"Approach to smart agriculture utilizing drones, sensors and AI"

Kazuhito Hayami
OPTiM Corporation
Industry Department, Marketing Manager
(In charge of our Smart Agriculture solutions)

Company Outline

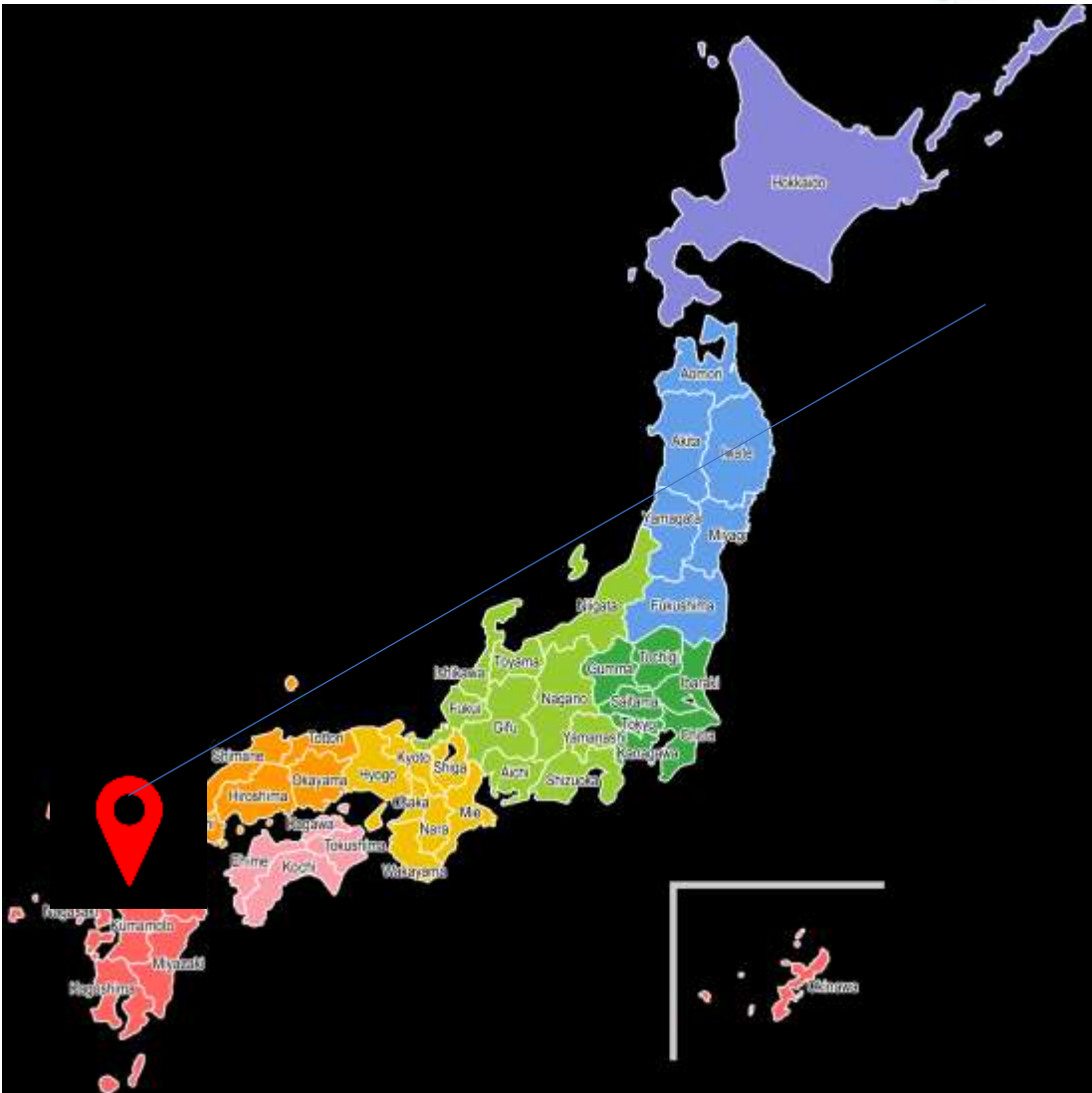|	
Corporation	OPTiM Corporation (Tokyo Stock Exchange, First Division: 3694)
Locations	Saga Office: OPTiM Headquarters Building, 1 Honjo-machi, Saga Tokyo Head Office: Shiodome Building 21F, 1-2-20 Kaigan, Minato-ku, Tokyo Kyukodai-mae Office: 680-41 Center of Iizuka Research & Development 103, Kawazu, Iizuka-shi, Fukuoka
President	Shunji Sugaya
Date of Establishment	June 8th, 2000
Capital stock	411,356,000 Yen
Fiscal year-end	March
Employees	450（including contract and part-time staff) 80 percent of OPTiM staffs are system engineers Average staff age: 33.3
Major stockholders	Shunji Sugaya, NIPPON TELEGRAPH AND TELEPHONE EAST CORPORATION, Fuji Xerox Co., Ltd.
Main business	License sales and maintenance support services -- i.e. Optimal business solutions (IoT Platform Services/Remote Management services/Support services, etc.)

Saga Office

Tokyo Head Office

Accelerating collaborative research with Saga University to develop next-generation technology

To OPTiM, "Intellectual property is the fruit of innovation"

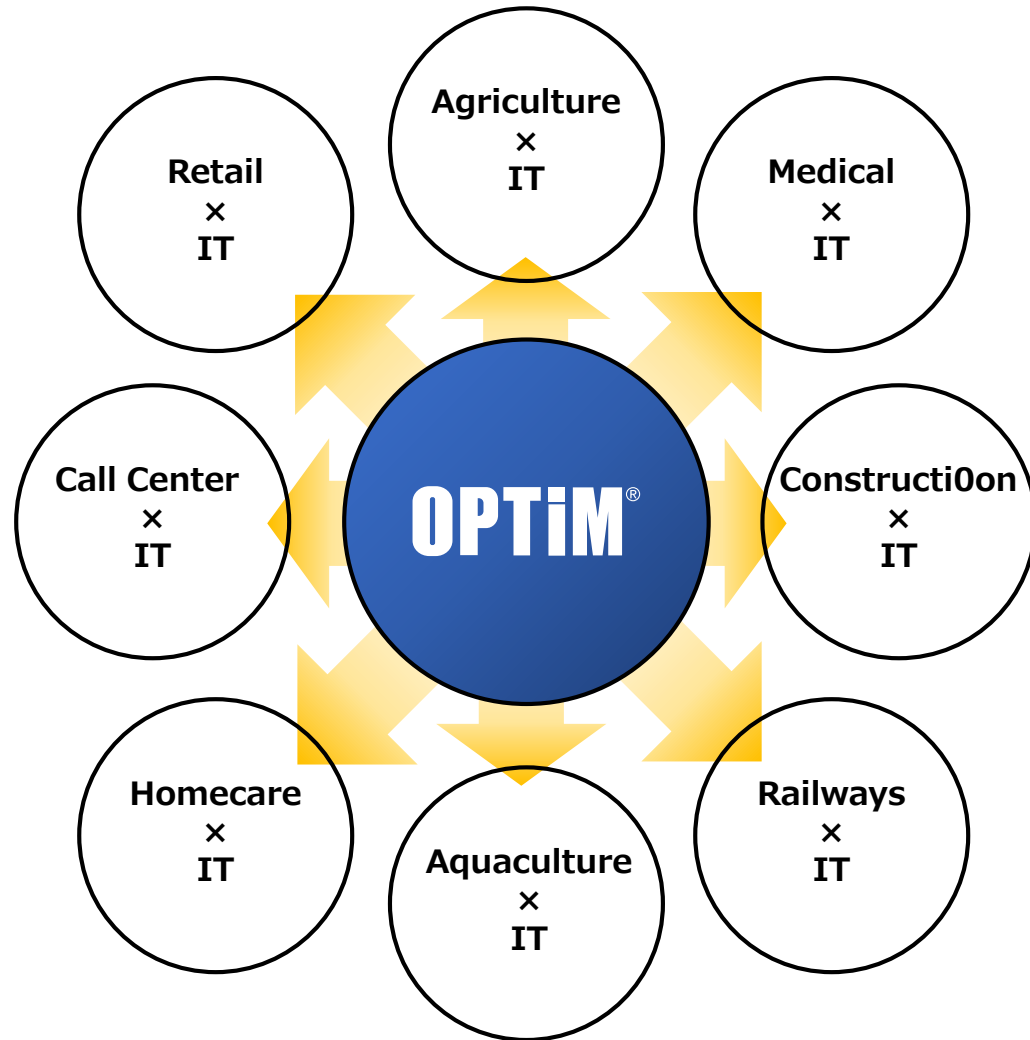| Rank(previous)		Company name	Patent asset volume (pts)	Registered patents
1	(1)	NTT	39,154	1,662
2	(2)	NTT docomo	24,056	803
3	(3)	MICROSOFT	20,847	755
4	(12)	YAHOO	12,733	312
5	(4)	ERICSSON	10,866	370
6	(5)	NHK	6,385	360
7	(7)	KDDI	5,299	391
8	(8)	Nomura Research Institute	4,503	144
9	(34)	OPTiM	2,345	19
10	(15)	FRANCE TELECOM	1,945	72

Our founder/CEO recognized as **the #1 individual** in the ranking of "Patent Asset Scale among Japanese in the Information Communication Industry between 1993 and 2015"

Inventor	Time from first patent application (years)	Inventor score (proportional)	Valid patents	All patents	First patent registration date	Last patent registration date	Average number of inventors	Company type	as of Jan. 2015
1st PLACE Shunji Sugaya	-13.86	306.8	119	119	2001/03/23	2013/09/12	0.050	OPTiM	
2 Y.M	-15.50	273.3	166	166	1999/08/03	2013/03/22	0.205	Major IT company	
3 M.S	-19.83	244.3	336	336	1995/04/03	2010/01/07	2.521	Major communications carrier	
4 K.H	-19.11	194.6	280	280	1995/12/22	2013/02/19	2.579	Major communications carrier	
5 Y.K	-9.80	185.2	298	298	2005/04/13	2013/06/28	2.557	Major communications carrier	

Device management technology (IoT field) for smartphones Comprehensive Patent Power **TOP10**

Rank	Company	Comprehensive power (rights holder score)	Valid patents	Individual power (top score)
1	Panasonic	612.0	86	78.8
2	Sharp	275.2	120	72.7
3	OPTiM	271.1	30	72.9
4	Mitsubishi Electric	186.4	26	72.5
5	Toshiba	166.2	32	79.3

3rd Place in "Comprehensive Patent Rankings for Electronic Device Management"(2014)

Agriculture × IT

Retail × IT

Medical × IT

Call Center × IT

OPTiM®

Constructi0on × IT

Homecare × IT

Aquaculture × IT

Railways × IT

OPTiM's Strategy 「○○×IT」

We strive to approach to the 4th Industrial Revolution era with 「○○×IT」 projects, combining our AI, IoT and robotics with every industry

