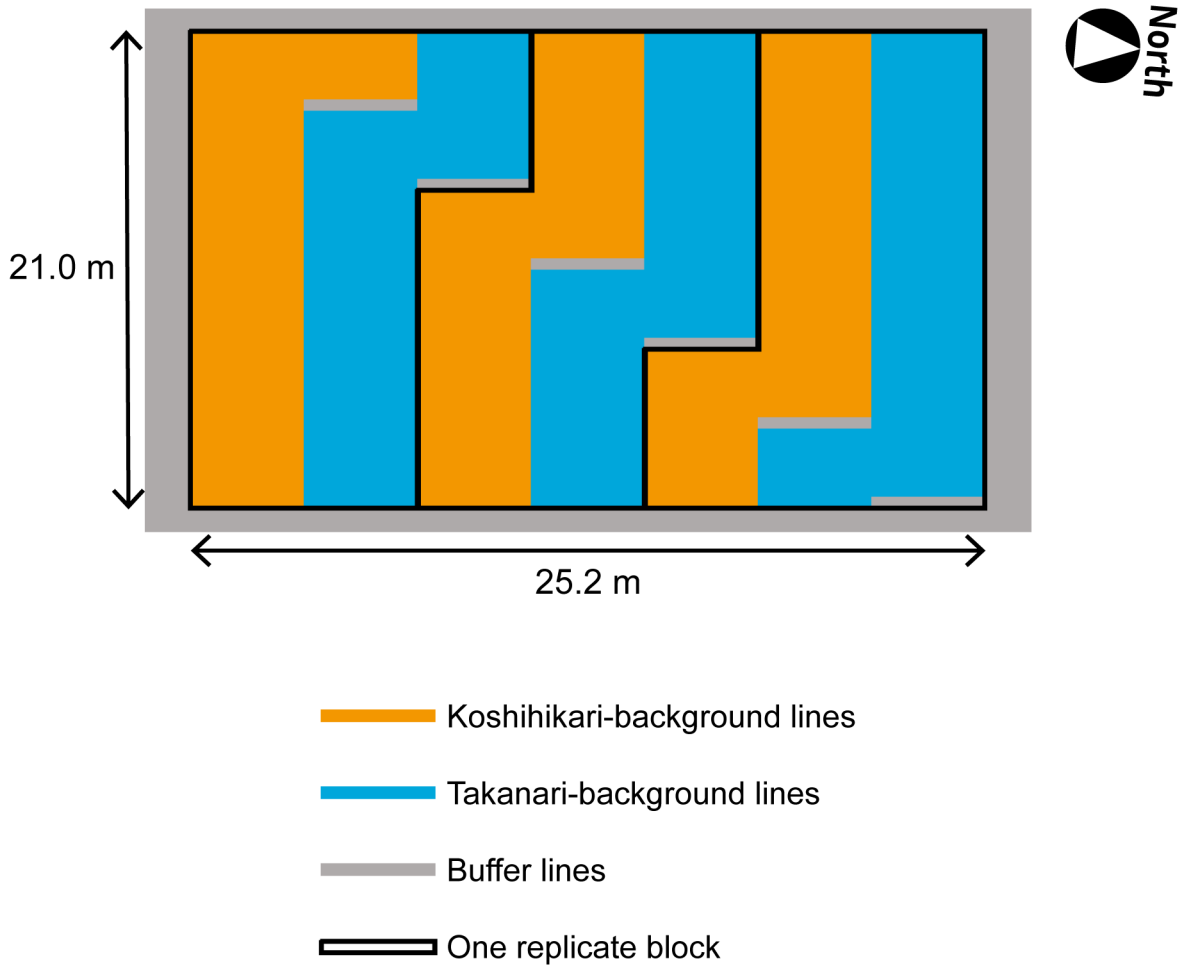
Supplementary Material for

Association between leaf photosynthesis and biomass accumulation in rice illustrated by a comprehensive gas exchange profile across the growing season

