**Supplementary Tables**

**Table S1: Description of DSSAT Genetic coefficients for wheat crop modified during model calibration.**

| Cultivars | P1V (Days) | P1D (%/10h) | P5 (ºC.d) | G1 (#/g) | G2 (mg) | G3 (g dwt) | PHINT (ºC.d) |
|---|---|---|---|---|---|---|---|
| Galaxy-13 | 22 | 41 | 596 | 31 | 28 | 1.3 | 70 |
| Ujala-16 | 19 | 45 | 510 | 32 | 24 | 1.9 | 68 |
| Anaj-17 | 16 | 40 | 691 | 37 | 22 | 1.2 | 74 |

P1V= Days optimum vernalizing temperature required for vernalization (P1V(v3.5)*10)
P1D= Photoperiod response (P1D(V3.5)*20)
P5= Grain filling (excluding lag) phase duration (P5(V3.5) *20 + 430)
G1= Kernel number per unit canopy weight at anthesis (G1(V3.5) *5 + 5)
G2=Standard kernel size under optimum conditions (G2(V3.5)*0.35+0.65) * P5/20)
G3 = Standard non-stressed mature tiller weight (incl grain) (G3(V3.5)*0.7)
PHINT= Interval between successive leaf tip appearances (PHINT(V3.5)

**Table S2: Description of DSSAT Genetic coefficients for Rice crop modified during model calibration.**

| Cultivars | P1 (˚C-d) | P2R (˚C-d) | P5 (˚C-d) | P2O (˚C-d) | G1 (#/g) | G2 (g) | G3 (g) | PHINT (˚C.d) | THOT (˚C) | TCLDP (˚C) | TCLDF (˚C) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Basmati Super | 570 | 121.0 | 331.3 | 12.2 | 64.0 | 0.0212 | 1.10 | 61.0 | 29.5 | 14.0 | 17.0 |
| Basmati-515 | 565 | 111.0 | 334.2 | 11.4 | 62.2 | 0.0201 | 1.12 | 68.0 | 28.0 | 15.0 | 18.0 |
| Kissan Basmati | 570 | 122.3 | 322.3 | 11.8 | 63.6 | 0.0200 | 1.00 | 65.0 | 28.2 | 15.0 | 17.5 |

P1= Time period (expressed as growing degree days [GDD] in ˚C-d above a base temperature of 9 ˚C) from seedling emergence during which the rice plant is not responsive to changes in photoperiod. This period is also referred to as the basic vegetative phase of the plant. Range: 150-800 ˚C-d.
P2R= Extent to which phasic development leading to panicle initiation is delayed (expressed as GDD in ˚C-d) for each hour increase in photoperiod above P2O. Range 5-300 ˚C-d.
P5= Time period in GDD (˚C-d.) from beginning of grain filling (3 to 4 days after flowering) to physiological maturity with a base temperature of 9 ˚C. Range 150-850 ˚C -d.
P2O= Critical photoperiod or the longest day length (in hours) at which the development occurs at a maximum rate. At values higher than P2O developmental rate is slowed, hence there is delay due to longer day lengths. Range 11-13 h. Default 12 h.
G1= Potential spikelet number coefficient as estimated from the number of spikelets per g of main culm dry weight (less leaf blades and sheaths plus spikes) at anthesis. Range 50-75 #/g.
G2= Single grain weight (g) under ideal growing conditions, i.e. nonlimiting light, water, nutrients, and absence of pests and diseases. Range 0.015-0.030 g. Default 0.025 g.

G3= Tillering coefficient (scalar value) under ideal conditions. Range 0.7-1.3.

PHINT= Phyllochron Interval (˚C-d). Time interval in degree-days for each leaf-tip to appear under non-stressed conditions. Range 55-90 ˚C-d. Default 83 ˚C-d.

THOT= Temperature (˚C) above which spikelet sterility is affected by high temperature. Range 25-34 ˚C. Default 28˚C.

TCLDP= Temperature (˚C) below which panicle initiation is further delayed (other than P1, P2O and P2R) by low temperature. Range 12-18 ˚C. Default 15˚C.

TCLDF= Temperature (˚C) below which spikelet sterility is affected by low temperature. Range 10-20 ˚C. Default 15˚C.

**Table S3: Description of APSIM Genetic coefficients for wheat crop modified during model calibration.**

| Genetic coefficients | Wheat cultivars | | |
|---|---|---|---|
| | Galaxy-13 | Ujala-16 | Anaj-17 |
| Emerg_to_endjuv (○d) | 422.0 | 389 | 390 |
| Startgf_to_ mat (○d) | 560 | 549 | 628 |
| Potential_grain_filling_rate (g per kernel per day) | 0.0020 | 0.0010 | 0.0010 |
| Grains_per_gram_stem (g per stem) | 24.0 | 35.5 | 28.0 |
| Max_grain_size (g per kernel) | 0.046 | 0.063 | 0.062 |
| Vern_sens | 2.5 | 2.16 | 2.35 |
| Photop_sens | 3.59 | 3.82 | 3.32 |

Emerg_to_endju = thermal time from emergence to end juvenile stage (○d)

Startgf_to_ mat = thermal time from beginning of grain-filling to maturity (○d)

Potential_grain_filling_rate = potential grain-filling rate (g per kernel per day)

Grains_per_gram_stem = coefficient of kernel number per stem weight at the beginning of grain-filling (g per stem)

Max_grain_size = potential maximum grain size (g per kernel)

Vern_sens = sensitivity to vernalization

Photop_sens = sensitivity to photoperiod

**Table S4: Description of APSIM Genetic coefficients for rice crops modified during model calibration.**

| Genetic coefficients | Rice cultivars | | |
|---|---|---|---|
| | Basmati Super | Basmati-515 | Kissan Basmati |
| Development rate in juvenile phase ($°Cd^{-1}$) | 0.000603 | 0.000601 | 0.000596 |
| Development rate in photoperiod-sensitive phase ($°Cd^{-1}$) | 0.000581 | 0.000500 | 0.000520 |
| Development rate in panicle development ($°Cd^{-1}$) | 0.000565 | 0.000570 | 0.0005690 |
| Development rate in reproductive phase ($°Cd^{-1}$) | 0.002170 | 0.002042 | 0.002100 |
| Photoperiod sensitivity ($h^{-1}$) | 0.3 | 0.3 | 0.3 |
| Maximum optimum photoperiod (h) | 12.0 | 11.6 | 11.8 |
| Spikelet growth factor (no $kg^{-1}$) | 62001 | 63800 | 64700 |
| Fraction shoots dry matter partitioned to the panicles as a function of different development stage | 1.0 | 0.98 | 1.0 |