OPTiM®

Medical × IT
（Supporting fundus examination and eye image analysis）

Saga University and OPTiM are working for early detection and treatment of glaucoma, diabetic retinopathy, and age-related macular degeneration by analyzing clinical ocular image data by AI
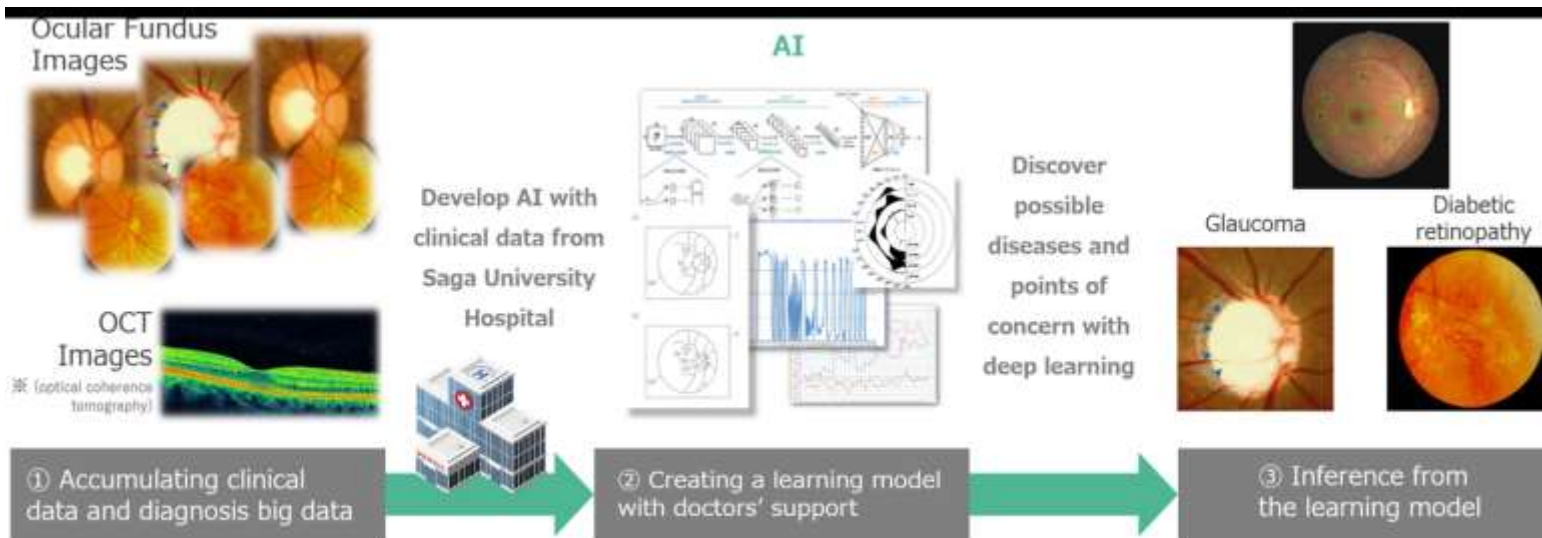
Example of Deep Learning for Medical Image Processing

Using deep learning to improve diagnosis accuracy and speed

OPTiM®

Construction × IT
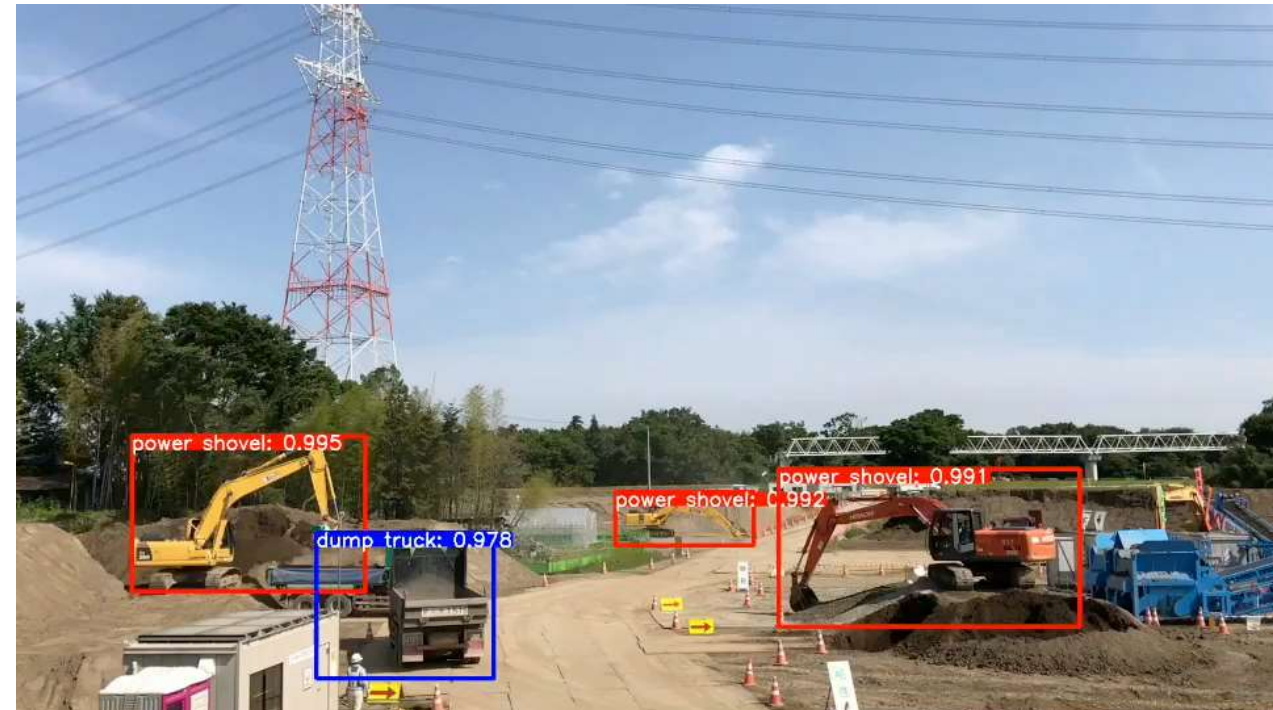
**New IoT platform「LANDLOG」
connecting all construction processes.**

Joint Venture with Komatsu
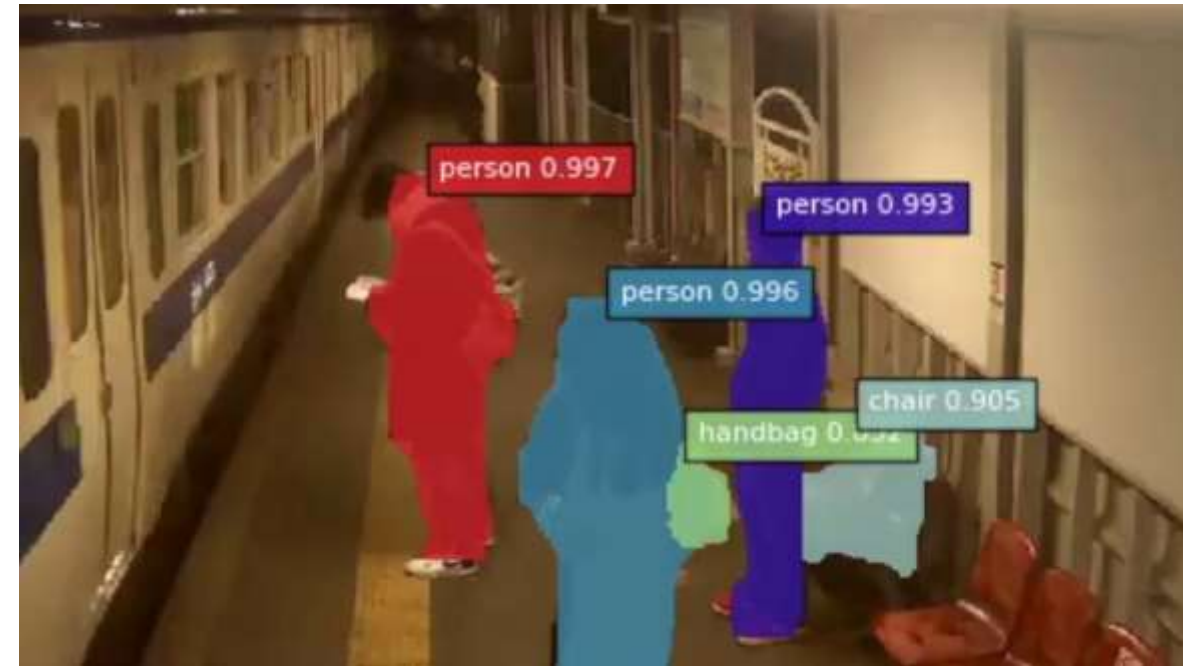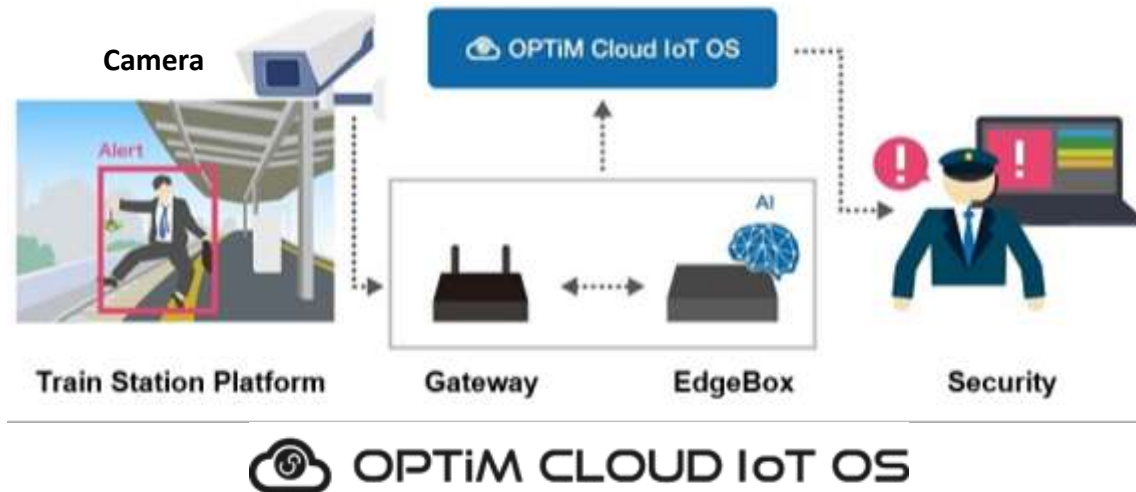

Analysis and visualization of construction machinery, track and workers by Deep learning (Object detection, Domain extraction etc.)

OPTiM®

7

Railway × IT
(Security for unstaffed station)

**AI image analysis of live camera feed.
When danger is detected,
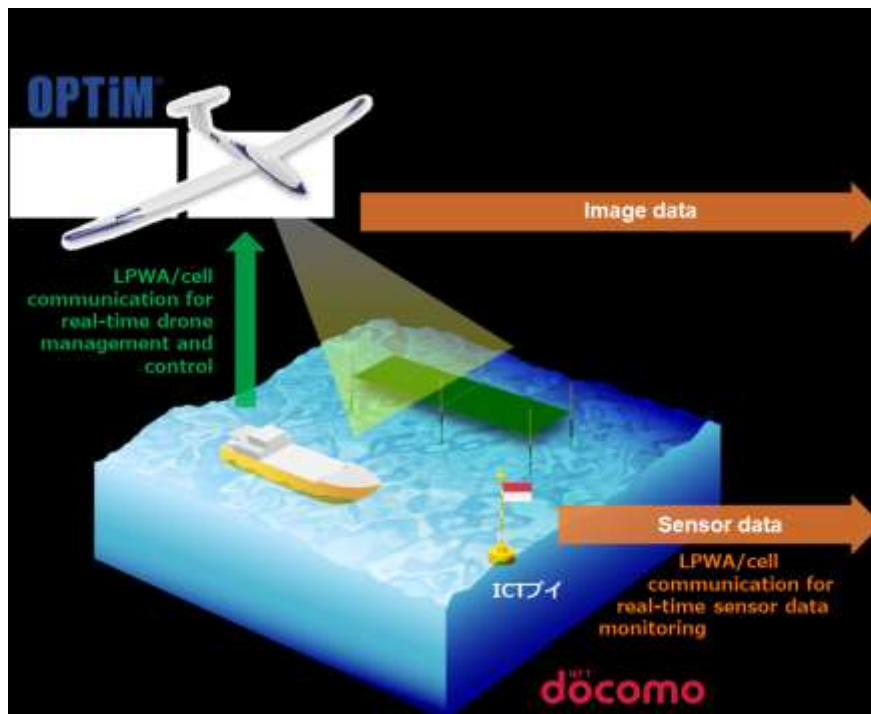an alert is sent to security staff**