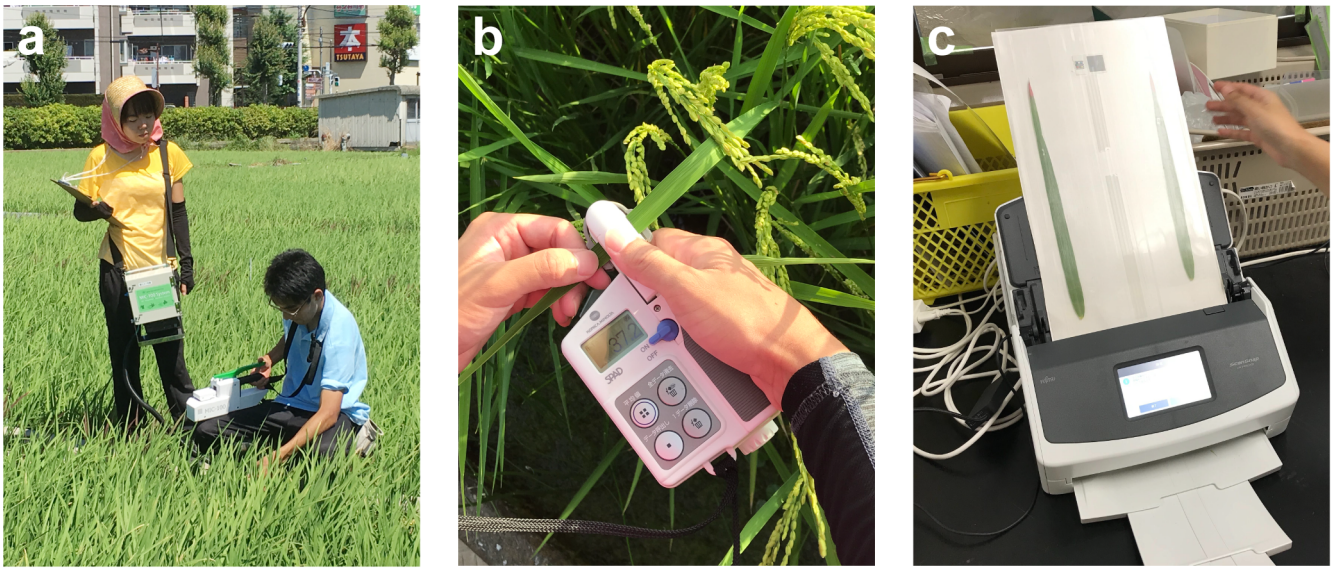
Sotaro Honda, Satoshi Ohkubo, Nan Su San, Anothai Nakkasame, Kazuki Tomisawa, Keisuke Katsura, Taiichiro Ookawa, Atsushi J. Nagano, Shunsuke Adachi*

*Corresponding author: S. Adachi, shunsuke.adachi.0210@vc.ibaraki.ac.jp

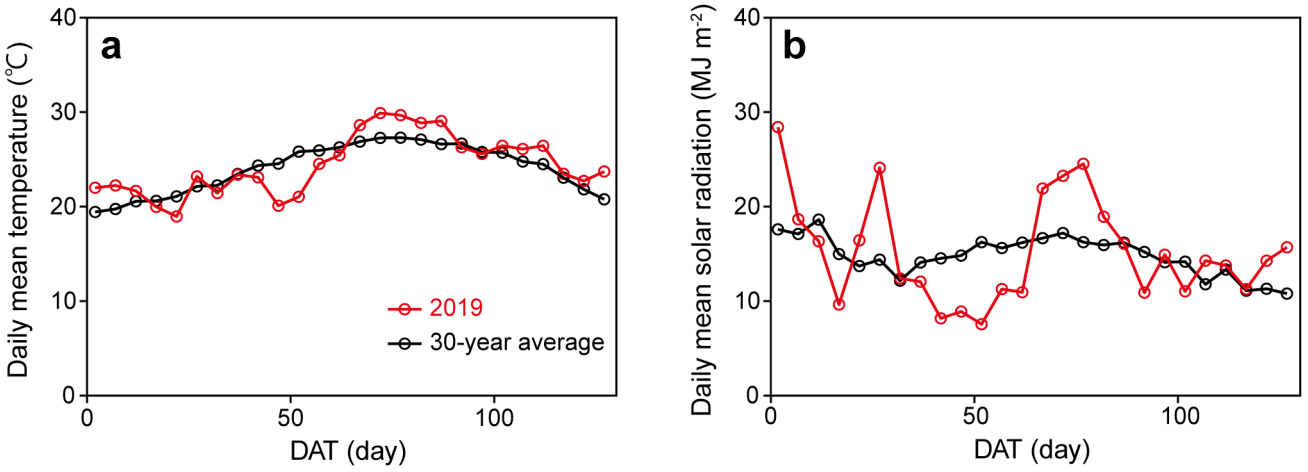
The PDF includes:



