THE HISTORY, IMPROVEMENT AND CURRENT INFORMATION SERVICE TO FARMERS OF THE EARLY-WARNING SYSTEM AGAINST COOL-WEATHER DAMAGE

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- **Summary**
• Main industry is agriculture
• Produces approximately 30% of Japan’s rice production
• Cool summer (particularly on the Pacific coast)
Rice Yield and Temperature

Rice yield (per 10a) and temperature (Jul and Aug)

Graph showing the relationship between rice yield (kg/10a) and temperature anomaly (°C) from 1920 to 2020. The graph includes data for Japan and Tohoku regions and highlights significant events in 1980 and 2000.
History of the Early Warning Systems and their Improvement

I. The Early Warning System
Cold Summer and yield reduction in 1993

- Serious yield reduction in 1993
- Low temperature continued from July through August
- Rice blast also caused yield reduction
Rice growth stages in Tohoku

- **Raising Seedling**
  - April ~

- **Transplanting**
  - Early May ~

- **Meiosis**
  - Early-Mid July

- **heading**
  - Early Aug ~

- **harvest**
  - Sep-Oct

★ Sensitive to temperature
★ Unstable climate

If the continuous low temperature is predicted in advance, we can protect panicles by deep water.
Yamase wind

- Cold and humid wind from the Pacific ocean

Caused by Okhotsk anticyclone
Rice Blast

Rice blast fungus need continuous humidity to increase
The Early Warning System for Rice

- Launched in 1996 as a website
- Display meteorological conditions/transitions
- Text-based early warnings against low temperature

URL
http://www.reigai.affrc.go.jp/
1) Weather monitoring

Observation data of AMeDAS (national meteorological observation network in Japan) was used to weather monitoring.

Maps of meteorological elements
- Precipitation
- Temperature
- Sunshine duration

Temperature Charts (for particular points) (1997, for Miyako, Iwate)
2) “early warning information”

- Early warning information was uploaded as text message
- Based on monthly forecasts by JMA (Japan meteorological Agency) announced once a week.

**Data monitoring**

**Monthly forecast (JMA)**

**Advices fit to the stage**
History of the Early Warning Systems and their Improvement

II. Improvement of data and ICT, and release of advanced system
Improvement of Meteorological Data

- Improvement in the resolution of meteorological data

Point data of AMeDAS

Statistical Downscaling

1km mesh data

Fig. 7. Estimated air temperature distribution on a 1km² mesh on July 20, 1993.

Kanno (1997)
Advantages of mesh dataset (1)

- Helpful to confirm the risks as distribution

Low Temp. risk

- Cold risks by 7-day mean temp.
  - -17°C: Danger
  - 17-19°C: Warning
  - 19-21°C: Caution
  - 21°C+: Notice

Rice leaf blast risk

- Infectiousness of rice leaf blast (by BLASTAM)
  - : Infectious
  - : Semi-infectious
  - : Notice

These maps were added to the Early Warning System
Advantages of mesh dataset (2)

- Provide meteorological information everywhere in the area
Release of advanced system ‘the Alert System for Rice Cropping' 

- Launched in 2009
- Requires user registration
- Collaboration with Iwate Prefectural Univ. (IPU)

→ Interfaces, graphics, user managements

**Data & Models**

- Observed data (1km mesh)
- Forecast data (-7days, 1km mesh) ← **New**
- Disease prediction model (Rice leaf blast)
- Rice growth model ← **New**

**User’s input** ← **New**

- Location
- Cultivar of rice
- date of transplanting
- Email address
Release of advanced system 'The Alert System for Rice Cropping'

Rice growth prediction

Risk information map

Alerts for low temperature, Rice blast, and advices by text and email
Further development of ICT environment and re-examination of the systems
Two systems by TARC

The Early Warning System for Rice

- Since 1996
- Weather monitoring over the whole area
- Open and simple system

The Alert System for Rice Cropping

- Since 2009
- More detailed information based on user input
- Closed system (user registration is required)
- Complicated interfaces
- Using 7-day forecast data (with consideration)
Revealed issues on system management

- Costs for weather forecast data, hardware, and softwares
- Levels of system security
- Effort to system maintenances

→ The newer system (Alert System for Rice Cropping) had been closed its service in Sep, 2018
Renovation of the Early Warning System

Renewal in 2014 as version 2

Improvement of agricultural guidance via website of local governments →

The weekly Early Warning Information (text based) was discontinued

Monitoring of cold summer damage is continued and updated
Summary

From the history and review of TARC’s systems

- Our systems are to prevent cold summer damages
- Weather forecast data were useful to gain lead time to prevent damages
- Mesh data were helpful for depicting spatial distributions of risks and for providing these information everywhere in the region
- The level of system specification is also important to the stable management as a public service.