Trial experiment with
of AI monitoring at JR train platform

Aquaculture × IT
（Improving yield and quality nori seaweed in Ariake Sea）

Integrate images from drones with sensor data from ICT buoys (water temperature, salinity concentration, etc.) on Cloud IoT OS. Perform image analysis and predict disease breakouts
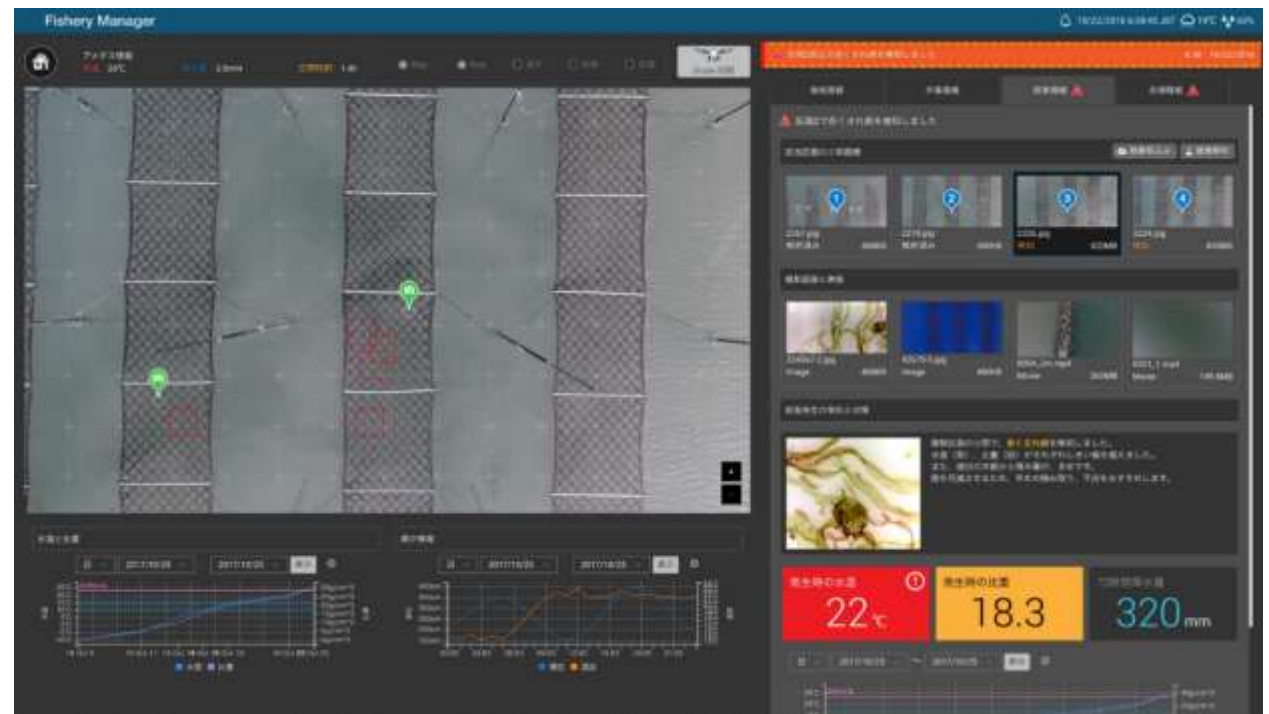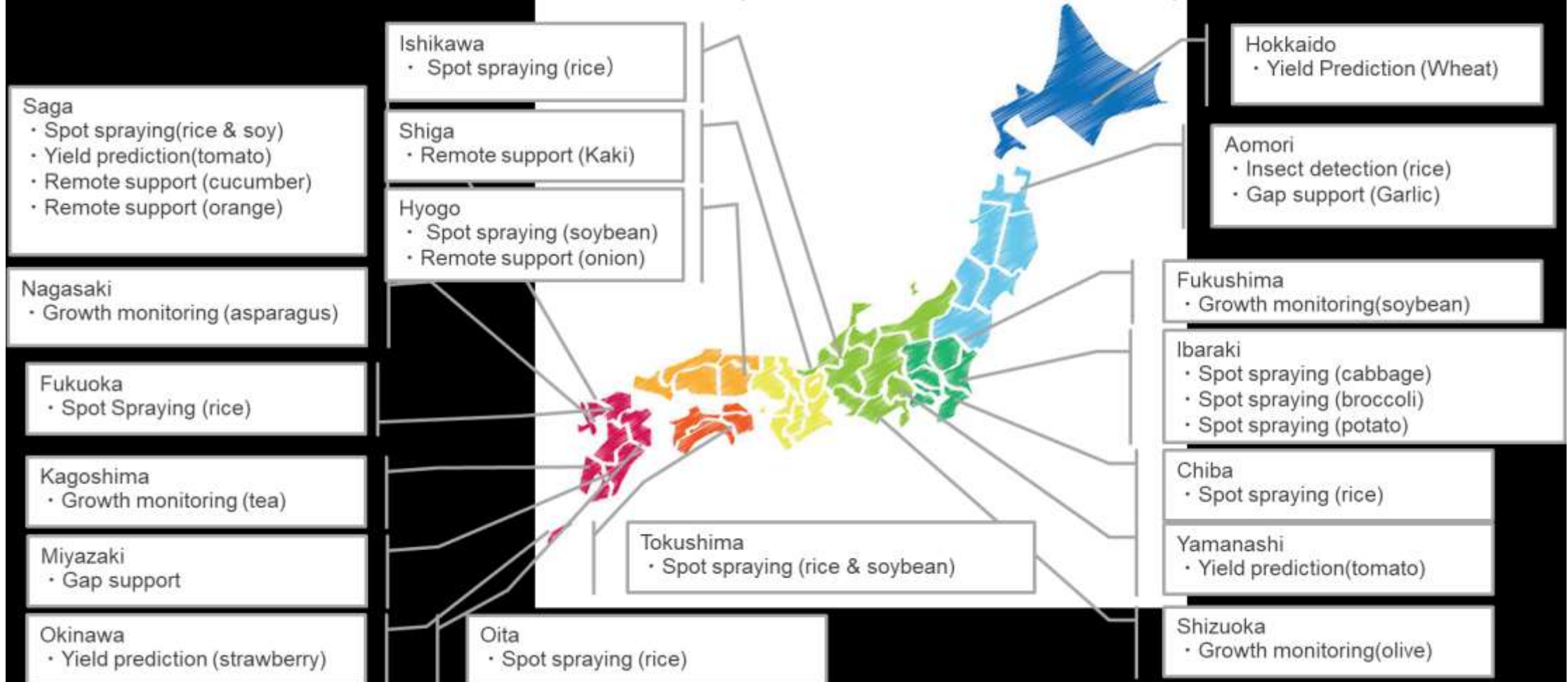
Smart Agriculture

Mission Statement for Agriculture

To make the **agriculture** more enjoyable, appealing and **profitable** by utilizing **AI**, **IoT** and **Robotics**.

Smart Agriculture Project in Japan

We have been applying our smart agriculture solutions on 18 crops in 18 prefectures in Japan

Ishikawa
· Spot spraying (rice)

Saga
· Spot spraying(rice & soy)
· Yield prediction(tomato)
· Remote support (cucumber)
· Remote support (orange)

Shiga
· Remote support (Kaki)

Hyogo
· Spot spraying (soybean)
· Remote support (onion)

Nagasaki
· Growth monitoring (asparagus)

Fukuoka
· Spot Spraying (rice)

Kagoshima
· Growth monitoring (tea)

Miyazaki
· Gap support

Okinawa
· Yield prediction (strawberry)

Tokushima
· Spot spraying (rice & soybean)

Oita
· Spot spraying (rice)

Hokkaido
· Yield Prediction (Wheat)

Aomori
· Insect detection (rice)
· Gap support (Garlic)

Fukushima
· Growth monitoring(soybean)

Ibaraki
· Spot spraying (cabbage)
· Spot spraying (broccoli)
· Spot spraying (potato)

Chiba
· Spot spraying (rice)

Yamanashi
· Yield prediction(tomato)

Shizuoka
· Growth monitoring(olive)

OPTiM®

OPTiM Crawler

Multi Camera **Capability**

High Level Camera **Stabilization**

AI Edge Computing **Module**

Auto Driving **System**

4WS/4WD **Driving**

Object

+
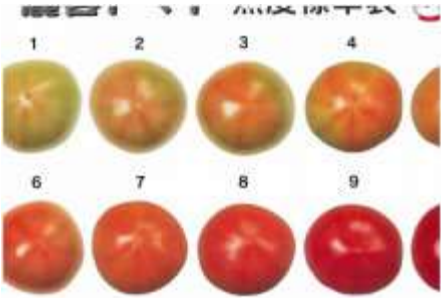
Color

+

Temperature

OPTiM ®
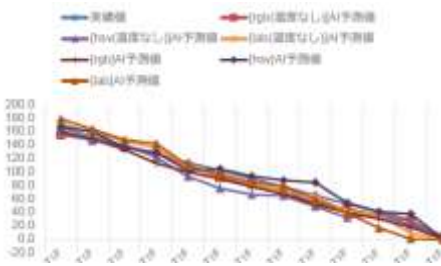
Easy Remote Work Support on a Smart Glass

OPTiM®

Remote support with wearable Smart Glass
enables young farmers to work with veteran level skills.
Know-how and techniques are precisely passed on to new generation.

Real-time screen projection,
Voice & visual instructions

■ Pain Points

✓ Long hour physical tasks are tough on elderly farmers

✓ Conventional training style using direct lecture strains both elder farmer and successor

✓ Training new farmers while actually working at the same time is inefficient

OPTiM®

Glider drone 「OPTiM Hawk」

OPTiM Hawk

This design is best suited for long flights over large areas, such as fisheries or forests.

Features

- 30+ km range, 1+ hour flight time
- Lightweight and rigid design by experienced Japanese designer
- Build-in electric gimbal for stable imaging
- Supports various wide area communication device, including OPTiM's 920Mhz telemetry system (contact OPTiM for details)

