group Leader at AIST (2000–2016)
 - Visiting Professor, Kyushu University (2025–present)
- **Co-Founder:** Prof. Yuji Oki
 - Ph.D. (Kyushu University)
 - Professor at Graduate School of Information Science and Electrical Engineering (2007- present)

Milestones

2020 – HaKaL founded to commercialize on-site diagnostics

2021– present – Joint R&D network established (Kyushu Univ., AIST, Kumamoto Univ., other partners)

2022 – Nishim Electric Award, Kyushu Electricity Open Innovation Program

2023 – 2025 – METI Go-Tech (R5–R7): field pilots with livestock/ag partners

2023– Research Grant, Kyutech Foundation

2023– Research Grant, Kakiyama Science Foundation

2025 – Fukuoka Prefecture Leading Project (R7)

2025 – Nippon Award, Agritech Grandprix (Leave a nest)

2025 – Selected for ISSIN 2025, Fukuoka Prefecture's innovation acceleration program



HaKaL's Core Technologies

• Microchemical Analysis

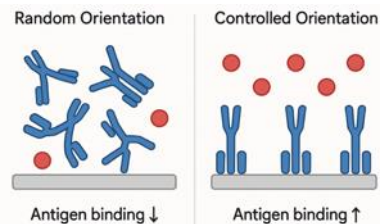
AIST/HaKaL (Miyazaki)

① Controlled Molecular Orientation

Optimize Molecular Recognition



Improved Reaction Efficiency



② Controlled Surface Chemistry

By integrating these technologies, HaKaL develops simple, affordable, rapid, and highly sensitive on-site diagnostic systems.

Improved Stability

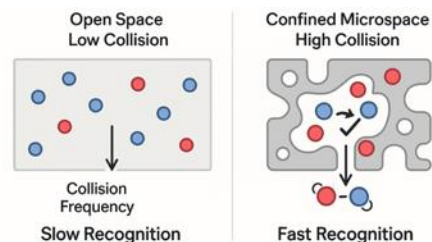


③ Controlled Reaction Space

Controls diffusion to increase collision frequency



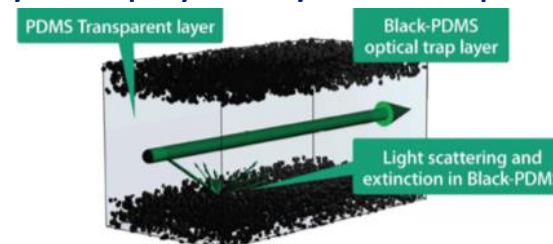
Accelerates reactions



• Device Fabrication Technologies

① Silicone Optics/Laser Technology (Oki)

Thermally and physically stable optical components



② Quantum Spatial Filters/MEMS (Dr. Nakashima)

Spatial design for optical control



Agricultural Issues & Solutions

AGRICULTURAL ISSUES

- Nutrient imbalance in soil
- Health management of livestock
- Contaminated irrigation or groundwater



ON-SITE MEASUREMENT SOLUTIONS



- Portable analyzer and smartphone-based readout
- Quantifies nutrients, minerals and pathogens directly in the field
- Data can be linked to cloud platforms for smart farming

