Real-time monitoring of soil information in agricultural fields in Asia using Fieldserver

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What is Fieldserver?
- To see is to believe -

- New technologies developed by NARO
  – National Agriculture and Food Research Organization
- An on-site field monitoring system
  – that collects data on crop, climate and soils in agricultural fields
  – and sends the data
  – along with high-resolution digital photos
  – to a laboratory via the Internet
- Each FS communicates through a Wi-Fi network
Soil information system by Fieldserver

We use $\text{ECH}_2\text{O}$ as a standard soil moisture sensor
Soil sensor

• ECH₂O soil moisture sensors measure
  – volumetric water content accurately and economically
  – the dielectric permittivity of the soil

• Benefits include:
  – TDR-level performance at a fraction of the cost
  – Very low power requirement
  – Easy installation at any depth and orientation

http://www.decagon.com/ECH2O/

Experimental site

• in a rain-fed field in Northeast Thailand
  – Soil moisture distribution changes dynamically according to land use
Monitoring data

- Meteorological data
  - air temperature
  - humidity
  - radiation
  - wind speed
  - precipitation

- Soil data at 4, 8, 16, 32 cm
  - soil moisture content
  - ground temperature
  - electrical conductivity

- Image data of the site

Diagram of real-time soil information monitoring system

- Soil data flow
  - Soil – sensor – (data logger) – Fieldserver –
  - Router – Satellite – AIT – NARO – UT
**Data storage** (AIT – NARO – UT)

Real-time monitoring data sent from a rain-fed field

Meteorological data are obtained as a xml-table and graphs

**An example of soil monitoring data**

- Precipitation
- Accumulated precipitation
- Soil temperature
- Soil moisture
- Water logging

*To see is to believe!*
Other sites

- SRI site in Bogor, Indonesia
- Spinach field in Chiang Mai, Thailand
- Cabbage field in Tsumagoi, Japan
- Glacial lake in Himalaya, Nepal

Soil moisture in Cabbage field changes according to rain and vegetation

To see is to believe!
Future of Fieldserver

under National project
Application of agro-informatics to management of safe agricultural production

Societal Benefits
- Low-cost, high-quality and safe agricultural production
- Information based on knowledge from scientific data and models
- Prediction of the best cultivation day
- Vegetation of cabbage

Data Integration and Fusion System
- Tools for data collection
- Link to models
- Link to agricultural information

Global observation data for agricultural production
- Climate prediction model
- Vegetation data by satellite
- Real-time observation data in agricultural field
- History of agricultural crop management
- Meteorological data

Agricultural production supporting tool considering propagating information (1997-2000)

Conclusions - Fieldserver -
- is a new technology for spatial measurement of agricultural field
- has a great potential for soil Information monitoring
- waits for the development of powerful and useful sensors:
  - ECHO-TE (Soil moisture, Soil temperature, EC)
  - Nitro-sensors (NH₄, NO₃, NO₂, etc)?
  - GHG-sensors (CH₄, N₂O, etc)?
- will bring precision agriculture a big chance under the National project related to the 10-year Implementation Plan for GEOSS

Decision by agricultural information
- Most appropriate day
- Seeding, planting, fertilizing
- How much pesticide should we spread?
- Soil moisture control

Future application
- Early-warning system for cold-weather damage
- Check system of right crop for right land system

Solution of food and environmental issues in the world
Thank you for your attention

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