OPTiM ®

OPTiM®

NDVI from multispectral cameras for yield prediction analysis

RGB image

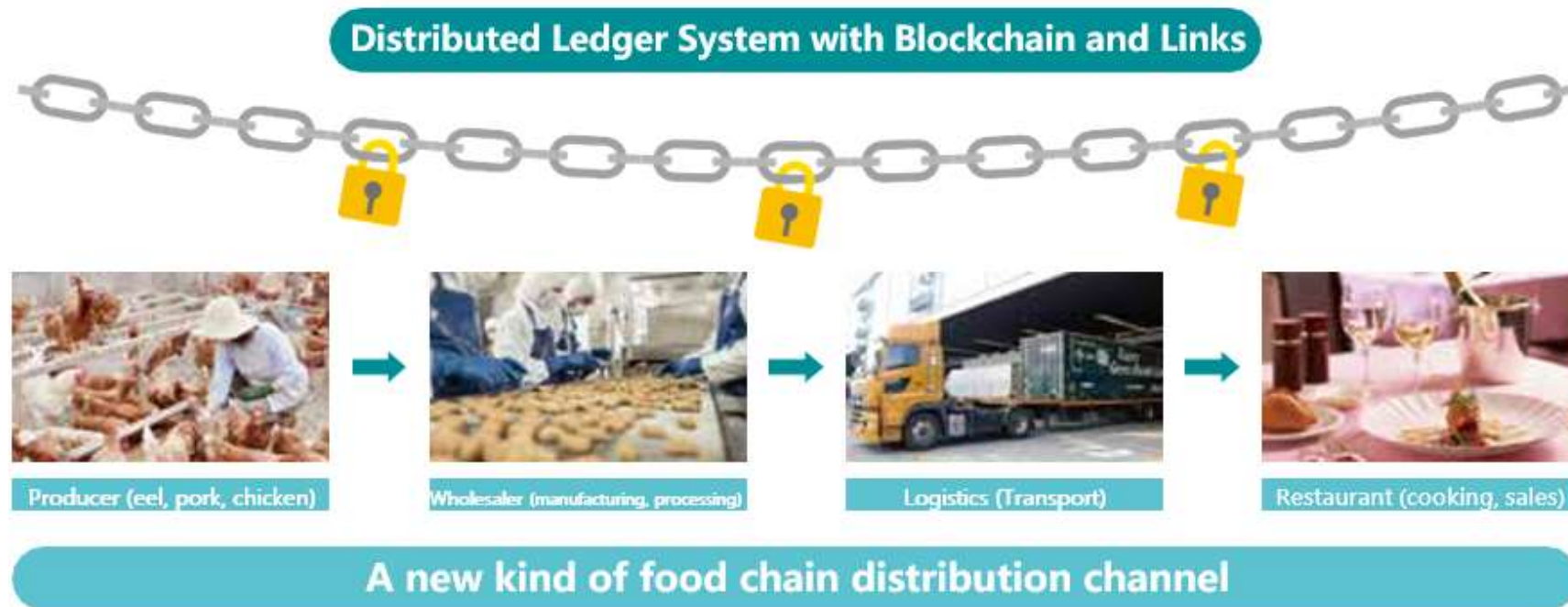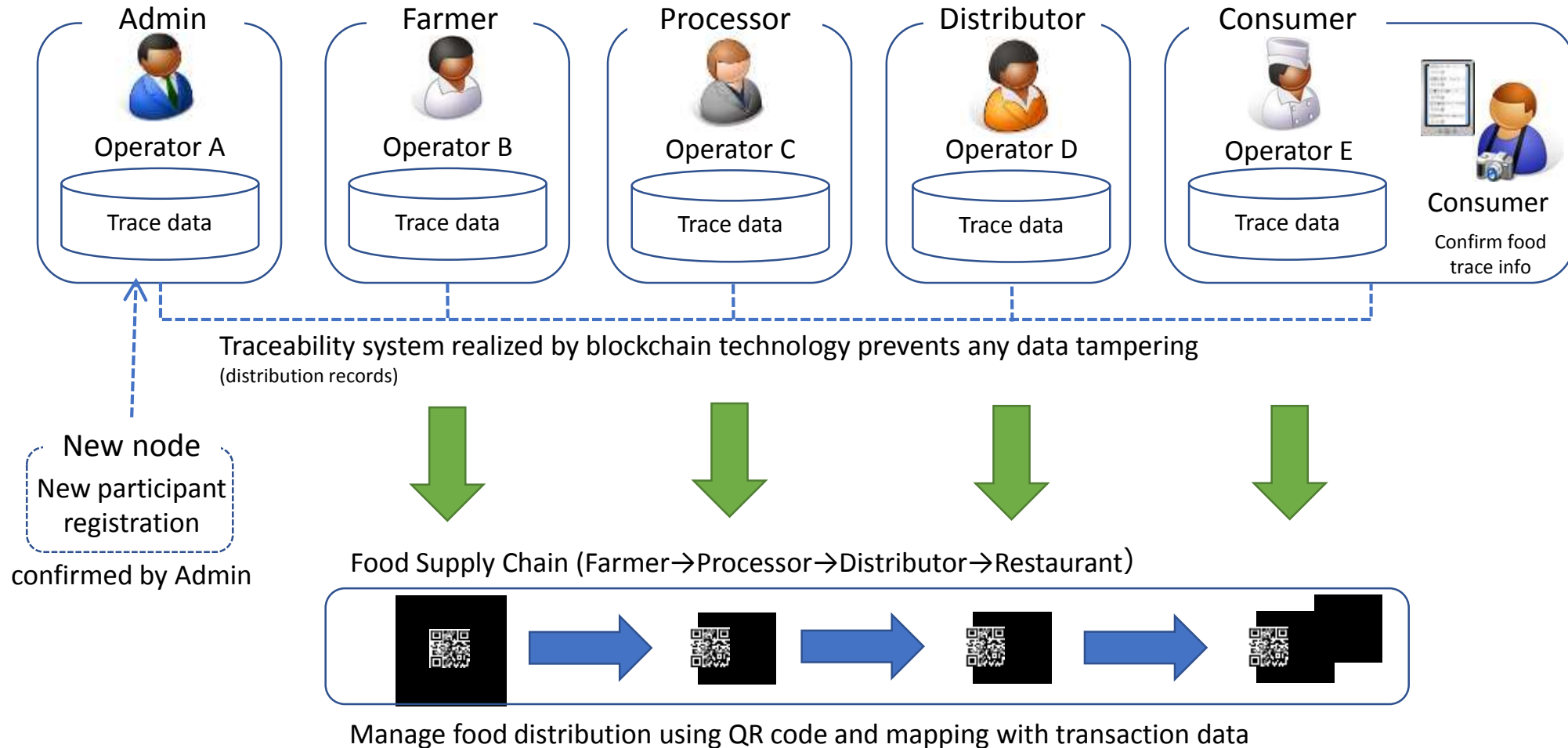**NDVI image**
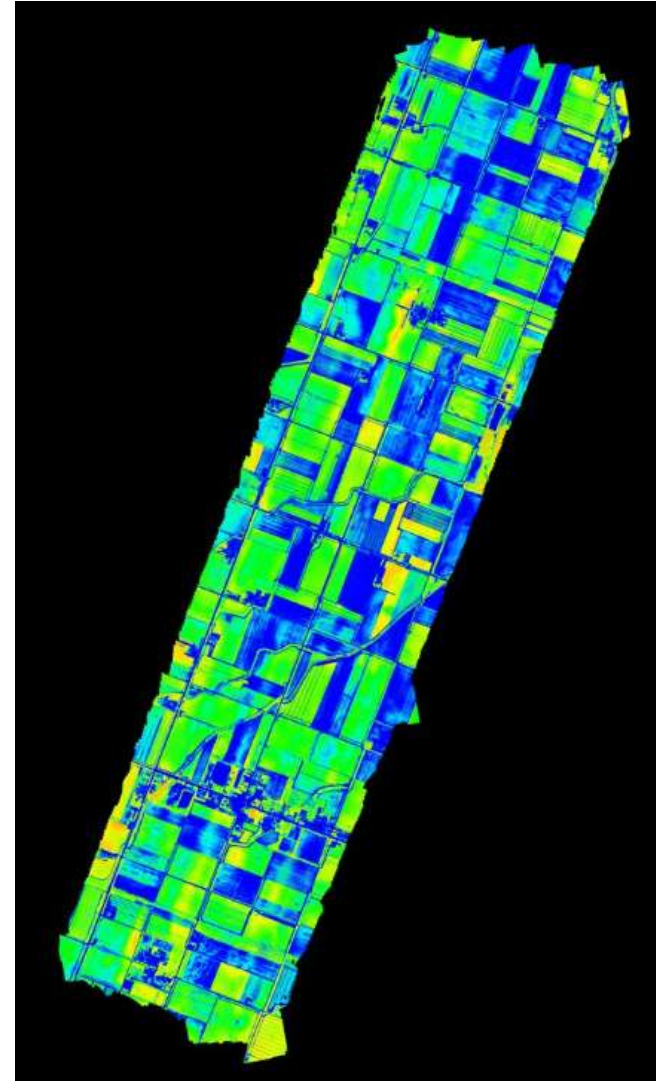
A platform allowing for produce traceability using blockchain

Realizing a supply chain that is open, efficient, and reliable with distributed database technology featuring block chain. This technology can save and manage all points in the history of the produce, such as cultivation, distribution, and more - providing total traceability.

OPTiM®

Agri Blockchain - Food Life Cycle Management -

Leverages food traceability and ensure high reliability with tamper-resistant Blockchain technology

Admin	Farmer	Processor	Distributor	Consumer
Operator A	Operator B	Operator C	Operator D	Operator E
Trace data	Trace data	Trace data	Trace data	Trace data

Consumer
Confirm food trace info

Traceability system realized by blockchain technology prevents any data tampering
(distribution records)

New node
New participant registration

confirmed by Admin

Food Supply Chain (Farmer→Processor→Distributor→Restaurant）

Manage food distribution using QR code and mapping with transaction data

OPTiM®

AI can detect the damage from pests and diseases via pictures taken by drone
➡Our technology can prevent insect damage in the early stage.
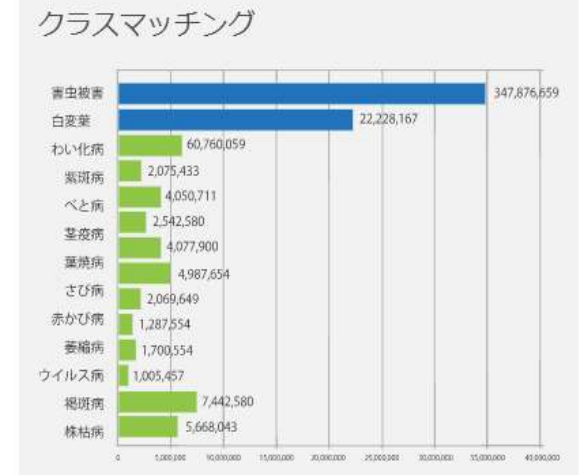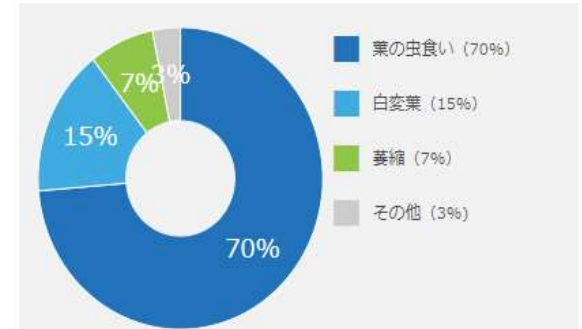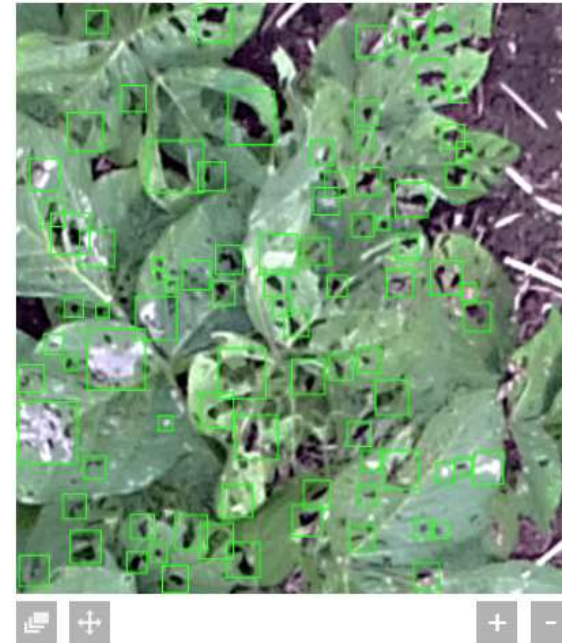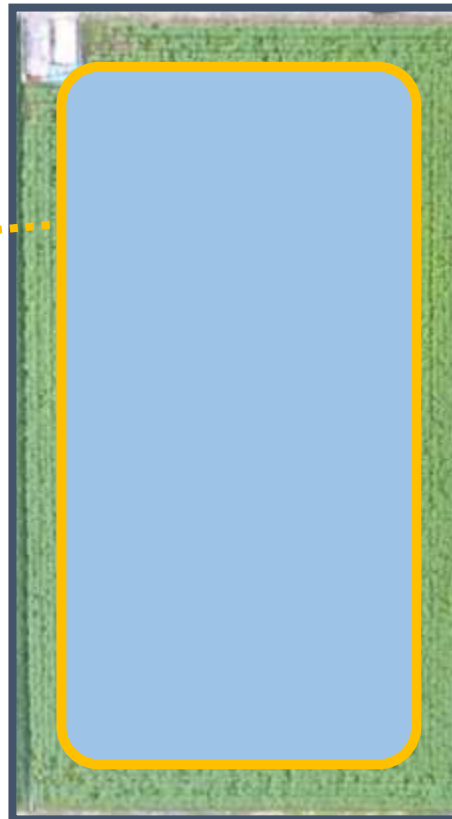
Normal Cultivation
(controlled field)