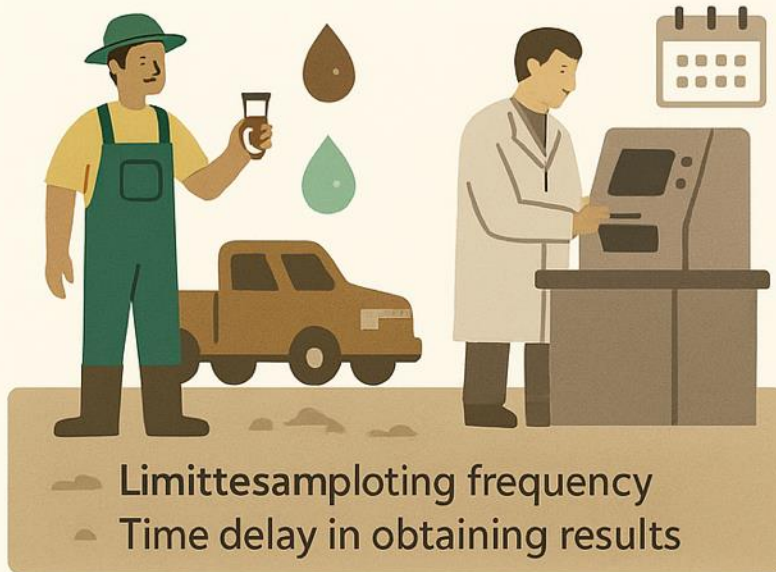


Current Status of Soil Testing

Current Status and Challenges in Soil and Water Quality Analysis

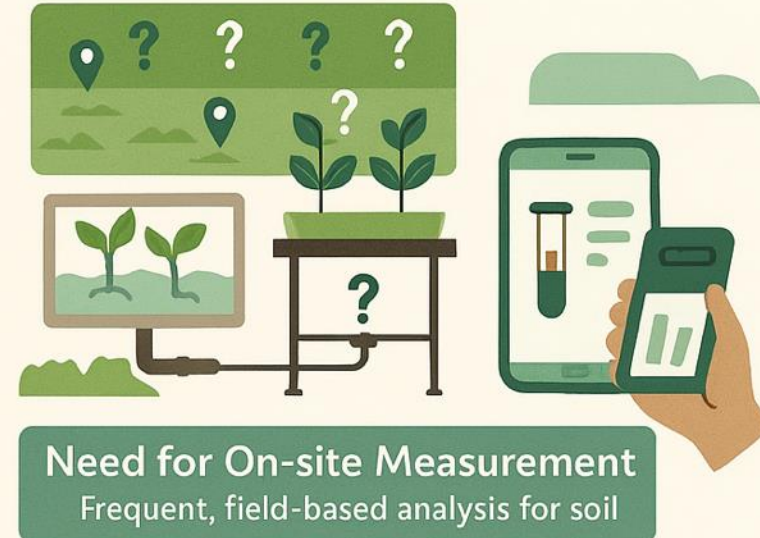
Current Practice

- Lab-based testing
- Limited sampling frequency
- Time delay in obtaining results
- Expensive and requires transport



Challenges

- Data gaps between sampling times
- Hard to manage field-level variations
- No real-time feedback
- Not suitable for precision farming



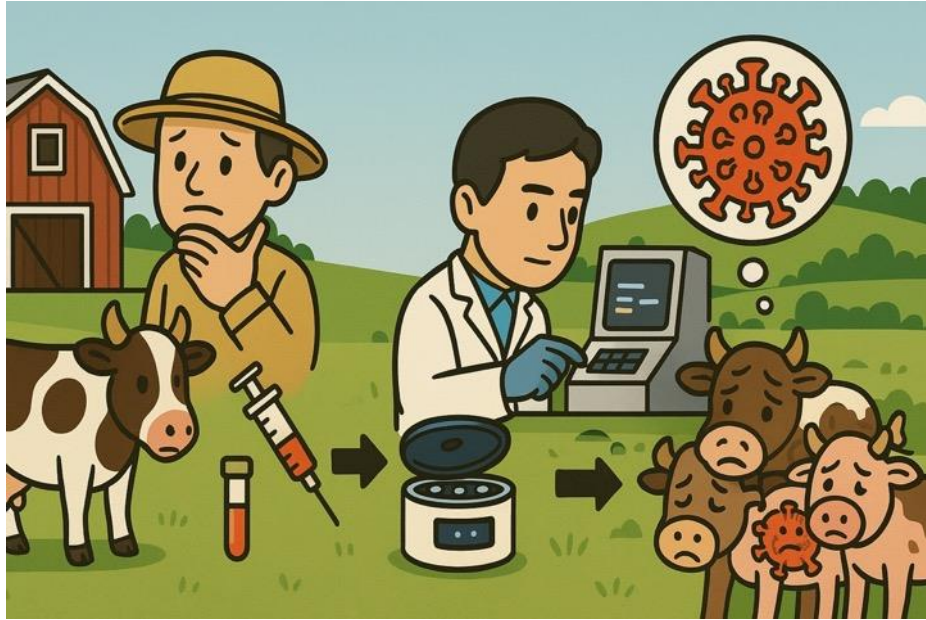
HaKaL's Solution for Soil/Water Analysis



1. Portable analyzer and smartphone-based readout
2. Quantifies nutrients, minerals, and pathogens directly in the field
3. Rapid, reagent-based testing for soil, water, and livestock samples
4. Data can be linked to cloud platforms for smart farming