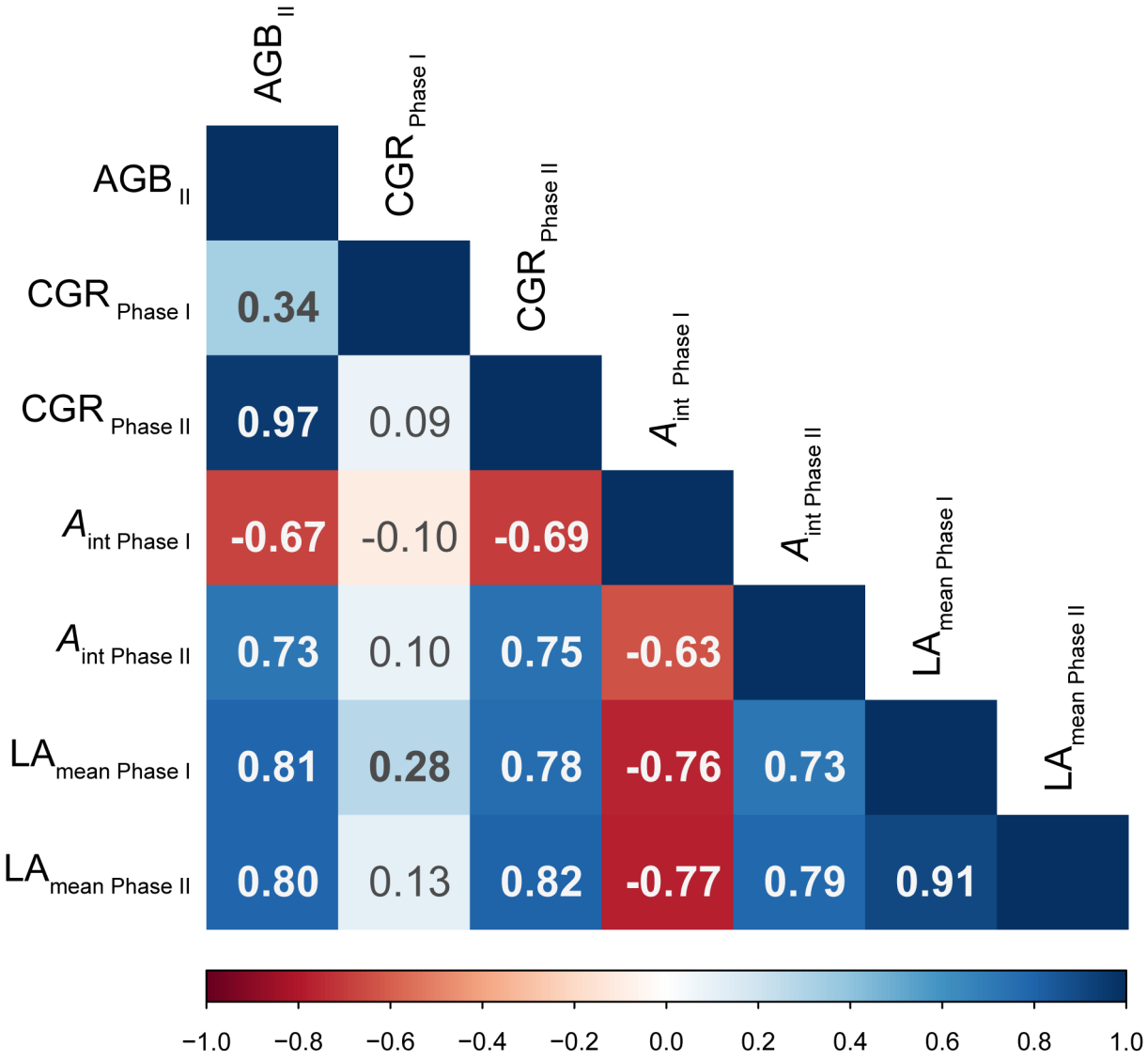
Supplementary Figure S1. Layout of the experimental plots in the paddy field.