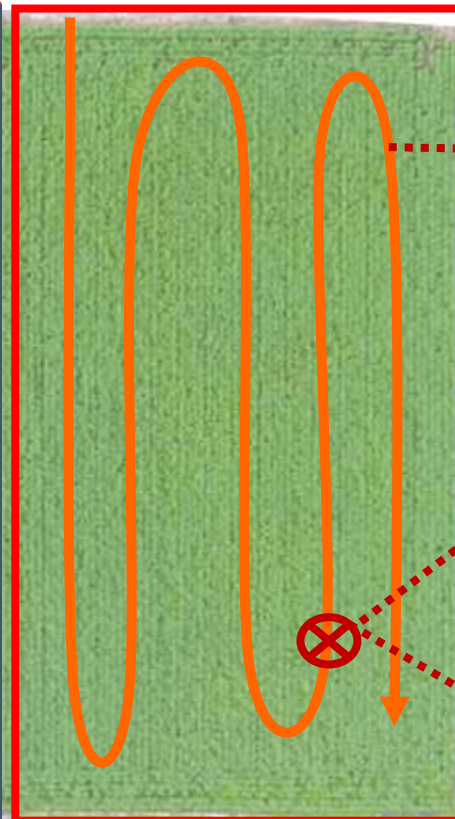Spay fertilizers and pesticides to the whole soybean field

Observed factors:
- Reduction of residual pesticide amount
- Pesticide cost
- Yield
- Quality
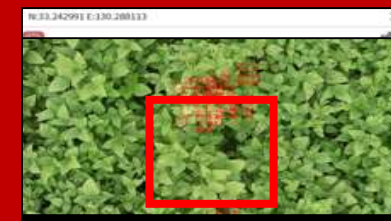- Labor cost

Normal Field

SmartAgri Field

Drone Spot Spraying Technology

1. Capture field whole image with automated flight drone

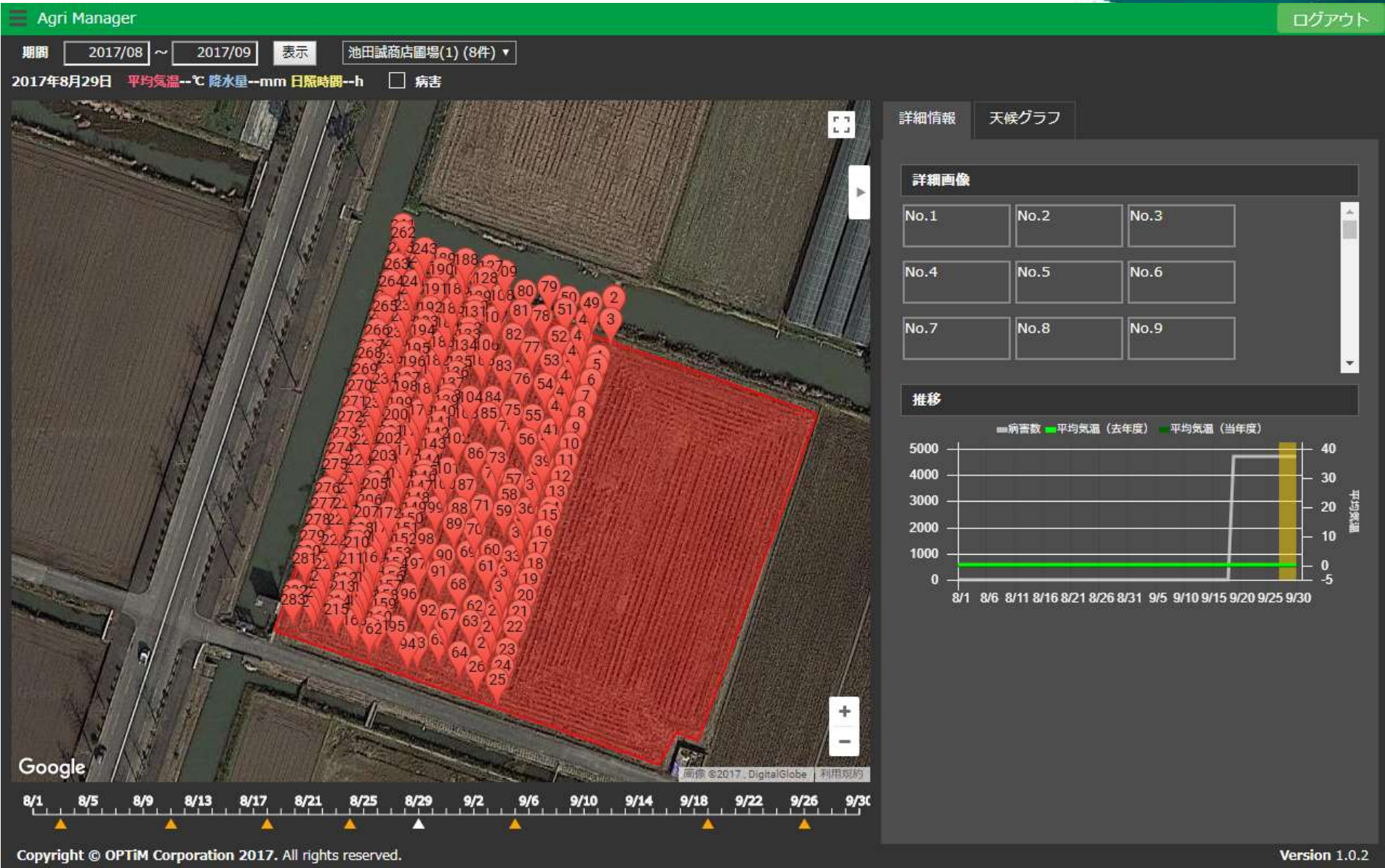2. Locate pest affected spot with AI image analysis

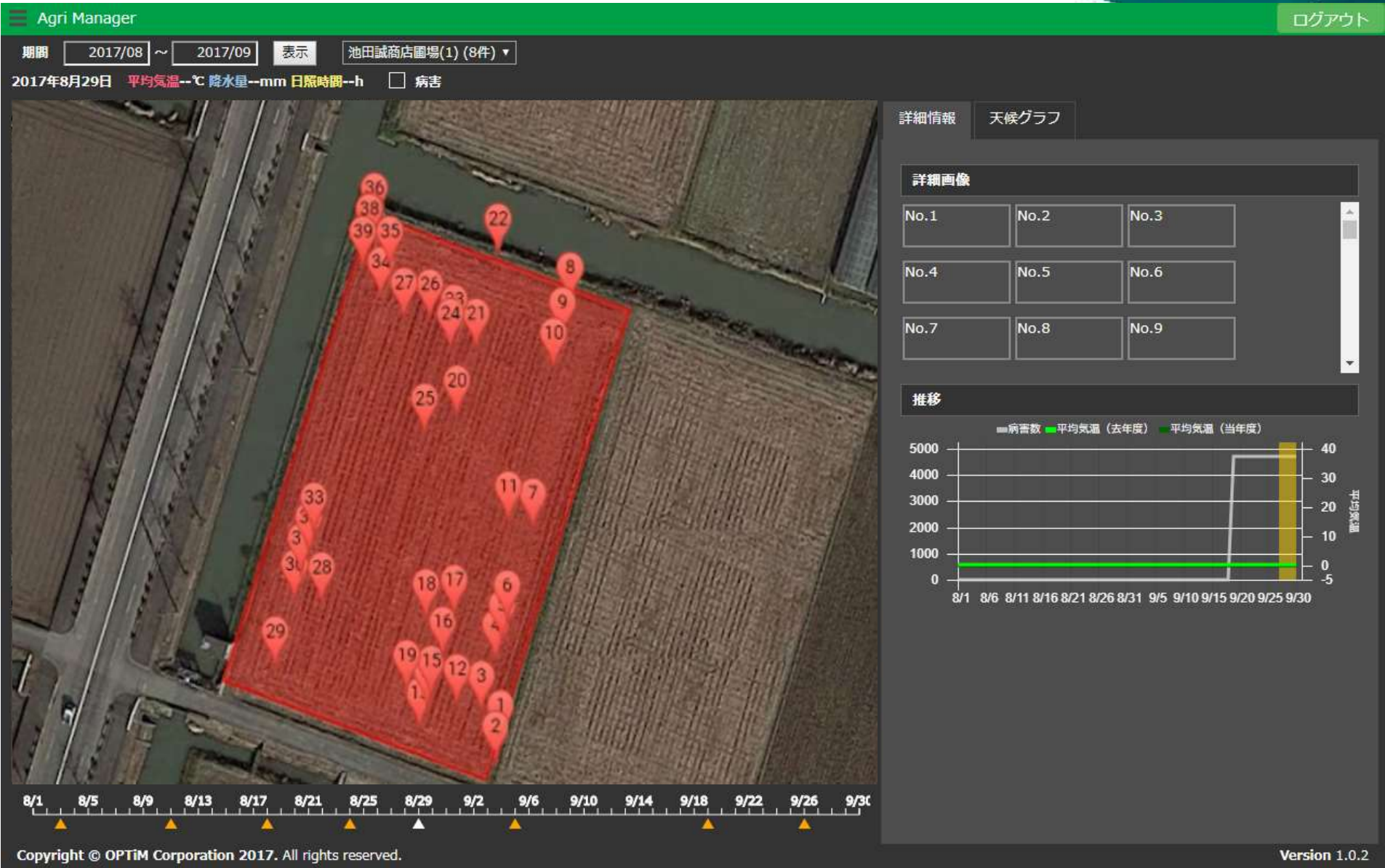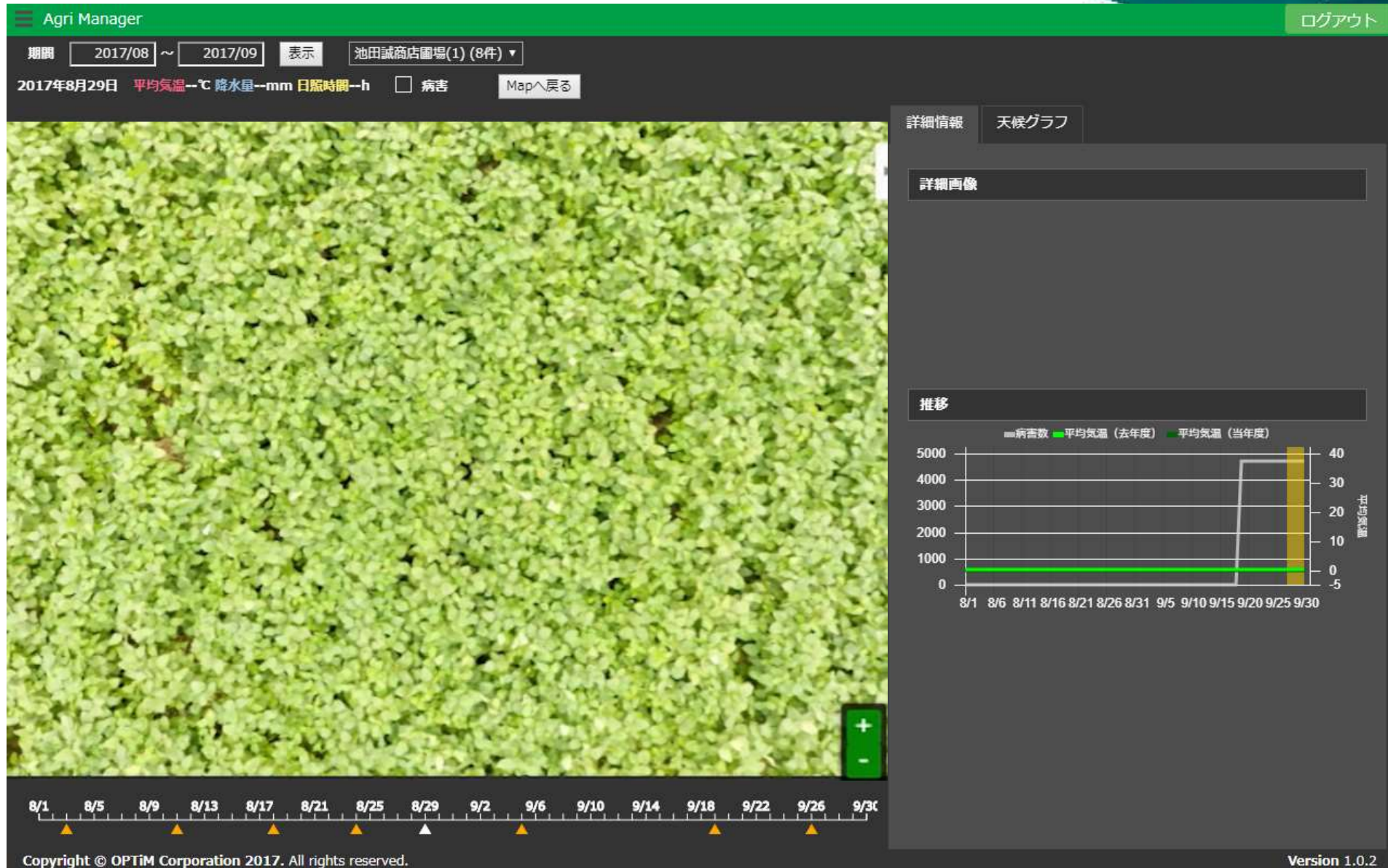3. Pinpoint pesticide spray at the spot with automated flight drone