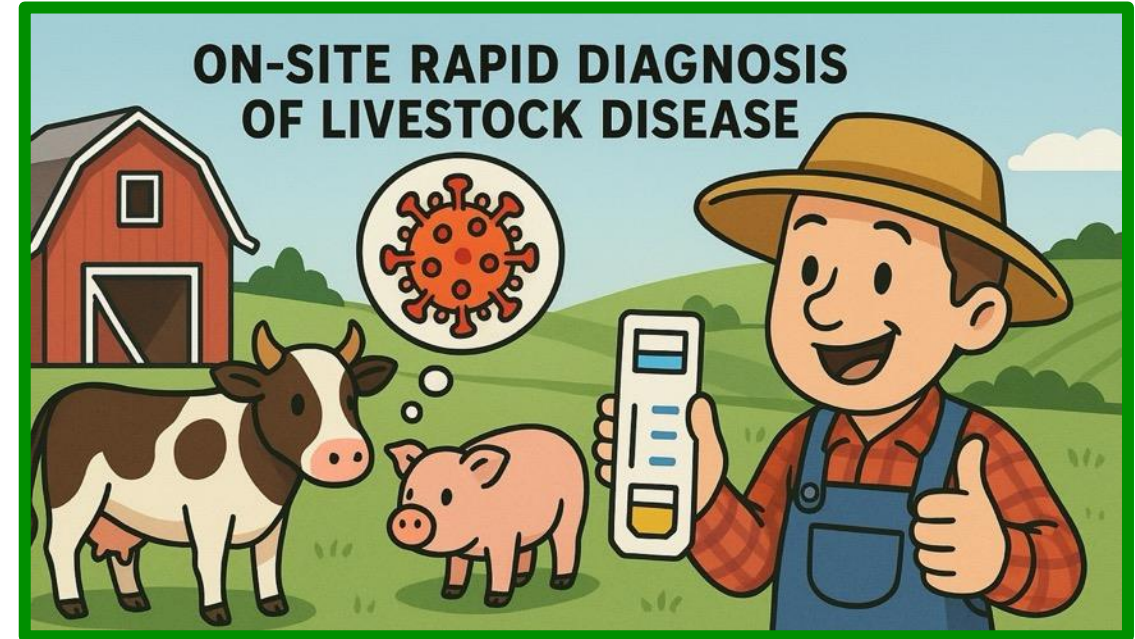
Current Status and Purpose of Veterinary Medical Testing

Conventional Methods



- ✓ Farmers typically request testing only after visible symptoms appear.
- ✓ Laboratory methods are accurate but costly and time-consuming.
- ✓ By the time results are returned, infections have often spread within the herd.

HaKaL's Goal



- ✓ Farmers can perform testing themselves, on-site.
- ✓ Affordable, rapid, and simple.
- ✓ Enables early detection and prevents outbreaks through timely isolation.

HaKaL's Solution for Veterinary Medical Testing

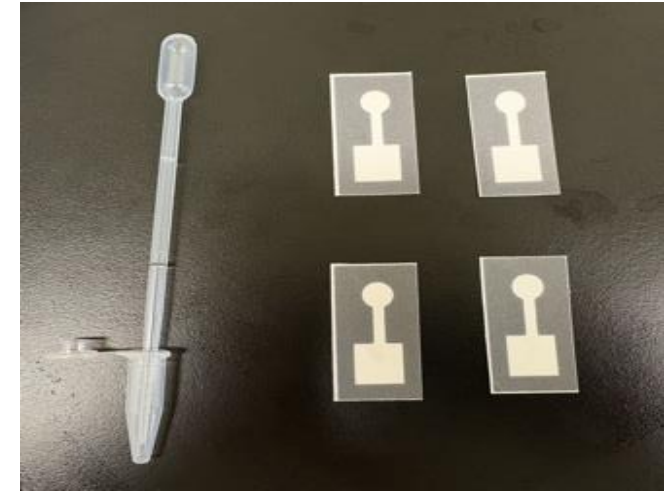
High-speed, Highly Sensitive Immunoassay Kit



- ✓ The test is completed within 15 minutes.
- ✓ Tests cost less than 1,500 yen per test.
- ✓ Achieves sensitivity approaching that of PCR.

Go-Tech Project (METI)

Paper Microfluidic ELISA Device



- ✓ The test is completed within 20 minutes.
- ✓ Tests cost less than 500 yen per test.
- ✓ Suitable for large-scale testing.

Leading Project, Fukuoka Pref.

Collaboration Opportunities

Bridging Field Sensing and Digital Agriculture Platforms

1. Soil & Water Data Integration – Connect on-site chemical measurements with cloud / AI systems for unified farm data.
2. Real-time Monitoring & Prediction – Use frequent field measurements to enhance satellite and IoT analytics for precision agriculture.
3. Digital Twin & Smart Farm Models – Feed nutrient and water-quality data into digital twin platforms to optimize irrigation and fertilization.
4. Sustainability & ESG Traceability – Support nitrate and heavy-metal monitoring for sustainable water use and compliance reporting.
5. One Health Data Platform – Link livestock data for integrated disease and environmental risk management.

Impact Summary

- Create a data bridge between on-site sensing and cloud analytics
- Enable real-time, science-based agricultural decisions
- Contribute to sustainability and One Health goals