

ORYZA Crop Model

Advancing rice science through crop modeling



Background

Crop modeling and systems analysis have become important tools in modern agricultural research. Crop models synthesize our insights into physiological and ecological processes that govern crop growth and development. The rice crop model ORYZA is integrating more than 30 years of research in rice. It has been conceived and developed by the International Rice Research Institute (IRRI) in close collaboration with the Wageningen University and Research Center (WUR). The model continuously evolves, accounting for new functions describing rice crop growth from its development for favorable lowland system to its latest version, describing the challenging aerobic system. It also considers innovations made in water and nitrogen management and the effects of climate change.

The Challenge

The continuous challenge to meet global food demand is at the heart of IRRI's mission. ORYZA is driving many of the innovations led by the Institute to develop and disseminate technologies to improve the resilience of rice-based farming systems and the sustainability of rice production at scale.

Results

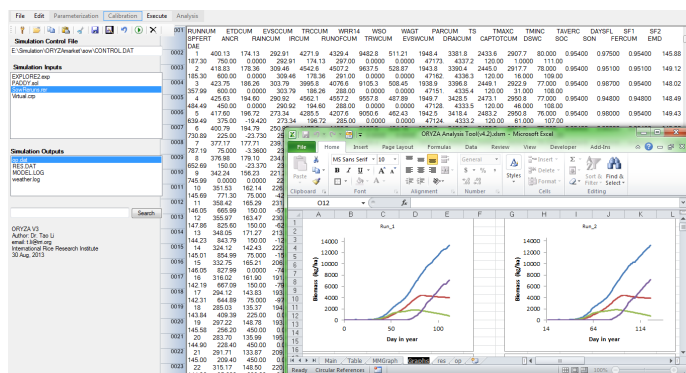
To date, ORYZA has reached 145 countries and almost 12,000 users. According to our analytics, almost 45% of those surveyed indicated that they are using the ORYZA model for their current research/work study; 30% would like to learn how to use the model and 25% would like to explore the possibility of using the model in their future research/work.

ORYZA has been the backbone of several existing digital tools at IRRI, including:

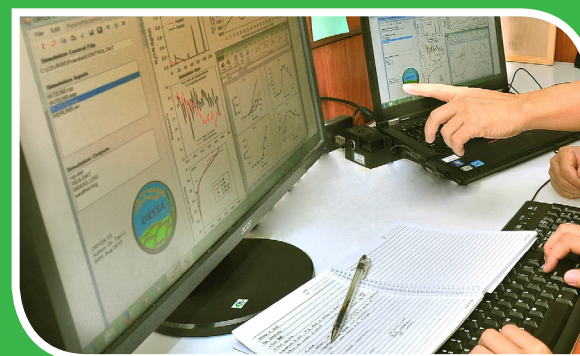
- Rice Crop Manager (RCM)¹
- Remote sensing-based Information and Insurance for Crops in Emerging Economies (RIICE)²
- Philippine Rice Information System (PRISM)³
- Odisha India Satellite-based Rice Monitoring System
- Andhra Pradesh India Satellite-based Rice Monitoring System, and
- Weather-Rice-Nutrient Integrated Decision Support System (WeRise)⁴

ORYZA is also a well-known reference in rice crop modeling communities. Most of well-tested and used modeling platforms have integrated ORYZA to enable rice crop growth simulations, including for instance:

- APSIM-ORYZA
- DSSAT



ORYZA 3 simulation using Windows Interface and the results in the Analysis Tool



✓ How does it work?

ORYZA simulates different rice varieties' development, growth, and yield in response to inherent soil physical and chemical properties, microclimate, and prevailing agronomic practices. ORYZA serves as an ideal tool for research addressing:

- optimization of water and nitrogen management
- identification of constraining factors on yield within site-specific conditions
- assessment of the climate change effects on production
- evaluation of varietal performance and effects of traits on target environments
- understanding and exploring interaction of Genotype (G), Environment (E), and Management (M)
- extrapolation of observed data over wider temporal and spatial scales assisting decision-making

The model can be used as an explanatory tool to advance our understanding of rice crop responses to varying environments and as part of experimental

studies. The model has been successful in identifying and making the gaps in our knowledge explicit and in guiding research to fill these gaps. The model can also be used in application-oriented research such as the design of crop ideotypes, analysis of yield gaps, optimization of crop management, ex-ante analysis of the effects of climate change on crop growth, and agro-ecological zonation.

ORYZA has been widely used by scientists, educators, academicians, and technology developers. It is available in Windows (32-bit and 64-bit) and Linux editions, which can be downloaded from **<https://sites.google.com/a/irri.org/oryza2000/downloads>**.

Integrated with analytics platform and GIS science, simulation outputs from the model have been used as inputs to policy briefs to promote sustainable rice production.

► Next Steps

Since 2009, the ORYZA model has been extended to rice production systems under constraining environments including abiotic stresses such as drought, salinity, and high temperature. These new functions were added in the model to simulate the effects of climate change and to assist researchers in their pursuit of the second green revolution. Some of these new features are in the latest version of the model ORYZA V3s.

ORYZA V3 assists in the development of climate ready rice varieties adapted to submergence, drought, salinity, and anaerobic germination. As rice research advances and the digitalization of agriculture becomes the norm, ORYZA will evolve to keep pace with the emerging technology. ORYZA will contribute to the collection and processing of big data, with a focus on genomics and sequencing, remote sensing, and satellite imagery.

¹<http://cropmanager.irri.org>

²<http://www.rice.org>

³<https://www.riceinfo.ph/about-us>

⁴<http://irri.org/our-work/locations/55-resources/tools/548-werise-weather-rice-nutrient-integrated-decision-support-system>



Reference: <https://sites.google.com/a/irri.org/oryza2000/scientific-documentation>

For more information, visit <https://sites.google.com/a/irri.org/oryza2000>

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