OPTiM®

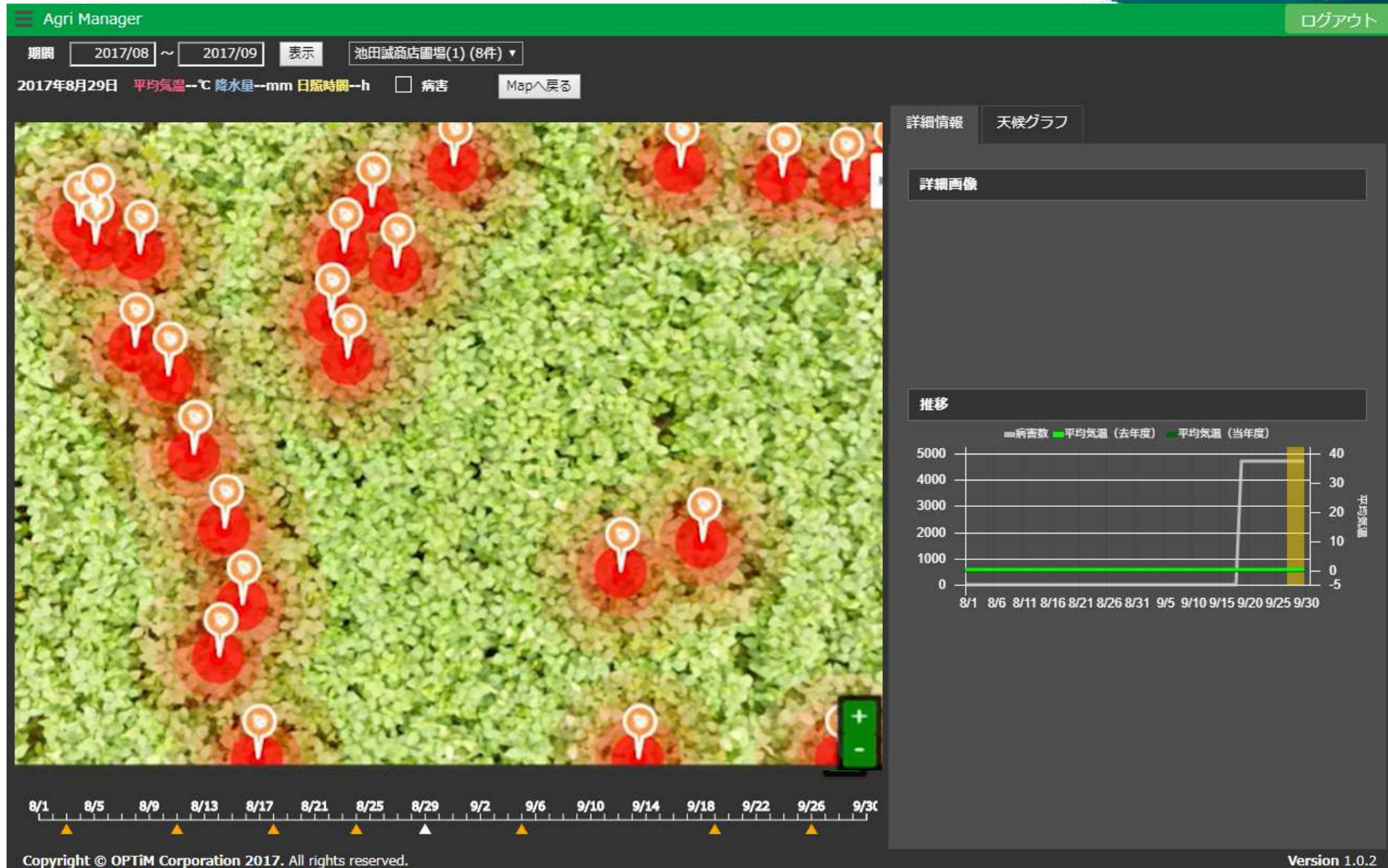# Capture field whole image (290 pictures) with automated flight drone

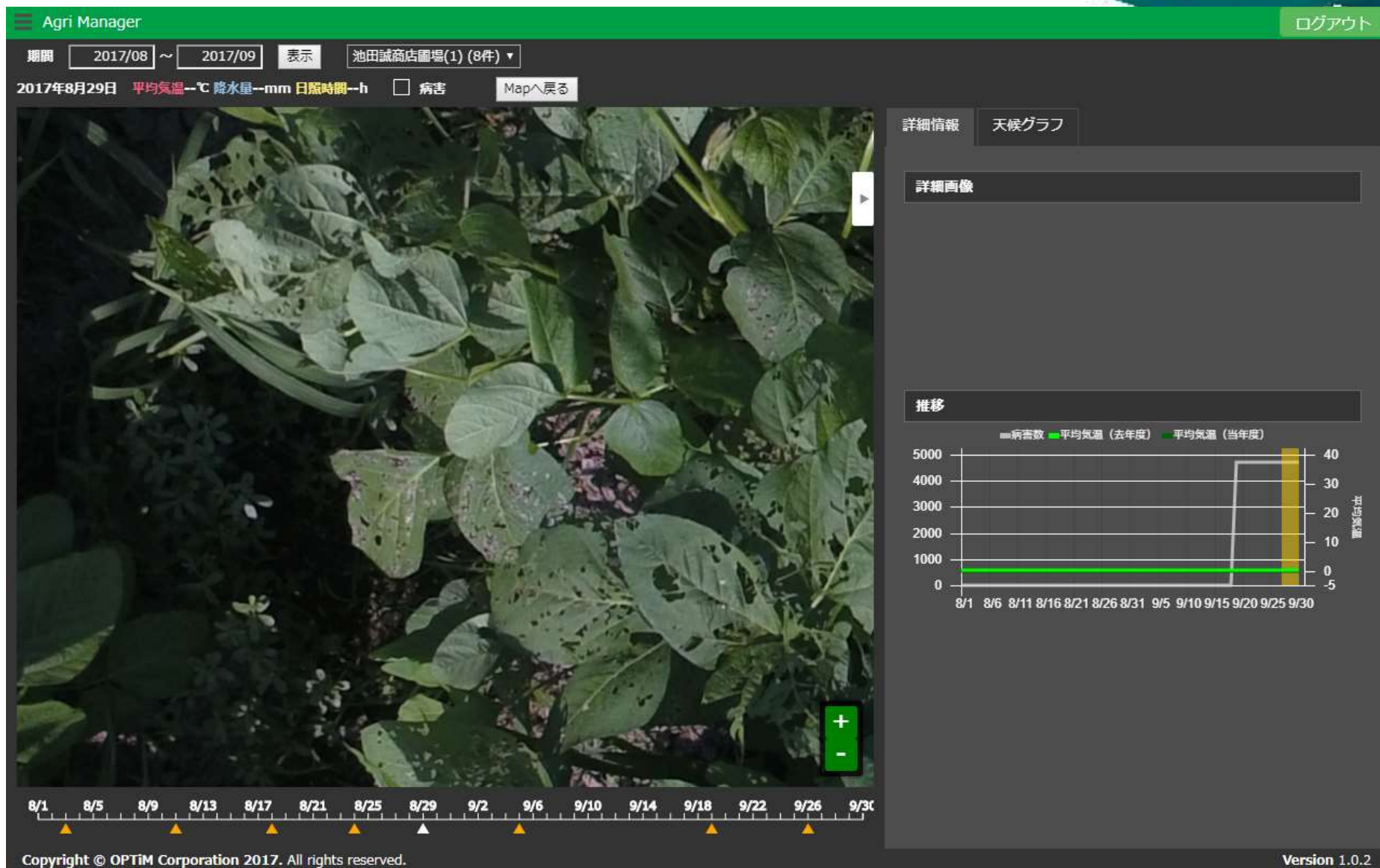# Locate 39 pest affected spots with AI image analysis

Aerial images

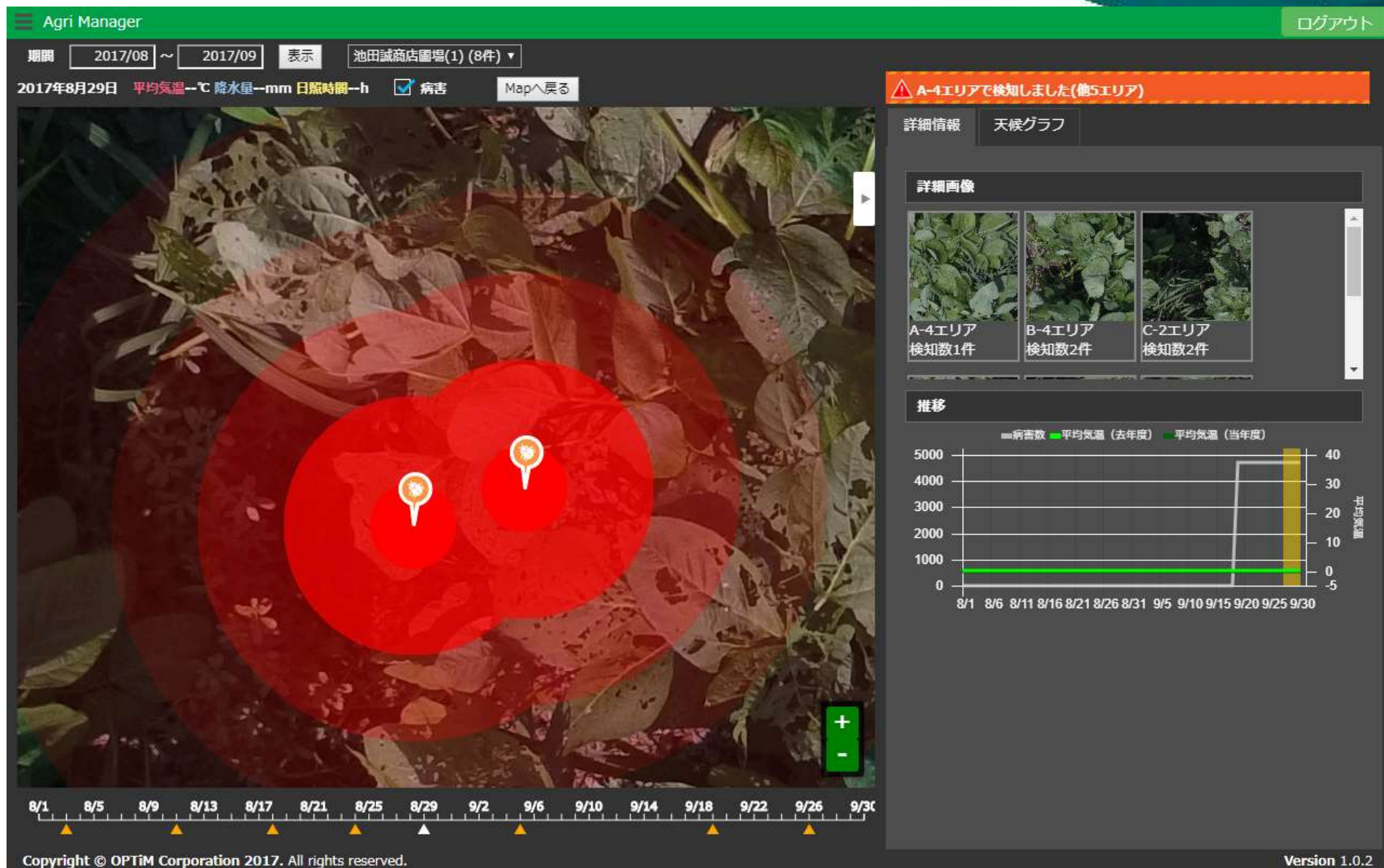# Aerial images

AI image analysis for pest affected spots

AI image analysis for pest affected spots

Reduced **90%** pesticide use!