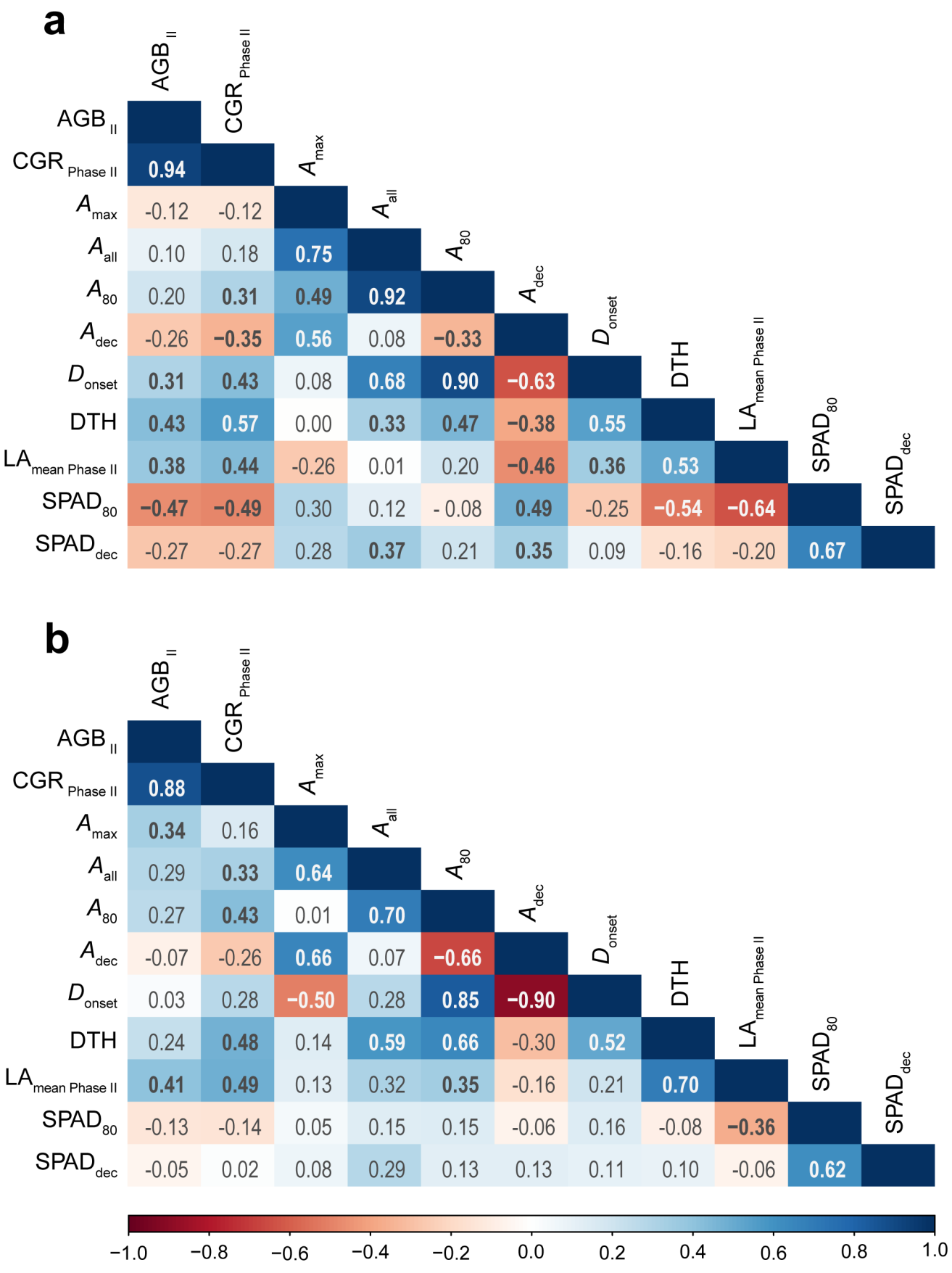
Supplementary Figure S2. Phenotyping procedures.
(**a**) Gas exchange measurement with a MIC-100 closed-type portable photosynthesis system.
(**b**) SPAD measurement with a SPAD-502 chlorophyll meter.
(**c**) Scanning of leaves with a ScanSnap iX1500 document scanner.



