

The Applicability of CERES-Rice Simulation Model in Korea

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1. Introduction

The crop growth simulation model could be adopted to evaluate the impact not only of the long term climate change such as atmosphere CO₂ concentration rising and global warming but also of the predicted short term weather variability on the national crop production.

There are several growth simulation models for predicting rice crop performance such as ORYZA1, CERES-Rice, Rice Clock Model, and SIMRIW. The CERES-Rice simulation model is one part of DSSAT. DSSAT includes biophysical models such as CERES, CROPGRO, CROPSIM, and SUBSTOR that simulate growth, development, and yield for more than 17 crops. DSSAT also includes several utilities for handling weather, soil, experiment, and crop genotype data for model inputs and that cover most of the factors that affecting the crop growth, development, and yield.

The objective of this study was to test the applicability of CERES-Rice simulation model by comparison of the simulated yield data with the actual yield data for the recent 2 years (2000, 2001).

2. Materials and Methods

In this study, the rice grain yield for 2000 and 2001 was predicted using the CERES-Rice simulation model. The paddy field of Korea was divided into about 1,500 cultivation zone units (CZU) that are supposed to have the similar soil and climate characteristics. All CZUs identified in a 1:250,000 analog map were digitized into an ArcView (ESRI, 1996) shape file of polygon feature. Daily meteorological data (solar radiation, temperature, and rainfall) were taken to the general public via internet service of KMA (Korea Meteorological Administration). Using the actual daily meteorological data for about 80 stations belonging to the Korea Meteorological Administration network, the meteorological data for about 1,500 CZU's were generated by spatial interpolation method. Genetic coefficients of three major Korean rice cultivars, 'Odae', 'Hwaseong', and 'Chucheong', representing the early-, medium-, and late maturity class, respectively, were parameterized by field data for experiments conducted at eight locations of NCES (National Crop Experiment Station) over a period of three years (1999-2001).

3. Results and discussion

Heading date was predicted fairly well by the CERES-Rice model at eight locations of NCES. Rice grain yield for 2000 and 2001 with daily actual weather data were simulated 4,950 and 5,090kg per hectare which showed a good agreement with the reported averaging data of the whole country. But, there were somewhat differences according to cultivation zone units. It was found that CERES-Rice simulation model with predicted weather spatial data could used for predicting rice grain yield before actual harvest in Korea.

Table 1. Comparison between the reported and simulated rice grain yield in 2000

Provinces	reported rice yield (kg/ha)	simulated rice yield (kg/ha)	error (%)
Gyeonggi	4,790	4,940	3.1
Gangwon	4,720	4,800	1.7
Chungbuk	5,230	4,960	-5.2
Chungnam	5,520	5,370	-2.7
Jeonbuk	5,200	4,980	-4.2
Jeonnam	4,930	4,770	-3.2
Gyeongbuk	4,810	5,130	6.7
Gyeongnam	4,560	4,680	2.6
Average	4,970	4,950	-0.4

Table 2. Comparison between the reported and simulated rice grain yield in 2001

Provinces	reported rice yield (kg/ha)	simulated rice yield (kg/ha)	error (%)
Gyeonggi	4,960	4,930	-0.6
Gangwon	4,920	4,690	-4.7
Chungbuk	5,310	5,050	-4.9
Chungnam	5,530	5,390	-2.5
Jeonbuk	5,440	5,300	-2.6
Jeonnam	5,020	5,180	3.2
Gyeongbuk	5,130	5,120	-0.2
Gyeongnam	5,010	5,060	1.0
Average	5,160	5,090	-1.4

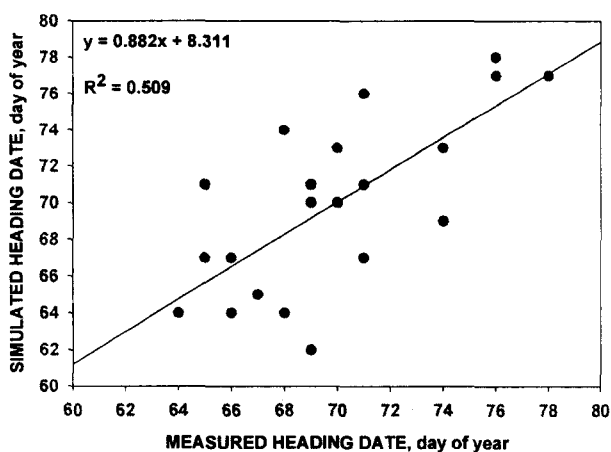


Fig. 1. Measured and simulated heading date of the rice cultivar 'Odaebyeo' by CERES-Rice for 8 locations in recent 3 years (1999-2001).

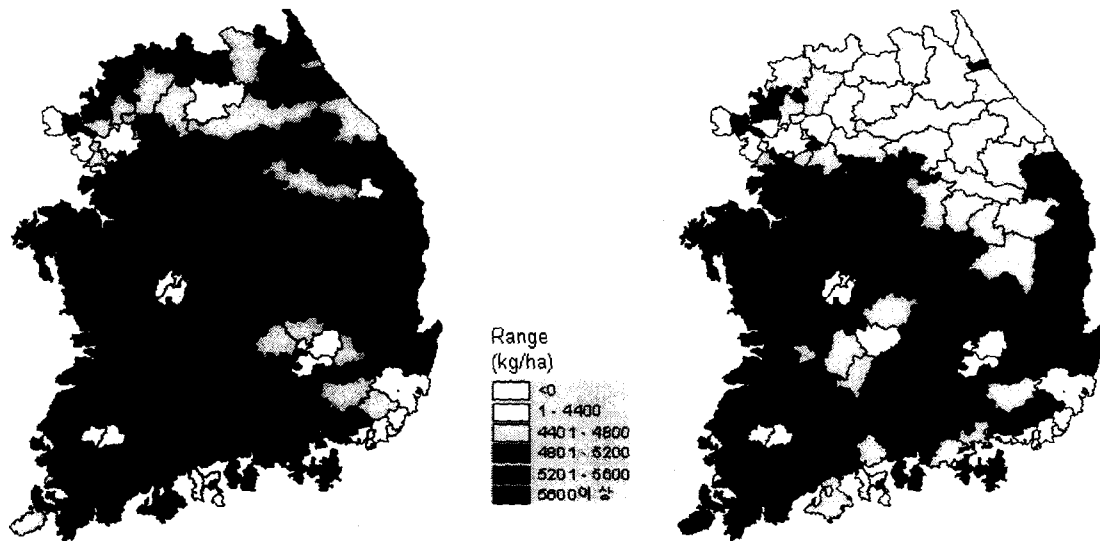


fig. 2. The reported (left) and simulated (right) rice grain yield for 2001 in Korea.

4. References

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