OPTiM®

Yield and quality (crop shape etc.) are retained at the same level as controlled field

OPTiM®

Result of residual pesticide test

Unit：ppm

Name of crops	TYPE	etofenprox	chlorantraniliprole	teflubenzuron	dinotefuran	quizalofop ethyl
Edamame	Reference value at simultaneous spraying	3	1	1	2	0．3

Name of crops	TYPE	etofenprox	chlorantraniliprole	teflubenzuron	dinotefuran	quizalofop ethyl
Edamame	Results when using a pinpoint pesticide spraying	No detected (＜0．01)	No detected (＜0．01)	No detected (＜0．01)	No detected (＜0．01)	No detected (＜0．01)

BLOOM
People Who are Interested
to Import Cosmetic
into Japan

As of 19 OCT 2017

OPTiM®
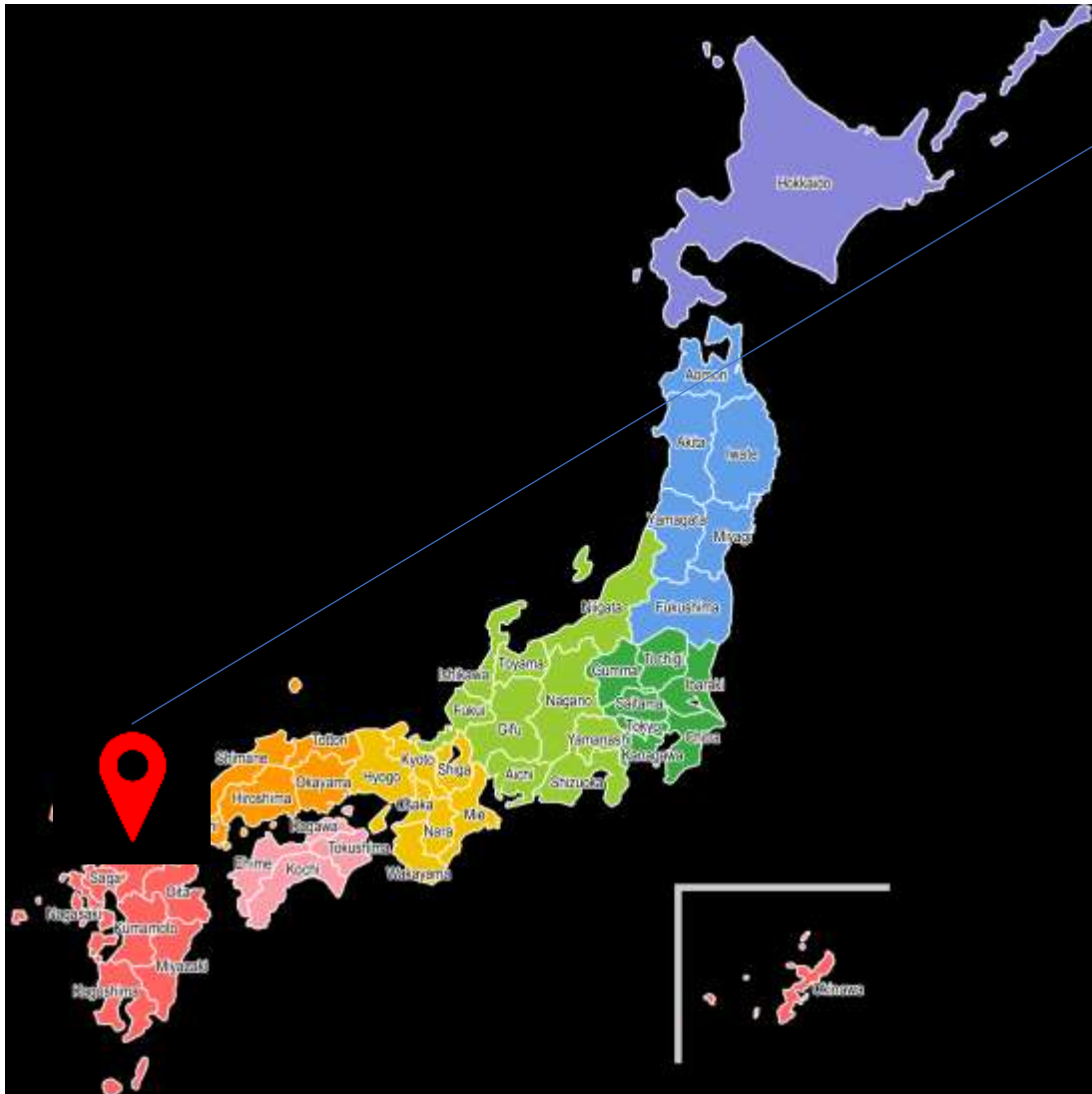
スマートえだまめ

Black Soy Bean produced in Saga prefecture

The secret of Smart Soybean deliciousness.
It is because the combination of farmers hearts and the cutting - edge technology ,
Pesticide usage is reduced ９０％, it is safe and secure soybean.

Safe, Secure and Tasty vegetables for you.

Data at Fukuoka Mitsukoshi

	Smart Soybeans	Normal Soybeans
Soy Bean price per 100 g	２０ ０ yen	６ ７ yen

Sold at about 3 times price

The price is set based on famous brand price range such as Tanba's Black Beans in Japan

OPTiM®

40

27th October 2017
Sold Beans at Department Store
Mitsukoshi Fukuoka

FUKUOKA

SOLD OUT

MITSUKOSHI
福岡

OPTiM®

Smart Agriculture Alliance

**Sharing the updated OPTiM technologies including drone spot spraying
with the future oriented farmers who are willing to apply the tech to their practices**

Financial institution	Cooperation	Farmers	municipality	University
Financial Support etc.	PoC（R&D）	**Share know-how and smart agri implementation** / **Crop grown by the Ag tech**	Cooperative research	Cooperative research