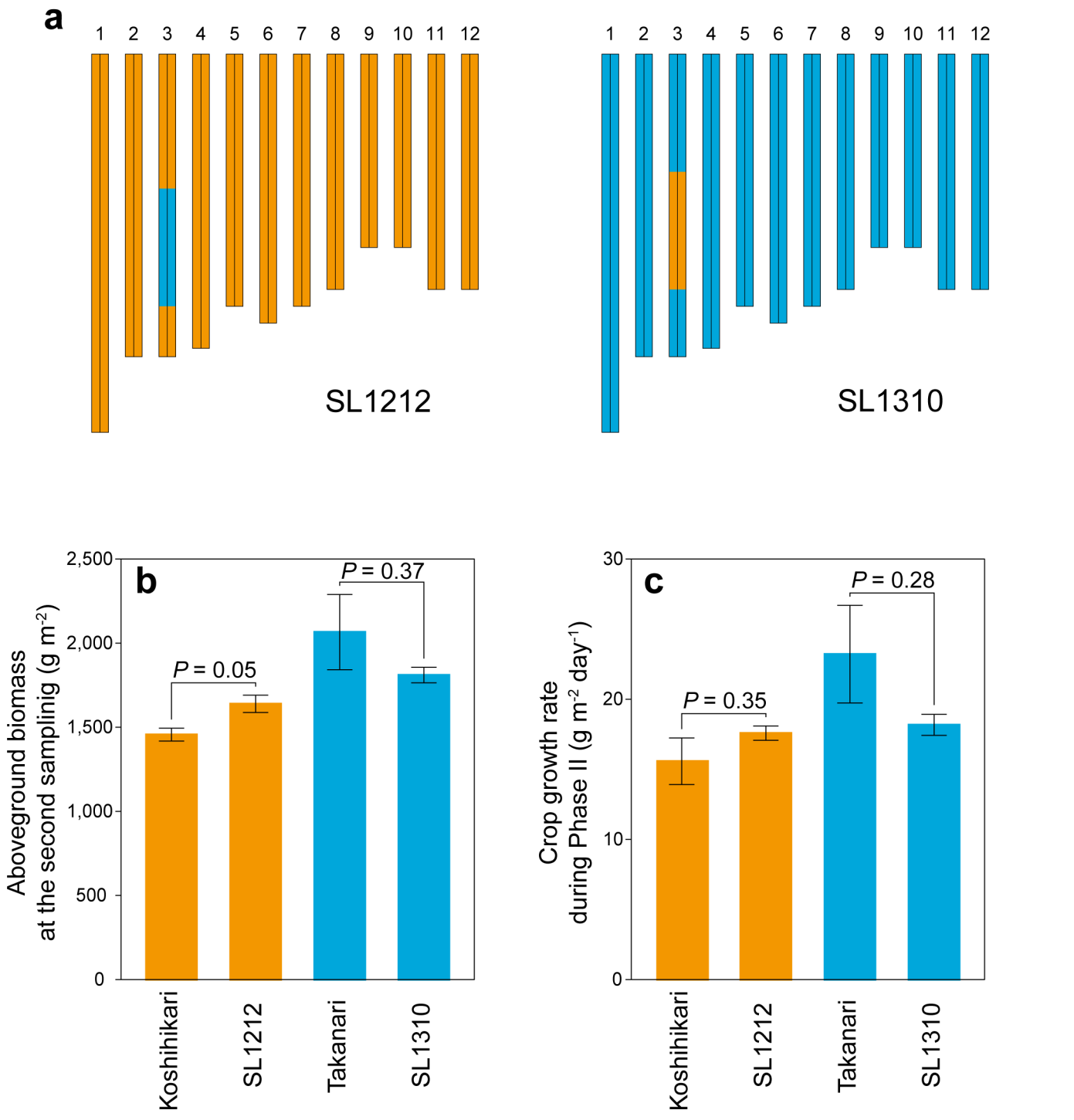
Supplementary Figure S3. Dynamics of (**a**) daily mean temperature and (**b**) daily mean solar radiation during the growing season. Daily mean temperature was obtained from the Automated Meteorological Data Acquisition Systems (AMeDAS) Fuchu site (35°41′N, 139°29′E) and daily mean global solar radiation was obtained from the AMeDAS Tokyo site (35°42′N, 139°45′E). The points are 5-day averages. DAT, days after transplanting.



