

Release Notes for ORYZA2000 (version 3)

ORYZA2000 version 3 has the following changes since the official release of ORYZA2000 version 2.13 in November 2009.

- 1. 'ROOTG' module:** Root growth module (ROOTG) is a new function that estimates the root's downward growth and the profile distribution of root biomass. Root biomass distribution within the root profile is determined by soil temperature, moisture, nitrogen, aeration, and root penetration condition.
- 2. New variables 'RMINT', 'ROPTT', 'RTBS', 'RCNL', and 'SODT':** We added these variables to the crop file as additional inputs to simulate root growth and distribution in the soil profile.
- 3. The 'SOMk' module:** We developed this module to study the dynamics of water and nitrogen supply in upland, rainfed, alternate wet and dry, and aerobic rice ecosystems. The dynamic processes account for organic carbon decomposition and release, nitrogen mineralization and immobilization, and mineral nitrogen transformation. The rates of decomposition and transformation are driven by soil temperature, moisture, pH, and the quality and quantity of substrates.
- 4. New variable 'NUTRIENT' in the experimental file:** The 'SOMk' module uses this variable to switch among the methods for nitrogen supply. Nitrogen transformation and the available mineral nitrogen content in the soil profile can be quantified dynamically or can be user-defined at a constant amount.
- 5. New variables 'SAND', 'CLAY', 'BD', 'SOC', 'SON', 'SNH4X', 'SNO3X', and 'SpH' in the soil file:** We introduced these new variables into the soil file to be able to use the modifications on nitrogen and carbon transformation, nitrogen and water uptake, and root growth. If either or both of the values of 'PRODENV' and 'NITROENV' are not 'POTENTIAL' in the experimental file, the above-mentioned eight variables must have values for each soil layer in the soil file.
- 6. Optional variables 'DHumus', 'Fcarboh', and 'Fcellulos' in the soil file:** These variables define organic matter decomposition. 'DHumus' is for the decomposition rate of old organic matter and 'Fcarboh' and 'Fcellulos' are for the fraction of carbohydrate and cellulose in fresh organic matter, respectively.
- 7. 'Stemp' module:** We developed the 'Stemp' module to estimate the soil temperature dynamics in soil layers, which are inputs necessary to quantify soil carbon and nitrogen dynamics and root distribution in the soil profile.

8. New variables 'SOILT' and 'SATAV' in the soil file: We introduced these two variables in the soil file to initiate the soil temperature in different layers and to identify the annual average temperature of the topsoil layer.

9. Modified water and nitrogen uptake: Total water uptake is dependent on soil water content and root biomass along the soil layers. Nitrogen uptake accounts for both water uptake and mineral nitrogen availability along the root zone. The interaction between water and nitrogen has been integrated in this version.

10. Additional drought stress quantification: The effects of drought stress on transpiration and CO₂ assimilation can be quantified based on the actual water uptake specified by the modified water uptake routine.

11. We have changed the variable type of '**SWIRTR**' from string type to integer type.

12. New variable 'FSWTD' in the crop file: We introduced this variable as a third option for quantifying drought stress based on transpiration and photosynthesis.

13. Modified assimilate allocation: We introduced drought stress, nitrogen deficiency, and radiation to modify the assimilation allocation. Drought stress and/or nitrogen deficiency will result in more assimilate going to the root such that a more intensive root system is developed to explore a larger soil volume for more water and/or nitrogen to alleviate the prevailing stress. Lower radiation stimulates more assimilate being allocated to the stem to occupy a larger volume for individual plants to capture more radiation for photosynthesis.

14. Change in the control file: Previously, the control file was strictly named only as 'control.dat', but, in this version, the user can rename the name of the control file and relocate its folder. However, a key phrase in the control file, 'CONTROLFILE = <control file path/control file name>', is required at the beginning of the first line of the control file.

15. New variable 'SOILKILL' in the control file: This variable was added in the control file to activate a managing function for continuous rice monoculture or a rice-fallow cropping system. If this variable is given a value 'YES' or if it does not appear in the control file, the simulation will not continue and will end when the crop reaches maturity. If the variable is given a value 'NO', the rice growth process will start at crop emergence and end at crop maturity, but soil processes will continue for the next crop and/or fallow period until the end time of the simulation.

16. New variables 'ICOMBA' and 'IRMTAB' in the experimental file: We introduced these two variables into the experimental file to achieve combination and complex irrigation management under different irrigation methods in a single cropping season.

17. New variables 'COLDMIN', 'COLDEAD', 'CTSTER', 'AMAXSLN0', and 'MINSLN' in the crop file: We changed these from default values to user-defined values to allow the

user to reset the values for these variables in the crop file when special varietal characteristics need indication, for example, stronger tolerance of heat or cold stress and/or nitrogen deficiency.

18. New standalone user interface (for Windows): We developed a simple user interface to replace the FSE (Fortran Simulation Environment) used with earlier versions of ORYZA2000 because further improvement of the FSE-based interface has stopped and FSE is not compatible with the latest version and Intel Fortran Compiler. The new interface provides simple functions for text editing of input files, simulation management, and display of simulation results. Note that the interface may require installation of '.Net Framework' from the Microsoft product webpage prior to installation.