An Agrometeorological Prediction System on Various Time Scales for Smart Weather Risk Management of Agricultural Sector in Korea

Jina Hur (hjn586@korea.kr)
Research Scientist / Ph.D.
National Institute of Agricultural Sciences
Rural Development Administration (RDA), S. Korea
Introduction

Natural hazards have caused extensive damage to national agricultural economies. Predictive weather information is important in the agricultural sector because it has potential to reduce climate risk by providing time to prepare. Climate variability and extremes occur at a variety of levels, which have different impacts on agriculture depending on the scales. However, the existing systems have limitation in obtaining the various future weather data of a place at a given time.

RDA Research Projects

**Short-term Prediction (~9days)**

A Farm-specific Early Warning System at Field Level (30×30m)

[https://agmet.kr](https://agmet.kr)

Mobile service

**Long-term Prediction (~6months)**

Subseasonal-to-Seasonal Climate Forecast System at Regional Level (5×5km)

HKUST Cooperative RDA project APEC Climate Center -MME project

✔ However, the existing systems have limitation in obtaining the various future weather data of a place at a given time.
A Farm–specific Early Warning System

Short-term (~9 days) Prediction

- The system forecasts real time weather conditions at the individual farm level and simultaneously assesses weather risk of specific crops.
- When the risk reaches the condition that can cause any damage to the crops, the Early Warning System is activated and the warning messages are delivered to the farmer’s mobile phone.
- The messages are sent with proper recommendations that farmers can utilize to protect their crops against potential damage.
**Short-term (~9 days) Prediction**

**A Farm-specific Early Warning System**

1. **Downscaling** to the farm level (30~270m)

   Parameters (11 types): Minimum/Maximum temperature, Solar irradiance, Sunshine duration, Precipitation, etc

   - KMA weather data (5x5km)
   - RDA weather data (30x30m)

2. **Weather Risk Assessments** of specific crop

   Risks (15 types): Freezing, Frost, Chilling, Sunburn, High temp etc.

   Crops (38 types): Apple, Pear, Rice, Bean, Grape, etc

3. **Service** through Web GIS and Mobile

   - Web GIS service (https://agmet.kr)
   - Mobile service (App: m2.agmet.kr)
The system projects the magnitude and direction of climate parameters at regional levels 1~6 months ahead.

To obtain high-resolution long-term prediction, the system adopts a chain of a global climate model and a regional climate model.

Seasonal forecast coupled with agricultural models can potentially enhance decision-making for different stakeholders.
Long-term (~6 months) Prediction

Subseasonal-to-Seasonal Prediction System

Seasonal Forecast Data

Parameters (11 types):
- Minimum/Maximum temperature,
- Solar irradiance,
- Sunshine duration,
- Precipitation, etc.

Application on Agricultural Field

- Corn Growth Status
  - USA: 19.1 °C
  - Corn Belt: 21.6 °C

- Waxy-corn Harvesting date
  - (Mid-maturing)

- Rice blast risk
  - Jeon-la province in 2021

Crop yield prediction model

Crop phenology model

Crop disease model

Rice disease epidemiological models

- Disease control based on predicted disease risks
- Selection of resistant varieties
- Planning for integrated cultural and chemical control management
- Increased surveillance for high-risk diseases

6-month outlook for S. Korea every season

Initial Condition and forecast result every month

Examples of estimating crop growth stages (starting date)

Seasonal climate (1-3 months lead time)

- Transplanting date
- Cultivar resistance
- Tillage, planting sites, etc.
Future Collaboration

Accurate real-time weather information at farm levels is an important element for smart farming. Agriculture is significantly influenced by the local climate in the farming region.

Subseasonal to seasonal forecast data contains potential valuable information for farmers and agriculture in general.

Climatology
- Agriculture is significantly influenced by the local climate in the farming region.

Real-time Forecast
- Accurate real-time weather information at farm levels is an important element for smart farming.

Seasonal Forecast
- Subseasonal to seasonal forecast data contains potential valuable information for farmers and agriculture in general.

The information is critical for farmers to choose the right crop according to the season.

This information could aid farmers in making easy decisions and help prevent multiple weather-related risks.

The information could predict Inter-annual variations of crop yield and agricultural planning in a few months advance.

Supports all countries in their sustainable Agrifood system.

- It is a method of agricultural technology to adapt climate change.
- It could help farmers save their efforts, time, and resources from harsh weather, with proactive steps to prevent any weather-caused loss.
- It plays a critical role in decision-making for different stakeholders—from farmers to policy makers to governments for food security.
Conclusion

✓ RDA has been building and operating two prediction systems for Smart Weather Risk Management in Korea.

✓ For short-term response to hazardous weather events, the Early Warning System is developed to assess farm-specific weather risks and to deliver custom-made risk management recommendations.

✓ For long-term preparedness to climate variability, the Subseasonal-to-Seasonal Prediction System is developed to predict a range of possible climate changes at specific temporal and spatial scales in 1~6 months ahead.

✓ These weather/climate prediction systems on various time scales help to inform added value for decision making in agricultural sector, which in turn can support sustainable Agrifood system.