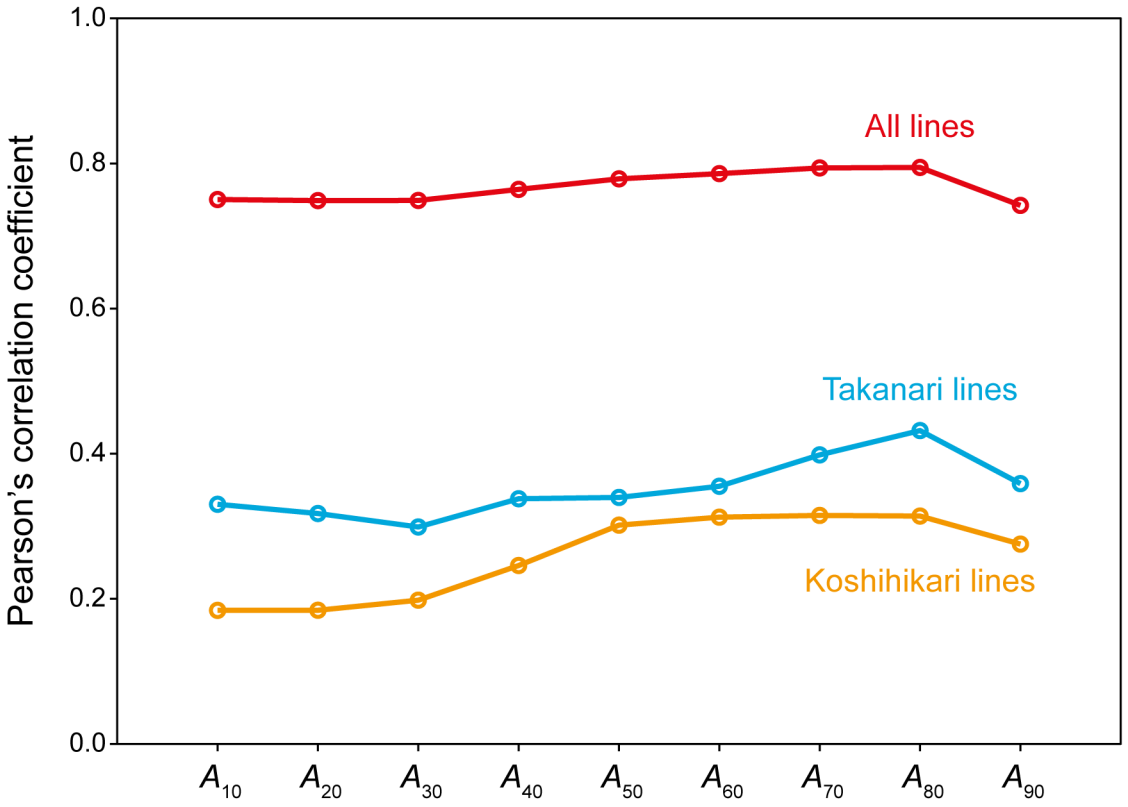
Supplementary Figure S4. Pearson's correlation coefficients of pairs of traits (biomass, crop growth rate, integrated CO_2 assimilation rate and mean single leaf area) among all lines examined. Values in bold type are significant ($P < 0.05$, two-sided *t*-test). Blue, positive correlation; red, negative correlation. AGB_{II}, dry weight of aboveground biomass at the second sampling; $CGR_{Phase\ I}$ and $CGR_{Phase\ II}$, crop growth rate during Phases I and II; $A_{int\ Phase\ I}$ and $A_{int\ Phase\ II}$, integrated *A* during Phases I and II; $LA_{mean\ Phase\ I}$ and $LA_{mean\ Phase\ II}$, mean single leaf area during Phases I and II.