OPTiM

Project

Smart-Agri Food Project	Smart-device Project	Other Project

OPTiM®
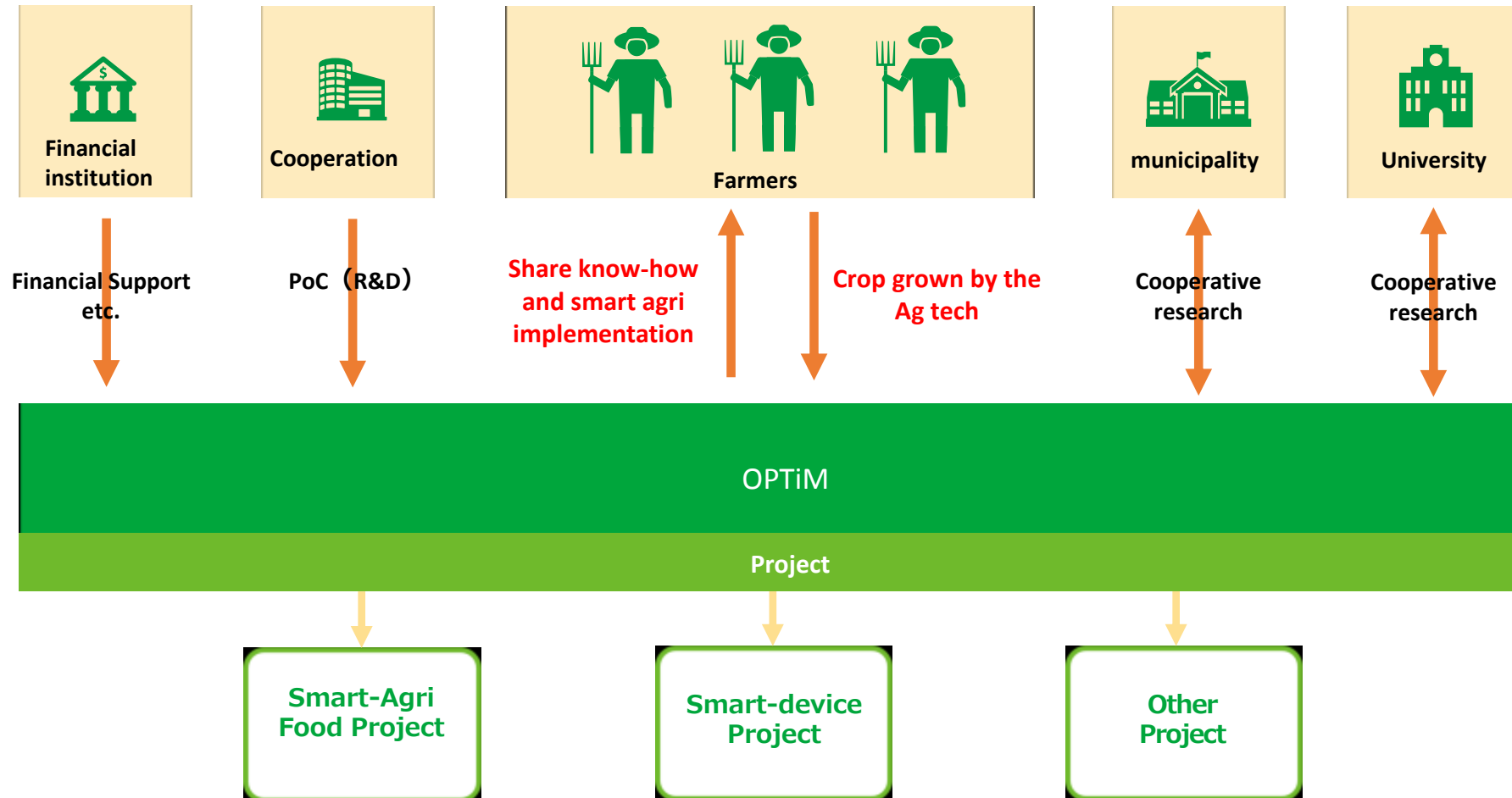
We are offering

Pin-point Pesticide Spraying Technology and Smart Agriculture Solution
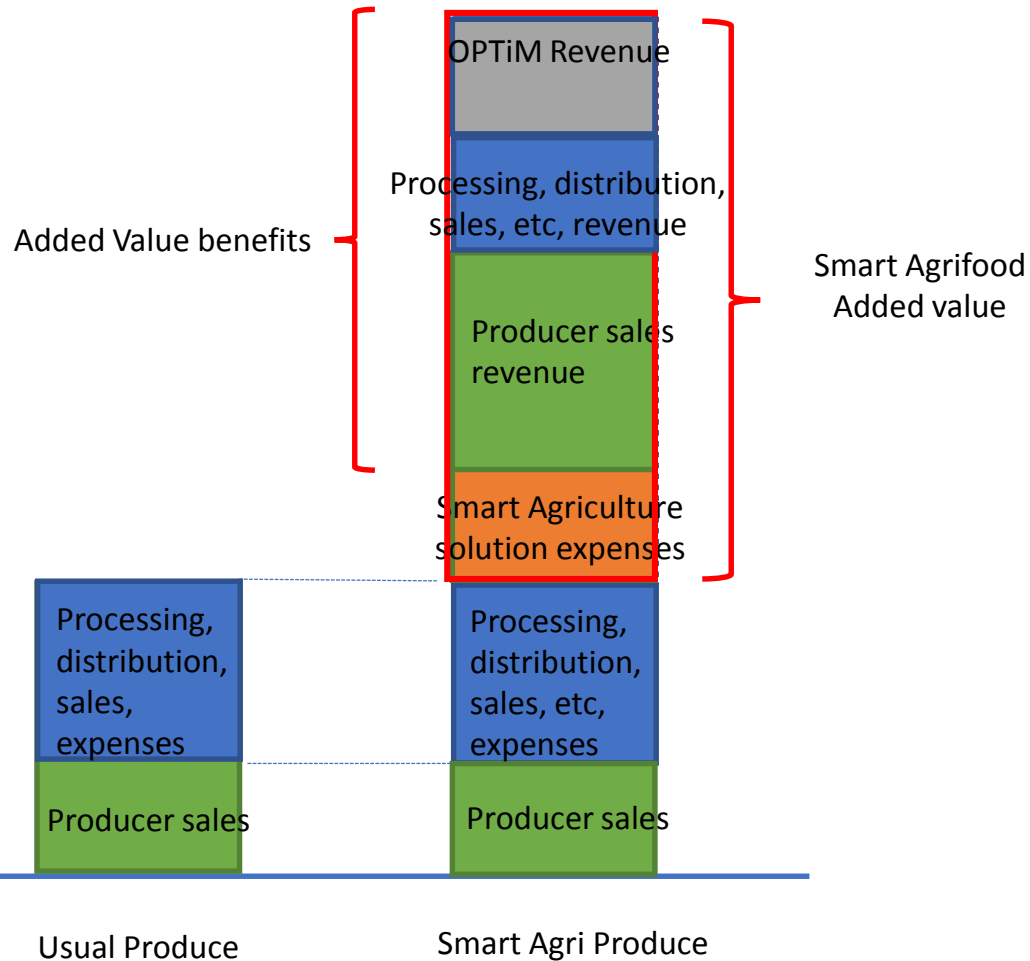
to farmer across Japan

with free of charge !!

OPTiM®

We will purchase **a total amount of harvest** produced with **Pin-point Pesticide Spraying Technology and Smart Agriculture Solution**

OPTiM®

① **Distribution of added revenue value**

Value

Added Value benefits

OPTiM Revenue

Processing, distribution, sales, etc, revenue

Producer sales revenue

Smart Agriculture solution expenses

Smart Agrifood Added value

Processing, distribution, sales, expenses

Processing, distribution, sales, etc, expenses

Producer sales

Producer sales

Usual Produce

Smart Agri Produce

② **Sale value increase**

Value

Additional producer sales revenue

Producer sales

Producer sales

Usual produce

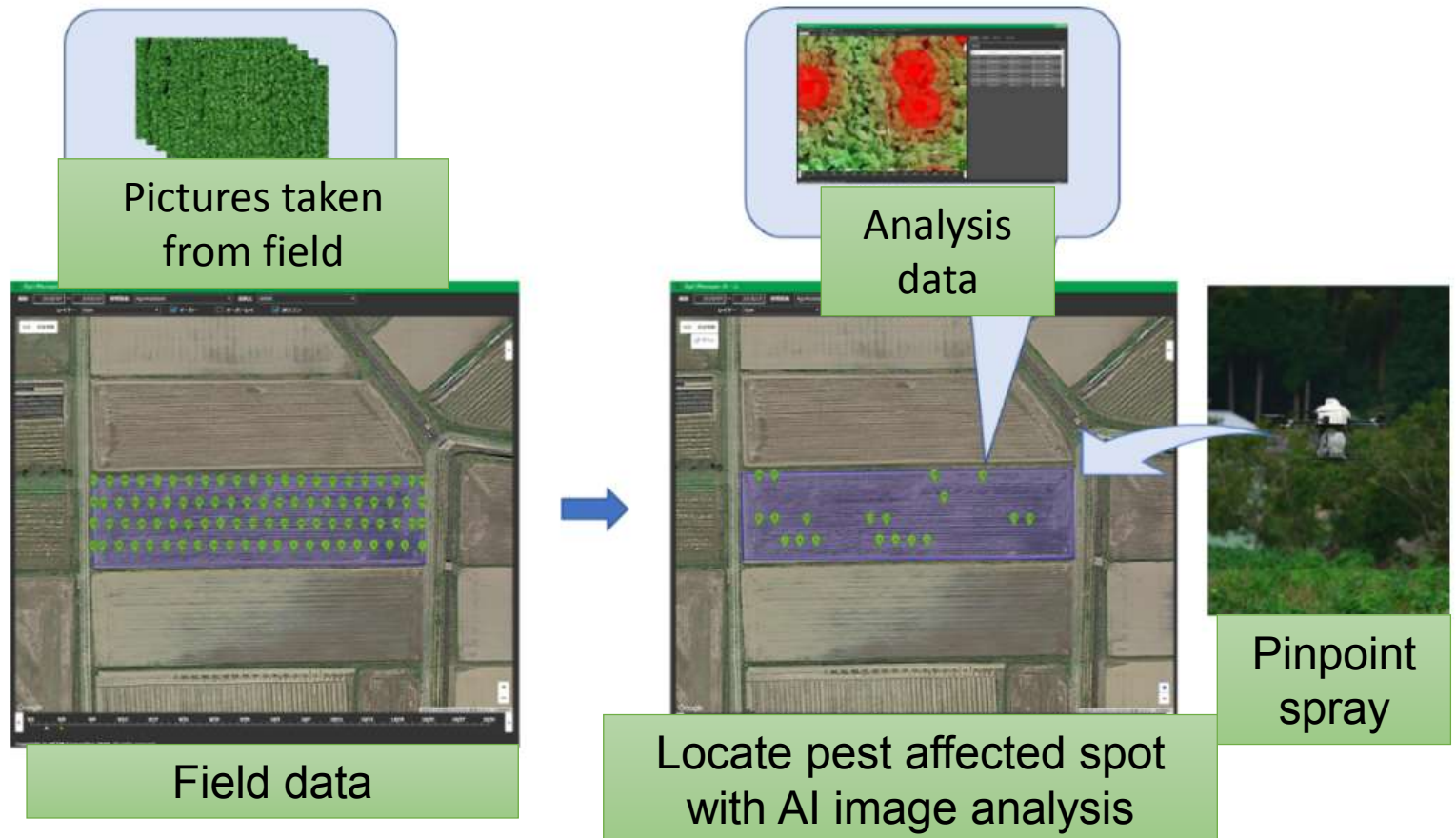Smart Agrifood produce Sales

OPTiM ®

"**0**" risk to utilize smart agriculture
（**Reduction of labor for pesticide application, cost of pesticide, health risk by pesticides** ）

"**0**" risk to waste products by smart agriculture

"**∞**" potential to yield more profit

OPTiM®

Reduced 99% pesticide use! Saved 30% amount of effort!

Pictures taken from field

Analysis data

Field data

Locate pest affected spot with AI image analysis

Pinpoint spray

OPTiM®

Up to Reduced 100% pesticide use!

スマート米

"AI"や"ドローン"を使った
"新しい栽培方法"

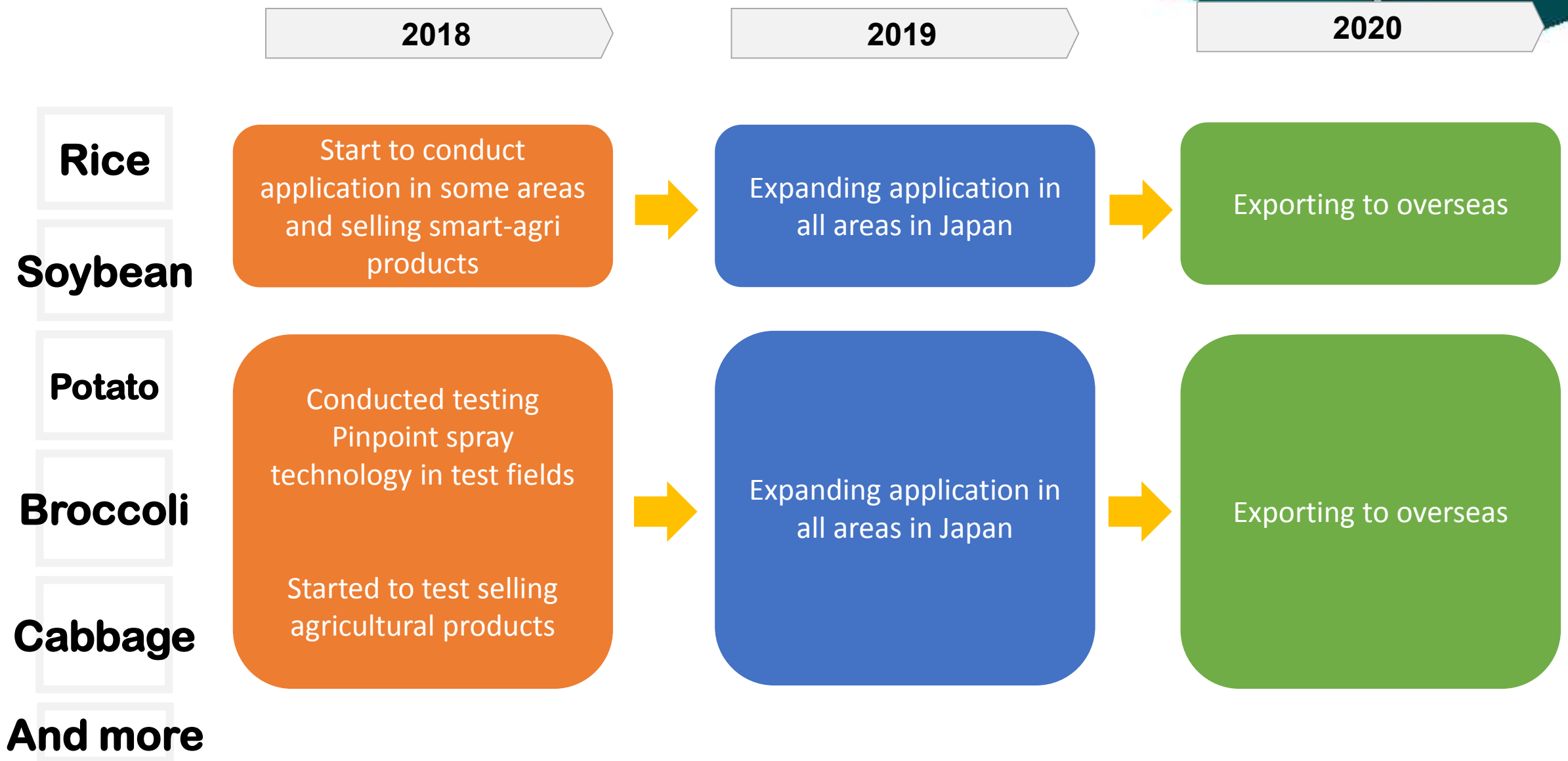特許番号：第6326009号

スマート米の売上の一部は、AIやドローンを活用した
新しい栽培方法にチャレンジする生産者に還元されます。

Smart-Agri Project
Plan for next step by crops and scale

	2018	2019	2020

Rice

Soybean

Start to conduct application in some areas and selling smart-agri products → Expanding application in all areas in Japan → Exporting to overseas

Potato

Broccoli

Cabbage

And more

Conducted testing Pinpoint spray technology in test fields

Started to test selling agricultural products → Expanding application in all areas in Japan → Exporting to overseas

OPTiM®

50

We are trying to make the best use of reducing the amount of pesticide.

In the future, **Pinpoint pesticide spray technology** will become a mainstream method of agriculture all over the world

OPTiM®

Our Pin-point spraying of pesticide application related technologies has acquisitioned the basic patent group in Japan and the US.

Patent number 6326009

OPTiM ®