**Supplementary Table 1:** Bio-physical parameters modified in APSIM-Oryza crop module in simulating the hybrid rice cultivars under different nitrogen fertilizer doses.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| APSIM Code | Description  | Unit | Default Value in APSIM-Oryza | Modified Value  | Reference  |
| RGRLMX | Maximum relative growth rate of leaf area | ℃d-1 | 0.0085 | 0.0125  | Bouman (2001) |
| RGRLMN | Minimum relative growth rate of leaf area | ℃d-1 | 0.0040 | 0.0080  | (Banerjee et al., 2022; Sarkar et al., 2022) |
| NMAXUP | Maximum daily N uptake | kg N ha-1 d-1 | 10 | 14 | (Banerjee et al., 2022) |
| FNTRT | Fraction N translocation from roots as (additional) fraction of total N translocation from stems and leaves (-) |  | 0.15 | 0.20 | Present Experimental value and (Banerjee et al., 2022) |
| EFF | Table of light use efficiency (-; Y-value) as a function of temperature | ℃ | 0.54 0.54 0.36 | 0.54 0.60 0.46 | Present Experimental value  |
| FSH | Table of fraction total dry matter partitioned to the shoot as a function of development stage (-; X value): | - | 0.50 0.75 1.00 1.00 | 0.47 0.80 1.00 1.00 | Present Experimental value  |

Reference

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**Supplementary Fig. 1:** Schematic representation of climate change scenario

**Supplementary Fig. 2:** Effect of climate changes on long term simulated grain yield of of the hybrid rice grownat different nitrogen fertilizer doses: [Historical (1988-2018, RCP4.5, RCP6.0, and RCP8.5] (Each column represents the average grain yield of twenty years simulated grain yield, and vertical bars represent the standard deviation either side of the mean)