Supplementary Figure S5. Pearson's correlation coefficients of pairs of traits (biomass accumulation, CO_2 assimilation rate and other agronomic traits) in (**a**) Koshihikari lines and (**b**) Takanari lines during Phase II. Values in bold type are significant ($P < 0.05$, two-sided *t*-test). Blue, positive correlation; red, negative correlation. AGB_{II}, dry weight of aboveground biomass at the second sampling; $CGR_{Phase\ II}$, crop growth rate during Phase II; A_{max}, maximum fitted value of *A*; A_{all}, accumulated *A* during Phase II; A_{80}, accumulated *A* from 72 days after transplanting (DAT) to D_{onset}; A_{dec}, accumulated *A* from D_{onset} to 128 DAT; D_{onset}, 1 day before *A* value declined below 80% of A_{max}; DTH, days to heading; $LA_{mean\ Phase\ II}$, mean value of single leaf area during Phase II; $SPAD_{80}$, mean SPAD value before D_{onset}; $SPAD_{dec}$, mean SPAD value after D_{onset}.



Supplementary Figure S6. Biomass at harvest and crop growth rate (CGR) during Phase II of Koshihikari, SL1212, Takanari and SL1310. (**a**) Graphical genotypes of the CSSLs; orange, Koshihikari genomic region; blue, Takanari genomic region. (**b**) Dry weight of aboveground biomass at the second sampling (AGB_{II}). (**c**) CGR during Phase II ($CGR_{PhaseII}$). Error bars represent standard error (n = 3). Statistical differences were tested by Welch's two-sided *t*-test (n = 3).



Supplementary Figure S7. Pearson's correlation coefficients of crop growth rate during Phase II ($CGR_{Phase\ II}$) with accumulated *A* after heading. Accumulated *A* was the integral from 72 days after transplanting (DAT) to D_{onset} (1 day before *A* declined below 10%-90% of maximum *A*). We selected A_{80} because it had the highest correlation in the combined data set and the Takanari line set and the second highest in the Koshihikari line set.

Supplementary Table S1. Standard deviations (SDs) of the traits shown in Figure 2.

Trait	Group	Phase or Sampling	SD
Integrated net CO_2 assmilation rate [μmol m^{-2} s^{-1} $phase^{-1}$]	Koshihikari lines	I	54.61
		II	79.83
	Takanari lines	I	65.98
		II	61.16
Mean single leaf area [cm^2]	Koshihikari lines	I	2.35
		II	4.24
	Takanari lines	I	3.49
		II	6.87
Aboveground biomass [g m^{-2}]	Koshihikari lines	1st	50.95
		2nd	141.86
	Takanari lines	1st	67.76
		2nd	144.70
Crop growth rate [g m^{-2} day^{-1}]	Koshihikari lines	I	0.72
		II	2.51
	Takanari lines	I	0.95
		II	2.17